Product Market Competition in a World of Cross-Ownership: Evidence from Institutional Blockholdings*

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We analyze the effects of institutional cross-ownership of same-industry firms on product market performance and behavior. Our results show that cross-held firms experience significantly higher market share growth than do non-cross-held firms. We establish causality by relying on a difference-in-differences approach based on the quasi-natural experiment of financial institution mergers. We also find evidence suggesting that institutional cross-ownership facilitates explicit forms of product market collaboration (such as within-industry joint ventures, strategic alliances, or within-industry acquisitions) and improves innovation productivity and operating profitability. Overall, our evidence indicates that cross-ownership by institutional blockholders offers strategic benefits by fostering product market coordination. (*JEL* G23, G32, G34, L11, L22)

Over the past few decades, publicly traded firms have become increasingly interconnected through common stock ownership. As Figure 1 shows, the fraction of U.S. public firms held by institutional blockholders that simultaneously hold at least 5% of the common equity of other same-industry

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firms has increased from below 10% in 1980 to about 60% in 2014. This increasing trend of institutional cross-ownership of same-industry firms suggests that treating firms as independent decision-makers in the product market may no longer adequately capture real strategic interactions among them. In fact, ample anecdotal evidence suggests that large common blockholders can exert influence on the corporate decisions and product market strategies taken by their cross-held firms.[1] While existing literature focuses almost exclusively on *direct* cross-ownership by same-industry firms (i.e., corporate equity holdings of each other), little attention has been paid to the role of *indirect* cross-ownership by large common shareholders, such as institutional investors in product market relationships.[2] Given the tremendous growth in same-industry institutional cross-ownership and the fact that such ownership is still largely unregulated (as opposed to the heavy regulations on direct same-industry ownership such as horizontal mergers), understanding the economic consequences of same-industry institutional cross-ownership, especially its implications for product market dynamics, is important for both academics and policy makers.

[Insert Figure 1 about here]

In this paper, we aim to address the above research question by empirically examining the effect of institutional cross-ownership of same-industry firms on product market performance and behavior. We hypothesize that cross-ownership can offer product market benefits by fostering coordination among firms that are cross-held by the same blockholder. Obviously, one major cost to institutional blockholders that hold multiple blocks in the same industry is under-diversification. Thus, the benefits derived from same-industry blockholdings must be large enough to offset such

[1] For example, U.S. Airways Group and AMR Corporation (the parent company of American Airlines) became cross-held by Tiger Management LLC in 1996. The two companies formed a broad marketing alliance in 1998. As another example, activist investor Carl Icahn was the largest shareholder in two truck makers, Oshkosh Corp. and Navistar International Corp., in 2011. He reportedly urged the two companies to merge (*Wall Street Journal*, December 20, 2011, "Icahn's Candidates for Oshkosh Board Would Support Navistar Merger"). Yet another example is the role played by TIAA-CREF, a cross-holder of two oil companies, Texaco and Pennzil, in resolving the litigation issues between the two firms in 1987 (Hansen and Lott 1996).

[2] Several studies investigate the product market implications of direct cross-ownership between firms. See, for example, Parker and Röller (1997), Allen and Phillips (2000), and Fee, Hadlock, and Thomas (2006).

costs to explain the observed pattern of institutional cross-holdings. One important benefit of institutional cross-holdings is economies of scale in information production (Kacperczyk, Sialm, and Zheng 2005). We argue that another important benefit is that institutional cross-holders can influence the product market strategies of these same-industry firms to enhance the combined value of their holdings.

A cross-holder's objective is to maximize risk-adjusted portfolio returns. However, intense competition among its portfolio firms, especially those operating in the same industry and thus offering similar products and services, can impose negative externalities (e.g., interfirm lawsuits, advertising wars, and research and development [R&D] races) on one another and reduce combined portfolio returns for the cross-holder. Consequently, the cross-holder has an incentive to make portfolio firms reduce rivalry against each other (Hansen and Lott 1996) and foster implicit or explicit coordination (such as joint ventures, strategic alliances, or acquisitions) among the firms in the product market.[3] This hypothesis predicts that firms cross-held by the same institutional blockholder should gain a competitive advantage in the product market relative to otherwise similar non-cross-held firms.

There are at least two fundamental reasons for why cross-ownership may improve the level and efficiency of collaboration between same-industry firms beyond what these firms can achieve on their own. First, due to incomplete contracting, firms considering collaboration with rivals in the same industry may be concerned about the risk of being expropriated by their counterparties. Because cross-holders' objectives are to maximize the combined value of their portfolio holdings, they may help align the incentives of the contracting parties and mitigate frictions associated with incomplete contracting. Second, cross-holders can reduce information asymmetry among same-

[3] Hansen and Lott (1996) provide a theory whereby cross-holders maximize their portfolio values by inducing their portfolio firms to internalize negative externalities. Similar arguments also have been made in the industrial organization literature on coalition formation among firms (see, e.g., Bloch 1995; Yi 1997).

industry firms and facilitate the exploration of profitable collaboration opportunities. Firms in the same industry have a natural tendency to conceal proprietary information from competitors, which may lead to suboptimal levels of collaborations. Cross-holders can facilitate coordination by enhancing information sharing among competing firms, thereby improving their product market performance.

Using a comprehensive sample of U.S. public firms from 1980 through 2014, we examine the impact of institutional cross-holdings of same-industry firms on product market performance. Our multivariate ordinary least-squares (OLS) analysis shows that cross-held firms experience significantly higher market share growth than non-cross-held firms. This result is robust to alternative empirical specifications and is driven primarily by activist institutions. We also find that the gains in market share associated with cross-ownership translate into higher stock valuation and improved operating profits.

Nevertheless, institutional blockholders do not invest randomly. A potential endogeneity concern is that institutions may choose to invest in firms with certain product market prospects. In the meantime, unobservable firm characteristics, such as corporate culture or managerial traits, may also correlate with both cross-ownership and future product market performance, making our OLS results spurious. To address these endogeneity concerns, we exploit a quasi-natural experiment of financial institution mergers using a difference-in-differences (DiD) approach. When two institutions merge, a firm block-held by one merging institution is likely to experience an increase in cross-ownership when one of its same-industry rivals is block-held by the other merging institution before the merger. Thus, the treatment sample consists of firms whose ownership linkages with same-industry firms are likely to increase just because of the merger. The control sample, on the other hand, consists of other block-held firms in the same institution's portfolio that are unlikely to experience such changes. We find evidence that treatment firms, relative to control

firms, experience an approximately 0.8 percentage points larger increase in annual market share growth (about 16% of its standard deviation) surrounding the institution mergers, which suggests a causal impact of cross-ownership on product market performance.

Using the same DiD framework, we then explore possible sources of product market gains induced by institutional cross-ownership. We find that treatment firms affected by the same institution merger are significantly more likely to engage in explicit coordination (joint ventures, strategic alliances, or within-industry acquisitions) with each other than control firms do, indicating a bridge-building role played by cross-holding institutions. We also find that treatment firms experience an increase in their innovation productivity and operating profit margin relative to control firms, suggesting that cross-held firms may collaborate on their innovation activities (e.g., by sharing technological know-how and other R&D resources) and may coordinate their product market strategies implicitly by cutting production and distribution costs (e.g., via collective bargaining against major suppliers and/or reducing marketing campaigns directly against each other). Overall, these results suggest that cross-ownership by institutional blockholders facilitates product market coordination.

Finally, we conduct two event studies to explore the stock price implications of cross-ownership. First, we examine the impact of a newly acquired block by an institution on the prices of stocks already block-held by the same institution. We find that stocks already block-held by the institution that are in the same industry as the newly acquired block experience an average cumulative abnormal return (CAR) of about two percentage points higher than those not in the same industry as the new block. Second, we analyze the announcement returns of treatment and control stocks in our institution merger sample surrounding the merger announcements, and find that the average CAR for treatment firms is approximately 1.5-1.7 percentage points higher than that for

control firms. These results indicate that the positive effect of cross-ownership on product market performance is reflected in stock prices and the gains are likely to be captured by the cross-holders.

Our paper makes four main contributions to the literature. First, to the best of our knowledge, this is the first firm-level study that examines the implications of institutional cross-ownership for firms' product market behavior and performance. Second, our paper is also the first to use financial institution mergers as an exogenous shock to firms' cross-holding status and to establish a *causal* link between institutional cross-ownership and firms' product market performance. Third, by analyzing the various coordination activities among cross-held firms, our paper sheds light on the possible channels through which interfirm relationships induced by modern ownership structure affect firms' strategic behavior and the competitive landscape of an industry. Fourth, and most importantly, our study illustrates that the traditional practice of treating firms as *independent* decision-makers in the product market (along with conventional measures of industry competitiveness) may not adequately capture real strategic interactions among firms or characterize the actual level of competition within an industry. Given the substantial growth of large cross-holdings, future studies on product market competition should take into account these indirect ownership linkages between firms operating in the same industry.

1. Hypothesis Development and Related Literature

1.1 Hypothesis development

Our main hypothesis is that cross-ownership by institutional blockholders facilitates product market coordination and improves product market performance. When same-industry firms become cross-held by the same institutional blockholder, the blockholder may play a bridge-building role by facilitating coordination among them. For instance, cross-held firms may enhance their product market competitiveness by forming strategic alliances among themselves, which would enable them to share resources (e.g., patent licensing agreements among technology firms), lower production

and distribution costs, and reduce duplication of R&D efforts. In the extreme, these firms may merge together to realize the full potential of synergies. Moreover, the cross-holding institution, because of its access to the management of the firms in which it holds large equity stakes, may facilitate information sharing among these cross-held firms and advise them to collaborate strategically by, for example, sharing technological know-how, coordinating resource allocation to avoid competing against each other in the same product space, or collectively bargaining against major suppliers to achieve purchasing efficiencies.

It is worth pointing out that we do not claim that cross-ownership is the only reason for coordination among firms in the same industry. Managers of same-industry firms may negotiate directly with each other and try to agree on different ways that can help both of them increase their operating efficiency without the help of cross-holders. We thus emphasize that, cross-owners, while by no means the only reason for interfirm collaborations, may play an important role in increasing the likelihood and efficiency of coordination among cross-held same-industry firms *beyond* what these firms can achieve on their own.

There are at least two fundamental reasons why cross-ownership may improve the level and efficiency of collaboration between same-industry firms. First, due to incomplete contracting (i.e., the inability of firms to write a contract that can address every possible contingency that may arise and every action that may be feasible in the future), firms considering collaboration with rivals in the same industry may be concerned about the risk of being expropriated or held-up by their counterparties (e.g., Klein, Crawford, and Alchian 1978; Williamson 1985).[4] Because of this concern, firms may avoid entering into potentially beneficial collaborative agreements with other

[4] A case in point is the collaborative R&D agreements among same-industry firms: it is very difficult, if not impossible, to consider every possible contingency in the long and uncertain innovation process and to formally write contracts that define who owns what of the newly created knowledge (except for some easily patentable outcomes and milestones). Yet losing highly valuable knowledge to competitors through collaborations can pose a direct threat to a firm's product market position.

same-industry firms in the first place. The presence of cross-holders whose objectives are to maximize the value of their combined portfolio holdings can help align the incentives of the firms considering collaboration and mitigate frictions associated with incomplete contracting. For example, cross-holders can serve as an enforcement mechanism for collaboration agreements. Firms in a collaborative agreement with same-industry rivals may have an incentive to deviate from a cooperative equilibrium to achieve higher short-term gains at the expense of their counterparties. Cross-owners can monitor/punish the deviating party and potentially change the payoff structure of the game by making it too costly for firms to deviate from the cooperative equilibrium.

Second, cross-holders can reduce information asymmetry among same-industry firms and facilitate the exploration of profitable collaboration opportunities. Firms in the same industry have a natural tendency to conceal proprietary information from their rivals because of competitive considerations. For example, Asker and Ljunqvist (2010) show that firms in the same industry avoid sharing investment banks out of concerns about leaking confidential information to rivals. Such fear of losing business secrets may discourage firms from developing business ties with same-industry firms that are mutually beneficial. Cross-holders can facilitate the sharing of information among competing firms to help them identify and explore possible cooperative opportunities, thereby facilitating coordination and improving their product market performance.

The null hypothesis of our study is that institutional investors that hold multiple blocks in an industry do not influence these firms' product market strategies or performance. This may arise because institutions have limited incentives and ability to push for changes in firms' product market strategies or because multiple blockholdings make institutions spread their effort too thin (i.e., become too busy to focus on each of their portfolio companies) and thus reduce their monitoring/advising effectiveness. Therefore, it is an empirical question whether cross-ownership affects firms' product market performance.

1.2 Relation to the existing literature

Our paper is related to several strands of finance and economics literature. The first is the literature on the implications of direct cross-ownership among same-industry firms for their product market behavior. Existing industrial organization theories suggest that cross-ownership among rival firms via mutual corporate equity holdings can reduce competition and lead to higher prices (e.g., Reynolds and Snapp 1986; Farrell and Shapiro 1990; Gilo, Moshe, and Spiegel 2006). Empirical studies find evidence that such cross-ownership arrangements offer strategic benefits in product market relationships (Allen and Phillips 2000; Fee, Hadlock, and Thomas 2006) and lead to collusive outcomes (e.g., Parker and Röller 1997). However, this line of research examines only cross-ownership by the same-industry firms themselves, but not that by common shareholders, such as institutional investors. Our paper complements this literature by showing that institutional cross-ownership provides strategic benefits by facilitating product market collaboration.[5]

Second, our study also fits in the literature on the influence of institutional investors on corporate decisions and performance. A number of studies find evidence that institutional investors play the role of large shareholders and discipline corporate managers in various settings (e.g., Bushee 1998; Hartzell and Starks 2003; Parrino, Sias, and Starks 2003; Gaspar, Massa, and Matos 2005; Del Guercio, Seery, and Woidtke 2008; Aghion, Van Reenen, and Zingales 2013). Much of the literature, however, treats institutional investors' portfolio holdings as independent positions and does not take externalities among portfolio companies into account. Three notable exceptions are Matvos and Ostrovsky (2008), Harford, Jenter, and Li (2011), and Becht, Polo, and Rossi (2016), all of which examine the effects of cross-ownership on mergers. Matvos and Ostrovsky (2008) find that cross-holders, that is, institutions that hold shares in both the acquirer and the target in an

[5] Moreover, there is a sizable literature in the 1970s and early 1980s on corporate objectives when shareholders are heterogeneous, for example, because they have different holdings in other firms (see, among others, Ekern and Wilson 1974; Radner 1974; Hart 1979; Grossman and Stiglitz 1980).

acquisition, are more likely to approve acquisitions, especially those in which the acquirer has negative announcement returns. Harford, Jenter, and Li (2011) show that cross-ownership is positively correlated with the probability of a firm being targeted in a takeover, but they do not find that cross-ownership significantly affects bidder returns or the bidders' share of synergies. Using a sample of takeovers in the United Kingdom, Becht, Polo, and Rossi (2016) find that cross-holdings are too small to affect voting outcomes.

Third, our paper is also related to a growing body of literature on the interconnectedness of firms and its implications. Firms can be linked to one another through various types of ties, such as customer-supplier relationships (Fee and Thomas 2004; Fee, Hadlock, and Thomas 2006; Cohen and Frazzini 2008), sharing of common financial intermediaries (Asker and Ljungqvist, 2010), and interfirm alliances (Chan et al. 1997; Gomes-Casseres, Hagedoorn, and Jaffe 2006).

In a contemporaneous working paper, Azar, Schmalz, and Tecu (2015) find evidence of anticompetitive effects associated with cross-ownership in the airline industry. Since the airline industry is characterized by high entry barriers and high concentration of market share among a small number of dominant players (there are only about ten publicly traded airlines in the United States), the anticompetitive effects they document may not be readily generalizable to other industries with dissimilar competitive landscapes. Unlike the focus of their paper, we focus on product market strategies by each individual *firm* (as opposed to each airline route in their study which is part of an airline company's portfolio of products), and analyze *all* industries, the majority of which can be very different in nature from the airline industry.[6] While they only use one institution merger during the financial crisis (i.e., in 2009) as an exogenous shock to cross-

[6] Given the prevalence of cross-ownership in many industries with different structures and characteristics (as Table 1 shows), a thorough understanding of the effect of cross-ownership across a wide spectrum of industries carries important policy implications. While regulators are rightly concerned about potential anticompetitive effects in some industries, the regulatory framework should be designed so as not to discourage efficiency-improving collaborations in other industries.

ownership, we examine multiple institution mergers spanning from 1983 to 2011, which mitigates the concern for potential omitted variables coinciding with a single shock that directly affect firm behavior. Moreover, we consider institutional blockholdings of 5% or more when defining cross-ownership, whereas Azar, Schmalz, and Tecu (2015) consider equity holdings exceeding 0.5%.

2. Sample Selection and Summary Statistics

2.1 Sample selection

The sample examined in this paper includes U.S.-listed firms with common stocks traded on the NYSE, NASDAQ, and AMEX during the period 1980–2014. To be included in our sample, a firm-year must have positive values for sales and total assets and nonmissing industry classification information (four-digit SIC codes), and belong to an industry with at least two firms.[7] We retrieved quarterly institutional holdings data from Thomson's CDA/Spectrum database (form 13F). Market share data and other financial statement items come from Compustat. Financial institution merger data are constructed following the same methodology as in Huang (2016). The above sample selection process results in 103,512 firm-year observations.

2.2 Variable measurement

2.2.1 Measuring cross-ownership. For each quarter in the 1980–2014 sample period, we extract institutional holdings information from Thomson Financial's 13F database and define a holding as a block if it exceeds 5% of the outstanding shares. We choose 1980 as the starting year of our sample period because the 13F data set starts its coverage in that year. Cross-holdings arise when an institution simultaneously holds more than one blocks in the same four-digit SIC industry at a given point in time.

[7] Following recent studies on the interaction between corporate finance and product market behavior, such as Campello (2006), Fresard (2010), and Hadlock and Sonti (2012), we use four-digit SIC codes to define product markets (industries) throughout the paper, although our results are robust to alternative industry definitions, such as Fama-French 48 industry classification or the 10-K text-based industry definitions developed by Hoberg and Philips (2010, 2016).

To gauge a firm's cross-ownership status in a given fiscal year, we construct five measures. The first, *CrossDummy*, is a dummy variable that equals one if the firm is cross-held in any of the four quarters in a fiscal year and zero otherwise. The second one, *NumConnected*, is the number of same-industry peers that share any common institutional blockholder with the firm. The third measure, *NumCross*, is the number of unique institutions that cross-hold the firm. The second and third measures capture the extent to which a firm is connected to other same-industry peers through cross-ownership. The fourth measure, *AvgNum*, is the number of same-industry peers block-held by the average cross-holding institution. Specifically, we first calculate the number of same-industry firms (other than the one under consideration) block-held by each cross-holding institution during a quarter and then average across all such institutions. This measure captures the intensity of cross-holding activities for the average institution and thus its incentive to influence the corporate policies of the cross-held companies. The last measure, *TotalCrossOwn*, is the sum of all cross-holding institutions' percentage holdings in the firm itself. This measure captures the potential aggregate influence of all cross-holding institutions on firm management. For all the cross-ownership measures except the first one, we first calculate the measures in a quarter and then average across four quarters in a given fiscal year to obtain the annual measures.

2.2.2 Measuring market share growth and control variables. We use the change in market share as our main measure for product market performance. Following standard practice in the literature on product market competition, we define a firm's market share as its sales in a year divided by the same four-digit SIC industry's total sales in that year. We then calculate a firm's market share growth as the difference in market share between the current year and the previous year. For example, if a firm's market share in year t is 10% and it is 12% in year t+1, the market share growth is two percentage points (or 0.02 in our regressions).

In this paper, we use sales-based market share growth as our primary measure for product market performance because of four reasons. First, it is well motivated by theoretical models linking corporate policies to product market performance (e.g., Maksimovic 1986; Bolton and Scharfstein 1990; Chevalier and Scharfstein 1996; Campello and Fluck 2006), and thus has become a standard measure of product market strength in recent empirical finance literature analyzing the interactions between financial/ownership structures and product markets (e.g., Campello 2006; Fresard 2010; Chemmanur and He 2011). Second, as Opler and Titman (1994) point out, sales-based market share growth is the most direct measure of customer-driven gains/losses in sales. Since the ability of a firm to generate cash flows depends in large part on attracting and retaining customers, market share growth captures an important dimension of a firm's product market performance. In fact, the very first step of many valuation models used by practitioners (such as discounted cash flow techniques) is to estimate a firm's future sales growth rate because it reflects a firm's expected market power and earnings potential that directly contribute to its value. Third, because market share growth of firms in the same industry sums up to one, the measure enables us to gauge the gain in sales by cross-held firms at the expense of other firms in the same industry. Fourth, sales are less subject to accounting discretion/manipulation than reported earnings. Thus, sales growth may provide a more reliable measure of corporate performance than earnings-based performance measures. Nevertheless, since we are interested in the extent to which product market share growth translates into profitability and firm value, we also use operating profitability and stock returns as our alternative performance measures.

We control for a vector of firm characteristics that may affect a firm's future market share growth. Firms at the growing stage of their life cycle, that is, those with smaller size (proxied by total assets), more growth opportunities (Tobin's q), and larger growth in fixed assets (percentage changes in property, plant, and equipment), are more likely to experience faster market share

growth. In addition, firms with more aggressive investment strategies, that is, those with higher capital expenditures, higher acquisition expenditures, and more R&Ds, should increase their market share at a faster rate.[8] We also control for a firm's cash holdings, leverage ratio (long-term debt divided by total assets), and operating profitability (return on assets), because recent studies (e.g., Campello 2006; Fresard 2010) find that these characteristics are closely related to the firm's future product market performance. Further, to separate the effect of cross-ownership from that of block ownership or institutional holdings in general, we control for the average fractional ownership by institutional blockholders, total institutional ownership, as well as a dummy variable for whether a firm is block-held by institutional investors in any fiscal quarter of the year. Finally, to control for investor activism, we retrieve Schedule 13D filings from the SEC EDGAR database and count the number of initial 13Ds (i.e., excluding amendments) targeting the firm during the year.[9] Since electronic filings became available on EDGAR starting from 1994, we retrieve all 13Ds during the 1994–2014 period and focus on the subsample of firm-years between 1995 and 2014 in tests involving this variable.

2.3 Summary statistics

To minimize the effects of outliers, we winsorize all continuous variables at the 1st and 99th percentiles. Table 1, panel A, provides summary statistics. The top five rows summarize our main measures for the extent of cross-ownership. About 40% of the firm-years in our sample are cross-held by at least one institution. The next row summarizes the one-year-ahead market share growth

[8] Following Chan, Lakonishok, and Sougiannis (2001) and Hirshleifer, Hsu, and Li (2013), we define a firm's R&D capital as its five-year cumulative R&D expenses assuming an annual depreciation rate of 20%. We then scale R&D capital by the sum of the firm's book equity value and itself. Replacing this variable with R&D-to-assets ratio in the regressions does not qualitatively change our results.

[9] Depending on whether they have activist intentions, investors can choose to file a 13-D or a 13-G form when their holdings exceed 5% of a company's outstanding shares. A 13-D is required only when the blockholder intends to engage in active intervention, whereas a 13-G form would suffice if the blockholder does not intend to change or influence the control over a company. Since we are interested in the heterogeneity across institutions in terms of activism, we use 13-D filings as an indicator.

($MktShareGrow_{t+1}$) for our sample firm-years. Since market share changes are essentially a zero-sum game (when there is no entry or exit), the mean and median market share growth rates are close to zero. There is, however, considerable variation in the variable, as indicated by an interquartile range of 0.005 and a standard deviation of 0.066. The rest of the panel summarizes our control variables. For example, the average firm in our sample has a book value of assets of $1.0 billion in real 1982-1984 dollars, a Tobin's q of 1.93, and a leverage ratio of 17.3%. The average fractional ownership by institutional blockholders is 11.4% and the average total institutional ownership is 36.8% of the outstanding shares. About 69.1% of the firm-years in our sample have at least one institutional blockholder. Finally, the average number of initial 13D filings targeting a firm during a year is about 0.14.

[Insert Table 1 about here]

Table 1, panel B, summarizes the characteristics of cross-held and non-cross-held firm-years. These univariate comparisons indicate that, on average, cross-held firms have higher market share growth, larger total assets, smaller Tobin's q, higher cash-to-assets ratio, lower leverage, better operating performance (in terms of ROA), more R&D capital, fewer capital expenditures, more acquisition expenses, greater institutional ownership, fewer initial 13D filings, and higher fractional ownership by institutional blockholders. In untabulated analysis, we find that the average holding period for an institutional block is about seven quarters and that approximately 80% of cross-held blocks are owned by nontransient institutions (Bushee 1998). These findings suggest that cross-holders are long-term shareholders who are likely to exert influence on corporate management to reap strategic benefits.

Table 1, panel C, presents the distribution of cross-held and non-cross-held firm-years across the Fama-French 12 industries. We further categorize non-cross-held firms into those are block-held and those that are not. As we can see, a reasonable fraction of firms in each industry is

cross-held, with a higher concentration in Business Equipment, Health care, and Telecommunications. Industries in which firms are the least likely to be cross-held are Consumer nondurables and Chemicals.

Figure 1 shows the pattern of institutional cross-ownership over time. The blue line with diamonds shows the fraction of U.S. public firms that are cross-held by institutional investors in any quarter of the fiscal year, and the purple line with squares shows the fraction of U.S. public firms that are cross-held by institutional investors in the last quarter of the fiscal year. Both lines show that the fraction of U.S. public firms that are cross-held has increased tremendously from below 10% in 1980 to about 60% in 2014, indicating that cross-ownership has now become so widespread that it is likely to have a profound impact on modern firm organization and market structure. The red dashed line shows that the fraction of institutional blockholders that hold more than one block in an industry is relatively stable over time, fluctuating mostly between 20% and 30%, which indicates that a cross-holding strategy has its own benefits (e.g., the economy of scale in information production and the potential benefits of fostering coordination among its portfolio companies) and costs (e.g., under-diversification and the exposure to industry-specific shocks), and thus has not become an industry norm. The green dotted line, which plots the fraction of all U.S institutional investors that cross-hold, reveals a somewhat similar pattern over time.

Overall, Figure 1 indicates that cross-ownership has gained considerable momentum over the past three decades, making it an important phenomenon to understand and explore.[10]

3. Relation between Cross-Ownership and Firm Performance

3.1 OLS analysis

To assess how a firm's cross-ownership relates to its future product market performance, we

[10] Since the main purpose of this study is to analyze the causal impact of cross-ownership on firms' product market performance rather than the motivations for cross-holdings from the perspective of an institution, we leave further investigations of these time trends to future studies. It is worth noting that our identification strategy (i.e., the institution merger setting) helps isolate the effect of cross-ownership from confounding factors that motivate cross-ownership.

estimate various forms of the following model using the OLS method:

$$MktShareGrow_{i,t+1} = \alpha + \beta CrossMeasure_{i,t} + \gamma Z_{i,t} + Year_t + Firm_i + \varepsilon_{i,t}, \quad (1)$$

where *i* indexes firm and *t* indexes time. The dependent variable is a firm's one-year-ahead market share growth as defined in the previous section. The cross-ownership measure, *CrossMeasure*, is one of the five cross-holding proxies for firm *i* over fiscal year *t*. To reduce the influence of large values of *NumCross*, *NumConnected*, and *AvgNum*, we use the natural logarithm of one plus these measures in the regressions. *Z* is a vector of firm characteristics that may affect a firm's future market share growth. *Year* captures year fixed effects and *Firm* captures firm fixed effects. We include firm fixed effects to mitigate the concern for time-invariant omitted variables that are correlated with both market share growth and cross-ownership. We cluster standard errors at the firm level.

Table 2, panel A, reports the OLS regression results estimating Equation (1) using *CrossDummy* as the measure for cross-ownership.[11] The coefficient estimates of *CrossDummy* in all four specifications are positive and significant at the 1% level, suggesting that cross-ownership is associated with a higher market share growth rate in the following year. In terms of economic significance, Column (4) implies that a firm's one-year-ahead market share growth when it is cross-held is 0.005 higher than when it is not cross-held. Considering that market share growth in our sample has a standard deviation of 0.066 and an interquartile range of 0.005, the magnitude of this effect is economically meaningful.

[Insert Table 2 about here]

As for the control variables, we find that firms with smaller total assets, higher Tobin's q, higher acquisition expenditures, and higher PPE growth exhibit higher future market share growth,

[11] To mitigate the concern about multicollinearity, we include the control variables set by set (especially the variables measuring institutional ownership, block ownership, and investor activism) in the regressions and find similar results to those reported here.

which is broadly consistent with our intuition. Interestingly, Column (3) shows that the presence of institutional blockholders is negatively associated with future market share growth, possibly because blockholders may have a preference for more mature firms. Since blockholders may differ in their incentives and abilities to influence corporate strategies, we include the natural logarithm of one plus the number of initial 13D filings targeting the firm during the current year as an additional control in Column (4). The results suggest that the presence of activist investors is associated with greater future market share growth, which is consistent with these investors exerting active influence on corporate strategies and performance (Brav et al. 2008).

Table 2, panel B, reports the OLS results using the other four measures of cross-ownership as well as two variations of the cross-holding dummy, with the first variation being a dummy for whether the firm is cross-held in the last fiscal quarter of the year, and the second being a dummy for whether the firm is cross-held in all four quarters over the fiscal year. We use the same set of control variables as in Column (4) of panel A. To save space, we only show the coefficients on the cross-ownership measures and omit those on the control variables. The coefficient estimates of all six measures are positive and significant at either the 1% or the 5% level. The economic magnitude is nontrivial as well. For example, Column (1) shows that a one-standard-deviation increase from the median of the number of same-industry peers that share common block-holders with a firm (i.e., from 0 to 5.521) is associated with an increase in a firm's market share growth of 0.004 (=(ln(6.521)-ln(1))*0.002).

Our OLS estimate of the relation between cross-ownership and future market share growth could be biased upward or downward due to time-varying omitted firm characteristics. For example, if the omitted variable is unobserved firm quality (which makes firms more likely to gain market share in the future) that cross-holding institutions can privately know and select on, then the OLS estimates could be biased upward because this omitted variable is positively correlated with both

cross-ownership and future market share growth. On the other hand, a second selection bias is that institutions might choose to cross-own firms based on other characteristics that tend to be negatively related to future market share growth, which could bias the OLS estimates downward. For example, cross-holders, because of portfolio diversification considerations (Faccio, Marchica, and Mura 2011), may choose to invest in mature firms or firms with more conservative product market strategies. In this case, the omitted variable in the OLS regression is a conservative corporate culture (or greater managerial risk aversion) that is positively related to cross holding but negatively related to future market share growth. Because of these potential selection biases, one should be careful when interpreting the magnitude of these OLS estimates. In Section 4, we adopt a cleaner identification strategy to tackle the endogeneity problem and provide more insight into the direction of the biases.

3.2 Robustness checks of the OLS results

We conduct a rich set of robustness tests for our OLS results and present them in Table 2, panel C. We use the same set of controls as in Model (4) of panel A and only show the results obtained using *CrossDummy* as the measure for cross-ownership. Robustness tests using other cross-ownership measures yield qualitatively similar results. Column (1) uses the 10-K text-based fixed industry definitions (FIC 500) developed by Hoberg and Philips (2010, 2016) to define product markets.[12] Column (2) examines only manufacturing industries (with SIC codes between 2000 and 3999). Column (3) uses a refined definition of industries by dropping those whose fourth digit of their SIC codes is 0 or 9, as some studies, such as Clarke (1989) and Kahle and Walking (1996), argue that these SIC codes might not accurately define economic markets. To address the concern that our OLS results might be driven by industries with a small number of firms, Column (4) drops industry-

[12] We thank Gerard Hoberg and Gordon Phillips for making their industry definitions publicly available on their Web sites. Although we report results using only FIC 500, our results are similar when using alternative industry definitions, such as FIC 300 or FIC 400.

years with fewer than five firms. In untabulated analysis, we also try dropping industry-years with fewer than 20 firms, or directly controlling for industry size (the number of firms in an industry-year), and find qualitatively similar results. Column (5) considers only firm-years that are block-held (i.e., having at least one institution holding more than 5% of the firms' equity). Column (6) examines only S&P 500 firms, and Column (7) uses an alternative definition of market share growth: the difference between a firm's log market share in the next year and its log market share in the current year. Column (8) examines long-run product market performance in terms of the change in market share from year *t* to year *t+3*. In all of the above regressions, the coefficient estimates of *CrossDummy* are significantly positive.[13]

3.3 Cross-ownership by different types of institutions

Since activist institutions have strong incentives and abilities to influence corporate decision-making, we examine whether the cross-holdings of activist institutions have a stronger association with firms' product market performance than cross-holdings of nonactivist institutions.[14] We define activists using Schedule 13D filings. We match the 13D filers with the 13F institutions in our sample and classify institutional blockholders into activist institutions (i.e., those that filed at least one 13D in the past three years) and nonactivist ones (i.e., those that did not file any 13D in the past three years). About 54% of the firm-years with cross-ownership have at least one activist cross-holder.

We construct the cross-ownership measures for activist and nonactivist institutions

[13] To rule out the possibility that our results are mechanically driven by firms making acquisitions, we also drop firms that make same-industry acquisitions during either the current or the next year (at *t* or *t*+1) or those making same-industry acquisitions in any year of our sample period. We find qualitatively similar results.

[14] However, we do not claim that nonactivist institutions have no influence on corporations. Recent studies show that, because of their large ownership stakes, seemingly passive institutions can exert significant influences on corporate governance and corporate decision-making (see, e.g., Appel, Gormley, and Keim 2016; Crane, Michenaud, and Weston 2016). Thus, cross-holdings by passive institutions may also play a role in facilitating coordination. It is useful to note that, if index funds and quasi-indexers are the main cross-holders and they indeed play a passive role in corporate decision-making, it should be more difficult for us to reject the null hypothesis that institutional cross-holders do not affect the product market performance of their cross-held firms.

separately and regress future market share growth on these cross-ownership measures. Table 2, panel D, presents the results. All specifications include the full set of control variables in panel A, as well as firm and year fixed effects. As we can see, the coefficients on all five cross-ownership measures based on activist institutions are positive and significant at the 1% level, whereas the coefficients on cross-ownership measures based on nonactivist institutions are generally insignificant. Moreover, the differences in the coefficients between the two types of institutions are significant in all five specifications. These results suggest that cross-ownership by activist institutions has a stronger association with future market share growth than that by nonactivist institutions.

We also conduct several additional robustness tests (the results of which are untabulated) to show that our OLS results are not driven by the growth of large index funds or quasi-indexers over time. First, we decompose cross-ownership into three types (dedicated, quasi-indexers, and transient institutions) based on Bushee's classification scheme and include the three cross-ownership types in our OLS tests. We find that the correlation between cross-ownership by dedicated investors and future market share growth is stronger (with a coefficient of 0.006) than that between cross-ownership by quasi-indexers and future market share growth (with a coefficient of 0.004). Second, we repeat the OLS tests by excluding firms in the S&P 500 index and find qualitatively similar results. Since S&P 500 index funds are the dominant player in the market, representing about 50% of the overall assets under management by U.S. index funds (Adams, Mansi, and Nishikawa 2009), this finding mitigates the concern that our results are driven by index funds. Third, we exclude firm-years after 2000 when ETFs and other index funds experienced rapid growth and find that our results still hold.

Overall, our OLS results suggest that cross-ownership is positively related to a firm's future market share growth, supporting the hypothesis that institutional cross-holders enhance a firm's

product market performance by influencing its strategic decision making.

3.4 Other performance measures

The above analysis follows the literature on the implication of a firm's financial and ownership structure for its product market performance (e.g., Campello, 2006; Fresard, 2010; Chemmanur and He, 2011) by examining a firm's market share growth. However, one may wonder whether the gains in market share translate into improvement in other performance measures, such as stock returns or operating profitability. To test this, we run OLS regressions of one-year-ahead abnormal stock performance and industry-adjusted operating performance (profit margins and return on assets) on cross-ownership measures and controls. To measure long-run abnormal stock performance, we calculate one-year-ahead buy-and-hold abnormal returns (*BHAR*) and cumulative abnormal returns (*CAR*) using the Fama-French-Carhart four-factor model over the twelve months immediately following a fiscal year-end using monthly returns. We use monthly stock returns over the prior 36 months to estimate factor loadings. We also construct three measures of operating performance. *NOP* is the industry-adjusted net operating profitability (net income before extraordinary items and discontinued operations, plus tax expense and interest expense net of interest income, divided by sales); *NPM* is the industry-adjusted net profit margin (net income before extraordinary items and discontinued operations divided by sales); and *ROA* is the industry-adjusted return on assets (operating income divided by total assets).

Table 3 reports the regression results. All specifications include the full set of control variables in panel A of Table 2 as well as firm and year fixed effects. We find evidence that a firm's cross-holding status is positively related to its future stock and operating performance, suggesting that the gains in product market share induced by cross-ownership indeed translate into higher stock valuation and improved operating profits. The economic magnitudes of the results are nontrivial. For example, Column (1) implies that a firm's buy-and-hold abnormal returns over the next twelve

months is 3.6 percentage points higher when it is cross-held than when it is not, which is about 6% of the interquartile range of the variable. Similarly, Column (4) implies that a firm's one-year-ahead industry-adjusted net profit margin is 0.009 higher when it is cross-held than when it is not, which is about 10% of the interquartile range of the variable. We note, however, that these results are just correlations and are subject to potential endogeneity concerns. Therefore, these economic magnitudes should be interpreted with caution.

[Insert Table 3 about here]

4. Identification

As discussed earlier, an endogeneity concern is that omitted variables correlated with both a firm's cross-holding status and its future product market performance could bias the results. Another concern is that firms with better prospects for future product market growth may attract more institutional cross-holders, resulting in reverse causality. In this section, we address potential endogeneity problems by using a relatively new identification strategy in the literature: a DiD approach based on the quasi-natural experiment of financial institution mergers that generates plausibly exogenous variation in a firm's cross-ownership.

4.1 The experiment

The experiment of institution mergers, first adopted in Huang (2014), relies on the fact that financial institutions (e.g., bank holding companies, security brokers, asset management firms) often merge for reasons unrelated to the fundamentals of their portfolio holdings. When two financial institutions merge, the acquirer usually takes over the existing portfolios (including the blockholdings) of the target and would generally maintain these acquired holdings (especially blocks) for an extended period of time due to liquidity and transaction cost concerns (see, e.g., Holthausen, Leftwich, and Mayers 1990; Keim and Madhavan 1996). Therefore, if a firm is block-

held by one of the merging institutions before the merger and in the meantime one of its same-industry peers is block-held by the other party to the merger, then both firms would become cross-held by the same (merged) institution right after the merger.[15] This event provides us with a nice quasi-natural experiment to test how firms' cross-ownership affects their subsequent product market performance. Institution mergers in our setting provide a source of plausibly exogenous variation in firms' ownership structure, which should affect a firm's subsequent product market performance only through their effect on the firm's cross-holding status.

Our experiment requires that financial institutions merge for reasons unrelated to the subsequent product market performance of individual firms. This is likely to be true, because interfirm mergers between financial institutions are often a result of consolidation in the financial sector in response to deregulations. For instance, commercial banks were allowed to directly acquire existing investment banks as Section-20 subsidiaries in 1997. Further, following the Gramm-Leach-Bliley Act of 1999, commercial banks, investment banks, securities firms, and insurance companies were allowed to consolidate. These fundamental changes in regulations led to a wave of mergers of financial institutions and, as a result, the combination of the asset management arms of the merging financial firms. Two examples are the merger between Chase Manhattan Corp. and J.P. Morgan & Co. in 2000 and that between Fleet Boston Corp. and Bank of America in 2003. The size and scope of these banks indicate that the mergers are plausibly exogenous to the performance of individual firms in their asset management arms' portfolios.[16] Over 60% of the institution mergers in our sample result from consolidation in the banking sector, while the rest are mergers between a bank and a nonbank financial institution and those between nonbank financial institutions. Previous

[15] Of course, these newly acquired cross-holdings by the merged institution may be sold after the merger due to other reasons, such as portfolio diversification considerations, turnover of portfolio managers, and firm- and industry-specific information. However, as long as there are no systematic economic forces to completely "undo" the formation of these new cross-holdings, we would, on average, still expect an increase in the extent of cross-ownership for these affected firms around the merger.

[16] See, for example, Houston, James, and Ryngaert (2001) for a discussion of the motivations for bank mergers.

literature also suggests that mergers between two pure-play asset management firms are motivated largely by business strategy considerations of the institutions themselves, such as to achieve economies of scale in fund operations and to build market share by expanding financial product offerings (Jayaraman, Khorana, and Nelling 2002). Therefore, these nonbank mergers in the financial sector may also constitute plausibly exogenous shocks to a firm's cross-ownership.

A key advantage of our identification strategy is that there are multiple shocks that affect different firms at exogenously different times. Identification with multiple shocks can mitigate a common difficulty faced by studies with a single shock, namely, the existence of potential omitted variables coinciding with the shock that directly affect the outcome of interest.

4.2 Identifying treatment and control firms

We construct our financial institution merger sample using SDC's Mergers and Acquisitions database. We require that (1) the merger is between two 13F institutions (or their parent firms) in the financial sector (with primary SIC codes in the 6000 to 6999 range) and announced during the period between 1983 and 2011; (2) the merger is completed within one year after the initial announcement; and (3) the target institution stops filing 13F forms within one year after the completion of the deal.[17]

We identify treatment firms as those that are likely to experience an increase in the number of ownership linkages with rival firms in the same industry due to the institution mergers. Specifically, we require that (1) the firm be block-held by one of the merging institutions during the quarter immediately before the merger announcement date and (2) the other merging institution do not block-hold the firm but block-hold at least one of its same-industry rival firms during the same

[17] As will be discussed below, since we require three years of data before the merger and three years after, our merger sample is restricted to the period from 1983 through 2011.

quarter before the merger.[18] We classify firms satisfying the above conditions as our treatment firms because these firms are likely to experience an increase in the extent of cross-ownership (i.e., the number of same-industry firms with which they share a common institutional blockholder) after the merger. Note that some treatment firms may be cross-held by one of the merging institutions before the merger. These firms are considered "treated" because they will form new ownership linkages with same-industry firms block-held by the other merging institution and thus receive the treatment.[19] The procedure described above does not use any ex post information, such as the actual cross-holding status of the firms post-merger. A crucial advantage of relying only on ex ante information to define treatments (and controls) is that it largely mitigates the concern that the actual holding/trading decision of the merged institution may be driven by private information about the firms.

When conducting the difference-in-differences analysis, we want to control for the managerial skills and investment styles of the merging institutions, which could be related to firm characteristics, such as future product market performance. Therefore, we require that control firms be block-held by the same merging institution that block-holds the treatments during the same quarter before the merger. The only difference between treatments and controls is that for the latter, we require that the other party to the merger do not simultaneously block-hold same-industry rivals of these firms so that the control firms' cross-ownership would not change simply because of the merger. However, this procedure necessarily implies that treatment and control firms involved in the same merger come from different industries (otherwise they would have both been classified as treatments). Although the inclusion of firm fixed effects in our DiD estimation framework largely mitigates the concern about time-invariant industry-specific effects (to the extent that firms do not

[18] Using the merger announcement date ensures that we only rely on ex ante information to define our treatment and control firms. Our baseline DiD results are nevertheless robust to using the closing date of the institution mergers to define treatments and controls.

[19] We thank an anonymous referee for the suggestion to include such firms in our treatment group.

switch industries), we fully address this concern by adopting an alternative procedure for defining controls, which we discuss in detail below in Section 4.4.

Our final DiD sample consists of 2,910 firms from 49 institution mergers between 1983 and 2011. Figure 2 shows the frequency of these institution mergers in our sample over time and Table A1 (see the appendix) provides a complete list of the mergers. As can be seen, there is very little clustering of the deals in particular years, which mitigates the concern that unobservable macroeconomic trends correlated with cross-ownership drive our DiD results.

We choose to study a symmetric seven-year window around the event year (i.e., three years before and three years after the institution merger plus the year of the merger) because of the trade-off between relevance and accuracy. On the one hand, choosing a window that is too long may incorporate too much noise that is irrelevant to the events. On the other hand, choosing a window that is too short may fail to capture meaningful changes in product market strategies and performance in response to the exogenous changes in cross-ownership, because it may take some time for cross-holders' influence to take effect. Given these considerations, we focus on a seven-year window, although results based on a five-year window are broadly similar.

4.3 DiD estimation

We employ a multivariate DiD approach to compare the change in market share growth for treatment firms with that for control firms. Specifically, we run the following regression:

$$AvgMktShareGrow_{i,j,t} = \alpha + \beta_1 Treat * Post + \beta_2 Post + \beta_3 Treat + \gamma' Control_{i,t-1} + \delta Fixed_{i,j} + \varepsilon_{i,j,t}, \quad (2)$$

where *i* indexes firm, *j* indexes the institution merger, and *t* indexes time (the period either before or after the merger). *AvgMktShareGrow* is the three-year average annual market share growth for firm *i* either in the pre-merger or the post-merger period.[20] *Treat* is a dummy that equals one for

[20] To ensure that our sample is not affected by survivorship bias, we do not require that firms have seven years of nonmissing financial data around financial institution mergers. Thus, the three-year average market share growth is

treatment firms and zero for control firms. *Post* is a dummy that equals one for the post-merger period and zero for the pre-merger period. *Control* is a vector of the control variables used in our OLS regression in Equation (1). To mitigate concerns for simultaneity, we measure control variables at year -4 for the pre-merger period and at year 0 for the post-merger period. In our most stringent regression specification, we include *firm-merger* fixed effects to absorb time-invariant characteristics across firms within the same merger as well as time-varying common time trends across mergers.[21] Under this regression framework, *Treat* itself is unidentified (and thus dropped from the regressions) because its effect is fully absorbed by the *firm-merger* fixed effects. In other specifications, we include firm fixed effects and merger fixed effects (and/or industry fixed effects) separately. In these cases, *Treat* is still identified because a given firm can act both as a treatment in one merger and as a control in another (occurring at a different time). To address the concern that residual market share growth for firms in the same institution merger might be correlated, we cluster standard errors by institution merger.

Panel A of Table 4 reports the results from the baseline DiD analysis as described in Equation (2).[22] In all specifications, the coefficient estimate before *Treat*Post* is positive and significant, suggesting that treatment firms, that is, those whose cross-ownership increases due to financial institution mergers, exhibit a greater increase in market share growth than control firms. In terms of economic significance, the coefficient estimates of *Treat*Post* across the five columns

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calculated based on available data. Our results are robust to requiring firms to have nonmissing financial data for all seven years.

[21] Note that a firm can appear in multiple mergers as a treatment or as a control. Thus, the inclusion of firm-merger fixed effects forces identification through variation in product market performance over time for the same firm in a given merger.

[22] To address the concern that *LnNum13D* is missing for a substantial fraction of the sample, which significantly reduces our sample size and test power, we add a new control variable, that is, *Missing13D* (which equals one if *LnNum13D* is missing and zero otherwise), in the DiD setting. At the same time, we replace missing values of *LnNum13D* with zeros to create a new variable, *LnNum13D_new*. Using both *Missing13D* and *LnNum13D_new* in our regressions (rather than *LnNum13D)* enables us to fully control for the effect of activist ownership without losing statistical power for the DiD tests. This approach to deal with control variables with significant missing information has been used by previous literature, such as He, Qian, and Strahan (2012, 2016). Nevertheless, the last specification (Column 5) in panel A of Table 4 shows that our baseline DiD results are robust to controlling for *LnNum13D* itself.

indicate that treatment firms, relative to control firms, experience around 0.7 to 0.9 percentage points larger increase in average annual market share growth during the three years after the institution merger than during the three years before the merger. This difference is economically significant, considering that market share growth in the DiD sample has a standard deviation of 4.9 percentage points.

[Insert Table 4 about here]

Note that the DiD estimate of the causal effect of cross-ownership on market share is larger than the OLS estimate. At least two reasons could explain this difference. First, as discussed earlier, this result suggests that the OLS estimate is downward biased, which is consistent with the notion that cross-holders, because of portfolio diversification considerations (Faccio, Marchica, and Mura, 2011), may choose to invest in mature firms or firms with more conservative product market strategies (that are expected to have relatively low market share growth). Second, the sample of firms/industries covered in our institution merger setting is different from that covered in our OLS analysis, which may also help to partially explain the difference in the magnitude of the estimates.

We then verify the premise of the quasi-natural experiment: institution mergers should on average lead to an increase in cross-ownership for the treatment group relative to the controls. Since the shock to cross-ownership is induced specifically by the institutions involved in the mergers, we define cross-ownership measures (including *CrossDummy* and *LnNumConnected*) with respect to the merging institutions.[23] Specifically, *CrossDummy* equals one if the merging institutions block-hold at least one other same-industry rival at the quarter-end immediately before the merger announcement date (for the pre-event period) or at the first quarter-end after the merger closing date (for the post-event period) and zero otherwise. Similarly, *LnNumConnected* is defined as the natural

[23] We conduct a robustness test using the same aggregate cross-ownership measures as in our OLS analysis as the dependent variables and find qualitatively similar results. This finding suggests that nonmerging institutions do not systematically reduce their cross-holdings in the treatment firms. The magnitude of the effects is smaller than that obtained using cross-ownership measures with respect to merging institutions, which is expected because of an attenuation bias due to substantial noise in the aggregate measures for cross-ownership.

logarithm of one plus the number of same-industry rivals that are blockheld by the merging institutions (i.e., the number of ownership linkages between the firm and its same-industry rivals that share the merging institutions as common blockholders) at the quarter-end immediately before the merger announcement date (for the pre-event period) or at the first quarter-end after the deal closing date (for the post-event period). We then carry out a multivariate DiD analysis on *CrossDummy* and *LnNumConnected* following the same specifications as in the first two columns of panel A of Table 4 (i.e., controlling for firm-merger fixed effects, but not other fixed effects). Panel B of Table 4 reports the results. Treatment firms experience significantly larger increases in cross-ownership around the mergers than control firms. The magnitude of the DiD estimates is economically sizable as well. For example, the DiD estimate for the effect of institution mergers on *CrossDummy* is around 0.24 to 0.27, which is economically large given that the mean of *CrossDummy* for the treatment group before the event is 0.48.

The success of the DiD approach hinges on a key identifying assumption, that is, the parallel trends assumption, which states that in the absence of treatment, the DiD estimate should be zero. We verify this assumption in two ways and report the results in Table A2 (see the appendix). First, we directly compare trends of market share growth between treatment and control firms during windows of different lengths up to six years before the event (similar to Almeida et al. 2012) and find no significant difference. Next, we perform a placebo test using year -4 as the "pseudo-event" year. Specifically, we use the same set of treatment and control firms identified in Section 4.2, and analyze their average market share growth during a seven-year window symmetrically around the hypothetical "event" year. In all four specifications similar to those reported in panel A of Table 4, the coefficient estimates before *Treat*Post* are statistically insignificant. The above two sets of results show that there are no observable divergent trends in market share growth between treatment and control firms before the exogenous shocks, suggesting that the parallel trends assumption is

likely to hold in our setting.

4.4 Robustness checks of the DiD analysis

We conduct various robustness checks of the DiD findings and report the results in Table 5. First, as stated earlier, the treatment and control firms in our main DiD analysis necessarily belong to different industries. To the extent that different industries may experience differential structural changes around the merger dates, our DiD results could merely reflect structural breaks in different industries rather than differences in firms' cross-ownership. Although there is no specific reason to expect a systematic change in the industries involved in our DiD sample that both coincides with the institution mergers and generates the empirical pattern we observe in Table 4, we still address this concern explicitly by using an alternative procedure to define control firms. Specifically, for each treatment firm, we first find its same-industry peers not block-held by the merging institutions but are block-held by some nonmerging institutions during the quarter before the merger. We then retain all such unique control firms for a particular merger, run our DiD analysis (following the first four specifications of Table 4, panel A), and report the results in Table 5, panel A. As we can see, our main DiD results continue to hold under this alternative definition of controls.

[Insert Table 5 about here]

Second, we adopt a propensity-score-matching method to control for differences in observable characteristics between the treatment and control firms prior to the event. Specifically, we rely on a nearest-neighbor matching of propensity scores, originally developed by Rosenbaum and Rubin (1983) and adopted in recent studies, such as Lemmon and Roberts (2010). We first run a probit regression to predict whether a firm becomes treated. We use a comprehensive list of pre-merger observable characteristics, including the full set of control variables in our main DiD regression as well as the level and trend of market share growth and cross-ownership status, as the explanatory variables. We then use the predicted probabilities, or propensity scores, from this probit

estimation and perform a nearest-neighbor match with replacement. We impose the common support condition in the matching algorithm by excluding treatment observations whose predicted propensity scores are higher than the maximum or lower than the minimum score of the controls. Since the number of potential control firms is considerably larger than the number of treatment firms, we choose three controls for each treatment. This allows us to avoid relying on too little information or including vastly different observations. However, our results are robust to any number of matches between one and five.[24] We repeat the main DiD tests (by following the first four specifications of Table 4, panel A) on the propensity-score-matched sample, and report the results in Table 5, panel B. As we can see, the increase in cross-ownership due to an exogenous shock continues to cause an increase in market share growth in this propensity-score-matched sample.

In untabulated analysis, we perform several additional robustness tests. First, to address the concern that our results could be driven by the growth in passive investors (i.e., large index funds or ETFs) over time, we repeat the DiD tests by restricting the mergers to those involving activist institutions or those involving dedicated institutions or non-quasi-indexing institutions (per Bushee's definition). The DiD estimates are significantly positive and slightly larger in magnitude relative to those obtained in our baseline DiD tests, suggesting that institutions that are more active in influencing corporations appear to be the main drivers of our results. Further, we conduct our DiD tests by excluding financial institution mergers announced after 2000, when ETFs and other index funds experienced rapid growth and find that our results still hold. Collectively, these findings mitigate the concern that our DiD results are driven entirely by passive institutions. Second, to make our DiD setting as clean as possible, we limit our sample of financial institution mergers to those in

[24] In untabulated analysis, we find that none of the matching variables are significantly different between the treatment and control firms post-matching. Further, the majority of differences in the estimated propensity scores between the treatment firms and their corresponding matches from the control group are trivial. Hence, the matching process seems effective in removing any meaningful observable differences between the two groups of firms prior to the DiD analysis.

response to the banking-industry deregulations in late 1990s (i.e., the Gramm-Leach-Bliley Act). Although this strict sample-screening procedure greatly reduces the number of observations, the DiD estimates remain qualitatively similar to those reported in panel A of Table 4. Last, we include the number of firms and the sales-based Herfindahl index for an industry-year as additional controls in our baseline DiD analysis to mitigate the concern for industry dynamics and find that our DiD results continue to hold.

Overall, the DiD analysis suggests that an exogenous increase in a firm's cross-ownership results in higher future market share growth, which is consistent with a positive causal effect of cross-ownership on product market performance.

5. Possible sources of product market gains

Our evidence so far is consistent with the hypothesis that cross-ownership helps firms on their product markets. In this section, we explore possible sources of product market gains induced by cross-ownership.

5.1 Explicit product market collaborations

In this subsection, we examine whether cross-owners facilitate explicit product market collaborations. If two firms in a given industry are owned (cross-held) by the same institution that exerts influence on firm management, they are likely to coordinate on product market strategies and better integrate their resources by entering into some form of product market agreements (joint ventures and strategic alliances), or, in the extreme case, merging with each other. Through these collaborative activities, cross-held firms may tap into larger new markets, grab more business

opportunities, enjoy greater economies of scale in production and sales, and ultimately compete more effectively against other non-cross-held rivals.[25]

To test the above conjecture, we perform a DiD analysis on firms' product market collaboration activities in the setting of institution mergers. Specifically, we compare the total number of explicit collaborative activities (including same-industry joint ventures, strategic alliances, and acquisitions) between two firms in a treatment pair with that between two firms in a matched control pair (matched by size and growth opportunities before the event) during the three years before and the three years after the institution merger. Since we look at the total number of collaboration activities within a pair during the pre- and post-period, we require that the two firms in a treatment or control pair have nonmissing records in the seven-year window around the institution merger years. The data on joint ventures, strategic alliances, and acquisitions during the 1980–2014 period were taken from the Security Data Company's (SDC's) Mergers and Acquisitions database. For acquisitions, we require that the acquirer own less than 50% of the target shares prior to the transaction. We consider mergers and full tender offers in which the target ceases to exist as a separate entity as well as partial acquisitions in which the acquirer seeks to own part of the target.

We define treatment pairs as pairwise combinations of any two treatment firms involved in the same institution merger as defined in our baseline DiD sample. We then match each treatment pair to three control pairs with the closest size and Tobin's q in the event (merger) year and retain all unique control pairs in the regressions.[26] We use two sets of control pairs. The first set is composed of pairwise combinations of control firms in our baseline DiD analysis (as defined in

[25] A number of studies find evidence that strategic alliances, joint ventures, and within-industry mergers and acquisitions are associated with improved corporate performance (e.g., Chan et al. 1997; Johnson and Houston 2000; Rindfleisch and Moorman 2001, 2003; Fee and Thomas 2004; Gomes-Casseres, Hagedoorn, and Jaffe 2006; Slovin, Sushka, and Mantecon 2007; Hoberg and Philips 2010; Sheen 2014).

[26] Specifically, we first compute the average firm size and Tobin's q for the two firms in each treatment and control pair, and then choose, for each treatment pair, three control pairs that have the smallest sum of the squared percentage differences in the average firm size and the average Tobin's q.

panel A of Table 4) that are involved in the same merger. We require that the two firms in each control pair to operate in the same industry.[27] The second set is composed of pairwise combinations of same-industry rivals to the firms in the treatment pair that are not block-held by the merging institutions but are block-held by some nonmerging institutions during the quarter before the merger (as defined in panel A of Table 5).

Table 6 presents the results. Each column includes pair and/or merger fixed effects. The dependent variable, *LnNumSame*, is the natural logarithm of one plus the total number of instances of explicit collaborations in the form of joint ventures, strategic alliances, or acquisitions between two firms in a pair during the three years before or the three years after the institution mergers. Panel A uses the first set of control pairs, and panel B uses the second set of control pairs. We conduct both a univariate and a multivariate DiD analysis. The multivariate DiD analysis includes the same set of control variables (averaged across the two firms in a pair) as in the baseline DiD analysis. Note that we control for pair fixed effects in the first two specifications, which uniquely identify pairs in the sample (i.e., none of the pairs appear in multiple mergers) and thus perfectly absorb merger fixed effects and industry fixed effects.

As we can see, the coefficient estimates before *Treat*Post* are all positive and significant (at the 5% level for panel A and at the 10% level for panel B), suggesting that firms in treatment pairs (i.e., those that are likely to experience an increase in cross-ownership due to financial institution mergers) increase their explicit product market collaboration between themselves via joint ventures, strategic alliances, or acquisitions compared with firms in control pairs after the institution mergers.

[27] An alternative way to construct a control pair is to take one control firm as in our baseline DiD analysis and find another firm that operates in the same industry as the first control firm but is not in our baseline set of control firms. We find qualitatively similar results using this alternative way of constructing control pairs.

Moreover, the multivariate DiD estimates of 0.014 to 0.017 are economically sizable, given that *LnNumSame* in the DiD sample has a mean of 0.003 and a standard deviation of 0.048.[28]

[Insert Table 6 about here]

The above DiD analysis suggests that explicit product market collaboration in the form of same-industry joint ventures, strategic alliances, or acquisitions might be one possible economic channel through which cross-ownership increases product market performance.[29]

5.2 Innovation productivity

Cross-held firms may also be able to achieve greater market share growth because they can share technological know-how and coordinate R&D efforts to lower production costs, enhance product quality, and improve innovative efficiency (Grossman and Shapiro 1986). To explore this possible economic gain due to cross-ownership, we analyze how treatment firms' innovation productivity changes relative to the control group in the institution merger setting.

Following the innovation literature (e.g., Hirshleifer, Hsu, and Li 2012), we measure a firm's innovation productivity by the number of patents it generates per dollar of its lagged R&D expenditures. We gathered patenting data from the database of Kogan et al. (forthcoming) (available at https://iu.box.com/patents), who covers patents granted by the United States Patent and Trademark Office (USPTO) up to 2010.[30] We average a firm's innovation productivity over the three-year period before and the three-year period after the institution mergers and adopt the same

[28] We note that these explicit collaborative activities are likely to only partially capture the extent of coordination between cross-held firms. There are many other types of collaboration among firms that our measure does not capture due to limited data availability. For example, firms may collaborate to set industry standards, conduct joint research, and enter into cross-licensing agreements or outsourcing agreements. Therefore, the estimates presented here should be viewed as a lower bound of the effect of cross-ownership on interfirm collaboration.

[29] In untabulated analysis, we find a significantly positive correlation between the intensity of explicit coordination activities (i.e., joint ventures, alliances, and acquisitions) and product market performance (e.g., market share growth, profit margins, or innovation efficiency) using our DiD sample. However, this result is only suggestive, because we do not have a clean identification for the effects of these collaboration activities.

[30] Following the recent literature (e.g., He and Tian 2013), we use the application year instead of the grant year to determine a firm's innovation output (i.e., patents) in a given year. To address the truncation concern for innovation activities that take place toward the end of our sample period, we adjust the patent data by following a standard practice in the innovation literature (first developed by Hall, Jaffe, and Trajtenberg 2001).

model specifications as in the baseline DiD test (i.e., the first four columns of panel A of Table 4). Table 7, panel A reports the DiD estimates. In all columns, the coefficient estimates before *Treat*Post* are significantly positive at the 5% level, suggesting that firms exhibit higher growth in innovation productivity following an exogenous shock to their cross-ownership. The DiD estimates of 0.012 to 0.013 across the four columns are economically nontrivial, given that innovation productivity has a standard deviation of 0.131 in the DiD sample. This finding is consistent with the innovation efficiency benefits offered by cross-ownership due to resource sharing and coordinated R&D efforts among cross-held firms. Therefore, the gains in innovation productivity due to collaboration on R&D projects might be another contributor to the improvement in product market performance induced by cross-ownership.

5.3 Operating profitability

To examine whether the gains in market share growth caused by cross-ownership translate into increases in operating profitability, we compare the change in operating profit margins and ROA between the treatment and control firms in the DiD framework. We use the same set of measures of operating profitability as in Table 3, that is, *NOP*, *NPM*, and *ROA*. We calculate the average of these industry-adjusted operating profitability measures over the three-year period before and the three-year period after the institution mergers and run multivariate DiD regressions as in panel A of Table 4. To make the panel fit on the page properly, we only keep the first two model specifications from panel A of Table 4 that we believe are the most stringent, which control for firm-merger fixed effects, but not other fixed effects.

The multivariate DiD results are presented in Table 7, panel B. As we can see, the coefficient estimates before *Treat*Post* are positive and significant at the 5% level in five of the six specifications, suggesting that cross-ownership enhances the profitability of firms. The results are economically significant as well. For example, the DiD estimates for *NOP* in the first two columns

range from 2.5 to 2.8 percentage points, which are economically large relative to its standard deviation in our DiD sample (13.5 percentage points). Similarly, the DiD estimates for ROA in the last two columns range from 0.8 to 0.9 percentage points, which are economically nontrivial, considering that this variable has a standard deviation of 7.1 percentage points in our DiD sample.

[Insert Table 7 about here]

It is worth noting that operating profitability (especially operating profit margins) likely reflects the outcome of both explicit and implicit product market coordination. The mechanisms discussed above suggest that cross-ownership by institutional blockholders fosters explicit product market coordination (e.g., joint ventures and R&D alliances). However, cross-holding institutions could use their information about the companies they block-hold and their influence over the companies' management to facilitate bridge-building and the development of implicit business ties. Although these "behind-the-scenes" activities are generally not observable, the outcome of such collaborative behavior can be partly captured by profit margins. A high profit margin could be a manifestation of reduced costs because of efficiency improvements induced by cross-ownership. For instance, cross-held firms can coordinate R&D efforts to lower production costs and improve innovative efficiency (Grossman and Shapiro 1986) and increase purchasing efficiencies (see, e.g., Fee and Thomas 2004). A high profit margin could also indicate a firm's ability to increase price without losing much demand for its products, which reflects its pricing power that may arise from its cooperation with same-industry firms held by a common blockholder. Such product market coordination activities include, but are not limited to, joint "predation" strategies via financial collaboration to drive out local competitors (see, e.g., Bolton and Scharfstein 1990) and reducing aggressive marketing campaigns that attack each other, which could potentially raise the local entry barrier and enhance the market power of cross-held firms against other same-industry rivals. Therefore, the evidence of a relative increase in operating profit margin for treatment firms

following institution mergers can be interpreted as consistent with cross-ownership facilitating both explicit and implicit coordination.

5.4 Efficiency gains or collusion?

As in the case of horizontal mergers (e.g., Fee and Thomas 2004), improved productive efficiency may be the primary driver of gains in product market share for cross-held firms. Cross-ownership, by fostering various forms of product market collaboration, can reduce cross-held firms' production and operational costs and help them realize greater economies of scale, which in turn allow the firms to charge a lower price to attract more customers and grab market share. If the increase in demand (and the corresponding quantities of goods sold) dominates the decrease in price (due to cost efficiency), then the firms' sales revenue (and thus their sales-based market share) will increase relative to that of their same-industry rivals that are not cross-held. Our results in Section 5.2 regarding innovation productivity in the DiD setting support the above production efficiency explanation, implying that institutional cross-ownership can lead to the sharing of technological know-how and coordinated R&D efforts among cross-held firms.

On the other hand, the gains in market share can also be driven by increased price collusion facilitated by cross-ownership. By reducing the number of *independent* decision-making firms in an industry, cross-ownership can induce the firms in the industry to coordinate better on price and move toward a more monopolistic equilibrium. While our data do not allow us to explore this possibility in detail, our 13D-filing event-study result (reported in Section 6.1) that corporate customers of cross-held firms do not experience negative stock price reactions indicates that price collusion induced by institutional cross-ownership seems unlikely to be the primary driver of our main results. Future research, equipped with detailed data on unit output price, unit marginal cost, and the quantities of goods sold, is needed to provide a definitive answer to this question.

6. Event Studies

If cross-owners facilitate coordination among their portfolio companies and improve these firms' product market performance, the stock prices of these companies should reflect the gains in market share. In this section, we conduct two tests to examine the effect of cross-ownership on stock returns using an event-study approach.

6.1 Announcement returns of existing blocks around schedule 13D filings

Schedule 13D filings provide an ideal setting to examine the stock price effect of cross-ownership for three reasons. First, 13D filings provide a clear indication of activism pursued by the filing institution. Second, 13D filings are generally unanticipated, because they are associated with significant abnormal returns for the firms being targeted around the time of the filings (Brav et al. 2008). Third, but not least of all, the acquisition of a new block and the corresponding filing of a 13D form would change the cross-holding status of stocks already block-held by the institution. Our hypothesis predicts that stocks already block-held by the institution that are in the same industry as the newly acquired block should experience significantly positive abnormal returns following the 13D filing on the new block. In contrast, stocks already block-held by the institution that are not in the same industry as the newly acquired block should experience insignificant returns due to the lack of coordination benefits.

For each 13D filing by a 13F institution, we retrieve the institution's 13F holdings in the quarter immediately before the filing and classify blocks in the institution's portfolio into cross-held blocks and non-cross-held blocks. Specifically, cross-held blocks are stocks already block-held by the institution that are in the same four-digit SIC industry as the newly acquired block, and non-cross-held blocks are stocks already block-held by the institution that are not in the same industry as the newly acquired block. We focus on initial 13D filings by institutions and identify 510 cross-held blocks and 8,081 non-cross-held blocks for the 1994–2014 period. We calculate the average CARs

of cross-held and non-cross-held blocks around the filing of a 13D on a newly acquired block by the same institution. The abnormal returns are obtained using the CAPM and the Fama-French-Carhart four-factor model. We use a 12-day event window, from day -1 to +10, with day 0 as the filing date.[31] The results, reported in Table 8, panel A, show that cross-held blocks deliver a CAR of 2.1% to 2.2%, whereas non-cross-held blocks have a much smaller CAR (close to 0%). The difference between the CARs of the two groups of blocks is significant at conventional levels. These results are consistent with our prediction that the stock prices of cross-held firms reflect the potential gains induced by cross-ownership.[32]

To test whether cross-ownership enables firms to raise prices at the expense of their customers, we examine the stock price reaction of corporate customers of cross-held firms in the 13D filing setting. If cross-held firms collude by increasing their prices and restricting output, the corporate customers of these cross-held firms should experience significant negative announcement returns around the 13D filing. We identify corporate customers of cross-held firms using Compustat industry segment files (following Fee and Thomas 2004). The result, reported also in Table 8, panel A, shows that corporate customers of cross-held firms have positive but insignificant CARs during the event window. This finding seems inconsistent with the hypothesis that cross-ownership engenders anticompetitive effects in our sample.

[Insert Table 8 about here]

6.2 Announcement returns of treatment and control firms around institution mergers

[31] It appears that it takes time for the market to fully incorporate the information in 13D filings. For example, Brav et al. (2008) use a 40-day window around the filings to examine the market reaction. In unreported analysis, we obtain qualitatively similar results using alternative window lengths.

[32] In untabulated analysis, we find that rival stocks in the same industry as the newly acquired stock that are not blockheld by the 13D filer but are blockheld by other institutional investors also experience positive abnormal returns around 13D filings. However, the magnitude of the CAR for these rival stocks (around 0.2%) is significantly smaller than that for our cross-held blocks (around 2%), suggesting that the CAR results we observe are not driven entirely by industry-wide misvaluation.

To gauge the causal impact of cross-ownership on a firm's stock price, we analyze the average CARs of treatment and control stocks in our DiD sample surrounding the announcement of the institution mergers. Again, we obtain the abnormal returns using the CAPM and the Fama-French-Carhart four-factor model, respectively, and examine the CARs from day -1 to +10, with day 0 as the announcement date of the institution merger. Since CARs reflect changes of stock prices for treatment and control firms, this test can be viewed as a DiD analysis on the effect of cross-ownership on stock performance.

Table 8, panel B, presents the results for this event study. The CARs for treatment firms are around 1.6%-1.7% and statistically significant, whereas those for control firms are small and insignificant. Moreover, the difference between the CARs for treatment firms and for control firms is significant at the 1% or 5% level. The economic magnitude is also large: treatment firms outperform control firms by approximately 1.4-1.7 percentage points during the 12-day announcement period. This finding is consistent with the conjecture that gains in market share growth due to an exogenous increase in cross-ownership are partly reflected in stock prices.[33]

7. Conclusion

In this paper, we have analyzed the impact of institutional cross-ownership on product market behavior and performance. We find that cross-held firms experience significantly higher market share growth than non-cross-held firms. We have established causality using a difference-in-differences approach based on the quasi-natural experiment of financial institution mergers. Further, we have explored and discussed several forms of product market coordination facilitated by cross-ownership: explicit coordination (in the form of within-industry joint ventures, strategic alliances,

[33] For robustness, we repeat our CAR tests in the DiD setting using two alternative definitions for control stocks. First, we define control stocks as same-industry rivals block-held by nonmerging institutions (as in panel A of Table 5). Second, we define control stocks using a propensity-score matching approach as in panel B of Table 5. In both cases we find results similar to those reported here.

or within-industry acquisitions) and improvements in innovation productivity and operating profit margins that may reflect implicit coordination activities. Overall, our evidence suggests that cross-ownership by institutional blockholders offers strategic benefits by fostering product market coordination. By establishing a causal relationship between cross-ownership and product market performance and exploring possible economic channels, our study has important implications for studies on the interaction of ownership/organizational structure and product market behavior and suggests that future research on product market competition should carefully examine firms' interconnectedness through common equity ownership.

References

Adams, J., S. Mansi, and T. Nishikawa. 2010. Internal governance mechanisms and operational performance: Evidence from index mutual funds. *Review of Financial Studies* 23:1261–86.

Aghion, P., J. Van Reenen, and L. Zingales. 2013. Innovation and institutional ownership. *American Economic Review* 103:277–304.

Allen, J., and G. Phillips. 2000. Corporate equity ownership, strategic alliances, and product market relationships. *Journal of Finance* 55:2791–815.

Almeida, H., M. Campello, B. Laranjeira, and S. Weisbenner. 2012. Corporate debt maturity and the real effects of the 2007 credit crisis. *Critical Finance Review* 1:3–58.

Appel, I. R., T. A. Gormley, and D. B. Keim. 2016. Passive investors, not passive owners. *Journal of Financial Economics* 121:111–41.

Asker, J., and A. Ljungqvist. 2010. Competition and the structure of vertical relationships in capital markets. *Journal of Political Economy* 118:599–647.

Azar, J., M. Schmalz, and I. Tecu. 2015. Anti-competitive effects of common ownership: Evidence from the airline industry. Working Paper.

Becht, M., A. Polo, and S. Rossi. 2016. Does mandatory shareholder voting prevent bad acquisitions? *Review of Financial Studies* 29:3035–67.

Bloch, F. 1995. Endogenous structures of association in oligopolies. *Rand Journal of Economics* 26:537–56.

Bolton, P., and D. Scharfstein. 1990. A theory of predation based on agency problems in financial contracting. *American Economic Review* 80:93–106.

Brav, A., W. Jiang, F. Partnoy, and R. Thomas. 2008. Hedge fund activism, corporate governance, and firm performance. *Journal of Finance* 63:1729–75.

Bushee, B. 1998. The influence of institutional investors on myopic R&D investment behavior. *The Accounting Review* 73:305–33.

———. 2001. Do institutional investors prefer near-term earnings over long-run value? *Contemporary Accounting Research* 18:207–46.

Campello, M. 2006. Debt financing: Does it boost or hurt firm performance in product markets? *Journal of Financial Economics* 82:135–72.

Campello, M., and Z. Fluck. 2006. Product market performance, switching costs, and liquidation values: The real effects of financial leverage. Working Paper.

Chan, L., J. Lakonishok, and T. Sougiannis. 2001. The stock market valuation of research and development expenditures. *Journal of Finance* 56:2431–56.

Chan, S., J. Kensinger, A. Keown, and J. Martin. 1997. Do strategic alliances create value? *Journal of Financial Economics* 46:199–221.

Chemmanur, T., and J. He. 2011. IPO waves, product market competition, and the going public decision: Theory and evidence. *Journal of Financial Economics* 101:382–412.

Chevalier, J., and D. Scharfstein. 1996. Capital market imperfections and countercyclical markups: Theory and evidence. *American Economic Review* 86:703–25.

Clarke, R. 1989. SICs as delineators of economic markets. *Journal of Business* 62:17–31.

Cohen, L., and A. Frazzini. 2008. Economic links and predictable returns. *Journal of Finance* 63:1977–2011.

Crane, A. D., S. Michenaud, and J. P. Weston. 2016. The effect of institutional ownership on payout policy: A regression discontinuity design approach. *Review of Financial Studies* 29:1377–408.

Del Guercio, D., L. Seery, and T. Woidtke. 2008. Do boards pay attention when institutional investor activists “just vote no”? *Journal of Financial Economics* 90:84–103.

Ekern, S., and R. Wilson. 1974. On the theory of the firm in an economy with incomplete markets. *Bell Journal of Economics and Management Science* 5:171–80.

Faccio, M., M. Marchica, and R. Mura. 2011. Large shareholder diversification and corporate risk-taking. *Review of Financial Studies* 24:3601–41.

Farrell, J., and C. Shapiro. 1990. Asset ownership and market structure in oligopoly. *Rand Journal of Economics* 21:275–92.

Fee, C. E., and S. Thomas. 2004. Sources of gains in horizontal mergers: Evidence from customer, supplier, and rival firms. *Journal of Financial Economics* 74:423–60.

Fee, C. E., C. J. Hadlock, and S. Thomas. 2006. Corporate equity ownership and the governance of product market relationships. *Journal of Finance* 61:1217–51.

Fresard, L. 2010. Financial strength and product market behavior: The real effects of corporate cash holdings. *Journal of Finance* 65:1097–122.

Gaspar, J., M. Massa, and P. Matos. 2005. Shareholder investment horizons and the market for corporate control. *Journal of Financial Economics* 76:153–65.

Gilo, D., Y. Moshe, and Y. Spiegel. 2006. Partial cross ownership and tacit collusion. *Rand Journal of Economics* 37:81–99.

Gomes-Casseres, B., J. Hagedoorn, and A. B. Jaffe. 2006. Do alliances promote knowledge flows? *Journal of Financial Economics* 80:5–33.

Grossman, G. M., and C. Shapiro. 1986. Research joint ventures: An antitrust analysis. *Journal of Law, Economics, & Organization* 2:315–37.

Grossman, S. J., and J. E. Stiglitz. 1980. Stockholder unanimity in making production and financial decisions. *Quarterly Journal of Economics* 94:543–66.

Hadlock, C., and R. Sonti. 2012. Financial strength and product market competition: Evidence from asbestos litigation. *Journal of Financial and Quantitative Analysis* 47:179–211.

Hall, B. H., A. Jaffe, and M. Trajtenberg. 2001. The NBER patent citation data file: Lessons, insights and methodological tools. Working Paper.

Hansen, R. G., and J. R. Lott, Jr. 1996. Externalities and corporate objectives in a world with diversified shareholder/consumers. *Journal of Financial and Quantitative Analysis* 31:43–68.

Harford, J., D. Jenter, and K. Li. 2011. Institutional cross-holdings and their effect on acquisition decisions. *Journal of Financial Economics* 99:27–39.

Hart, O. D. 1979. Monopolistic competition in a large economy with differentiated commodities. *Review of Economic Studies* 46:1–30.

Hartzell, J. C., and L. T. Starks. 2003. Institutional investors and executive compensation. *Journal of Finance* 58:2351–74.

He, J., and X. Tian. 2013. The dark side of analyst coverage: The case of innovation. *Journal of Financial Economics* 109:856–78.

He, J., J. Qian, and P. Strahan. 2012. Are all ratings created equal? The impact of issuer size on the pricing of mortgage-backed securities. *Journal of Finance* 67:2097–137.

———. 2016. Does the market understand rating shopping? Predicting MBS losses with initial yields. *Review of Financial Studies* 29:457–85.

Hirshleifer, D. A., P. Hsu, and D. Li. 2012. Innovative efficiency and stock returns. *Journal of Financial Economics* 107:632–54.

Hoberg, G., and G. Phillips. 2010. Product market synergies and competition in mergers and acquisitions: A text-based analysis. *Review of Financial Studies* 23:3773–811.

———. 2016. Text-based network industries and endogenous product differentiation. Journal of Political Economy 124:1423–65.

Holthausen, R. W., R. W. Leftwich, and D. Mayers. 1990. Large-block transactions, the speed of response, and temporary and permanent stock-price effects. *Journal of Financial Economics* 26:71–95.

Houston, J., F., C. M. James, and M. D. Ryngaert. 2001. Where do merger gains come from? Bank mergers from the perspective of insiders and outsiders. *Journal of Financial Economics* 60:285–331.

Huang, J. 2016. Shareholder coordination, corporate governance, and firm value. Working Paper.

Jayaraman, N., A. Khorana, and E. F. Nelling. 2002. An analysis of the determinants and shareholder wealth effects of mutual fund mergers. *Journal of Finance* 57:1521–51.

Johnson, S. A., and M. B. Houston. 2000. A reexamination of the motives and gains in joint ventures. *Journal of Financial and Quantitative Analysis* 35:67–85.

Kacperczyk, M., C. Sialm, and L. Zheng. 2005. On the industry concentration of actively managed mutual funds. *Journal of Finance* 60:1983–2012.

Kahle, K., and R. A. Walking. 1996. The impact of industry classifications on financial research. *Journal of Financial and Quantitative Analysis* 31:309–35.

Keim, D. B., and A. Madhavan. The upstairs market for large-block transactions: analysis and measurement of price effects. *Review of Financial Studies* 9:1–36.

Klein, B., R. Crawford, and A. Alchian. 1978. Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics* 21:297–326.

Kogan, L., D. Papanikolaou, A. Seru, and N. Stoffman. Forthcoming. Technological innovation, resource allocation, and growth. *Quarterly Journal of Economics.*

Lemmon, M., and M. Roberts. 2010. The response of corporate financing and investment to changes in the supply of credit. *Journal of Financial and Quantitative Analysis* 45:555–87.

Matvos, G., and M. Ostrovsky. 2008. Cross-ownership, returns, and voting in mergers. *Journal of Financial Economics* 89:391–403.

Maksimovic, V. 1986. Optimal capital structure in oligopolies. PhD Dissertation, Harvard University.

Opler, T., and S. Titman. 1993. The determinants of leveraged buyout activity: Free cash flow vs. financial distress costs. *Journal of Finance* 48:1985–99.

Parker, P. M., and L. Röller. 1997. Collusive conduct in duopolies: Multimarket contact and cross-ownership in the mobile telephone industry. *Rand Journal of Economics* 28:304–22.

Parrino, R., R. W. Sias, and L. T. Starks. 2003. Voting with their feet: Institutional ownership changes around forced CEO turnover. *Journal of Financial Economics* 68:3–46.

Radner, R. 1974. A note on unanimity of stockholders' preferences among alternative production plans: A reformulation of the Ekern-Wilson model. *Bell Journal of Economics and Management Science* 5:181–84.

Reynolds, R. J., and B. R. Snapp. 1986. The competitive effects of partial equity interests and joint ventures. *International Journal of Industrial Organization* 4:141–53.

Rindfleisch, A., and C. Moorman. 2001. The acquisition and utilization of information in new product alliances: A strength-of-ties perspective. *Journal of Marketing* 65:1–18.

———. 2003. Interfirm cooperation and customer orientation. *Journal of Marketing Research* 40:421–36.

Rosenbaum, P. R., and D. B. Rubin. 1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70:41–55.

Sheen, A. 2014. The real product market impact of mergers. *Journal of Finance* 69:2651–88.

Slovin, M., M. E. Sushka, and T. P. Mantecon. 2007. Analyzing joint ventures as corporate control activity. *Journal of Banking and Finance* 31:2365–82.

Williamson, O. 1985. *The economic institutions of capitalism: Firms, markets, relational contracting*. New York: The Free Press.

Yi, S. 1997. Stable coalition structures with externalities. *Games and Economic Behavior* 20:201–37.

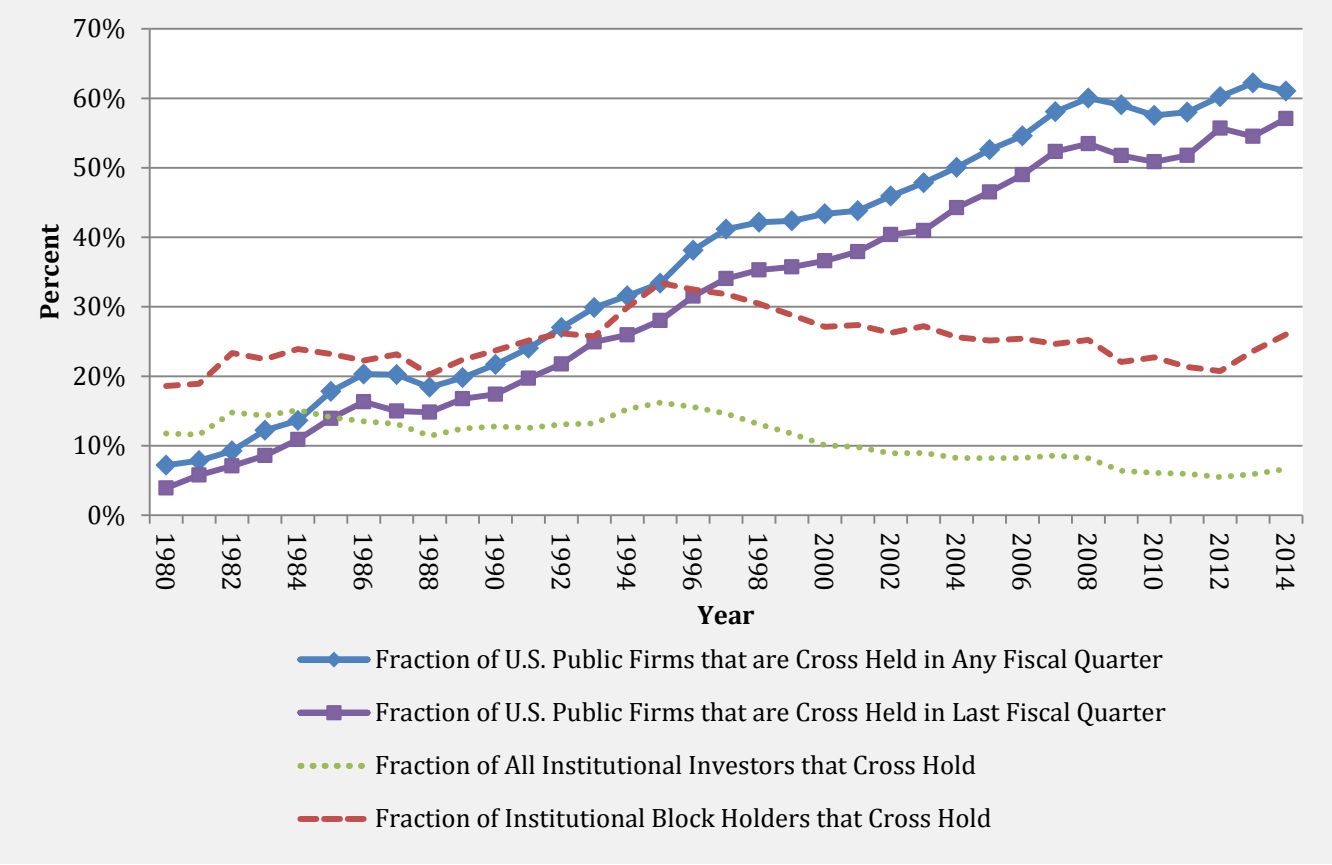

Figure 1
Patterns of institutional cross-ownership over time
This figure plots the trend in cross-ownership by institutional investors from 1980 through 2014. Institutional blockholders of a firm are those that hold at least 5% of the outstanding shares of the firm. A firm is defined to be cross-held by an institution in a given quarter when the institution simultaneously block-holds the firm and at least one other firm in the same four-digit SIC industry. The blue line with diamonds shows the fraction of U.S. public firms that are cross-held by institutional investors in any quarter of the fiscal year. The purple line with squares shows the fraction of U.S. public firms that are cross-held by institutional investors in the last quarter of the fiscal year. The green dotted line represents the fraction of all U.S institutional investors that cross-hold same-industry firms in a given year. The red dashed line shows the fraction of institutional blockholders that cross-hold same-industry firms in a given year. The unit of observation for the green dotted line and the red dashed line is an institution-year.

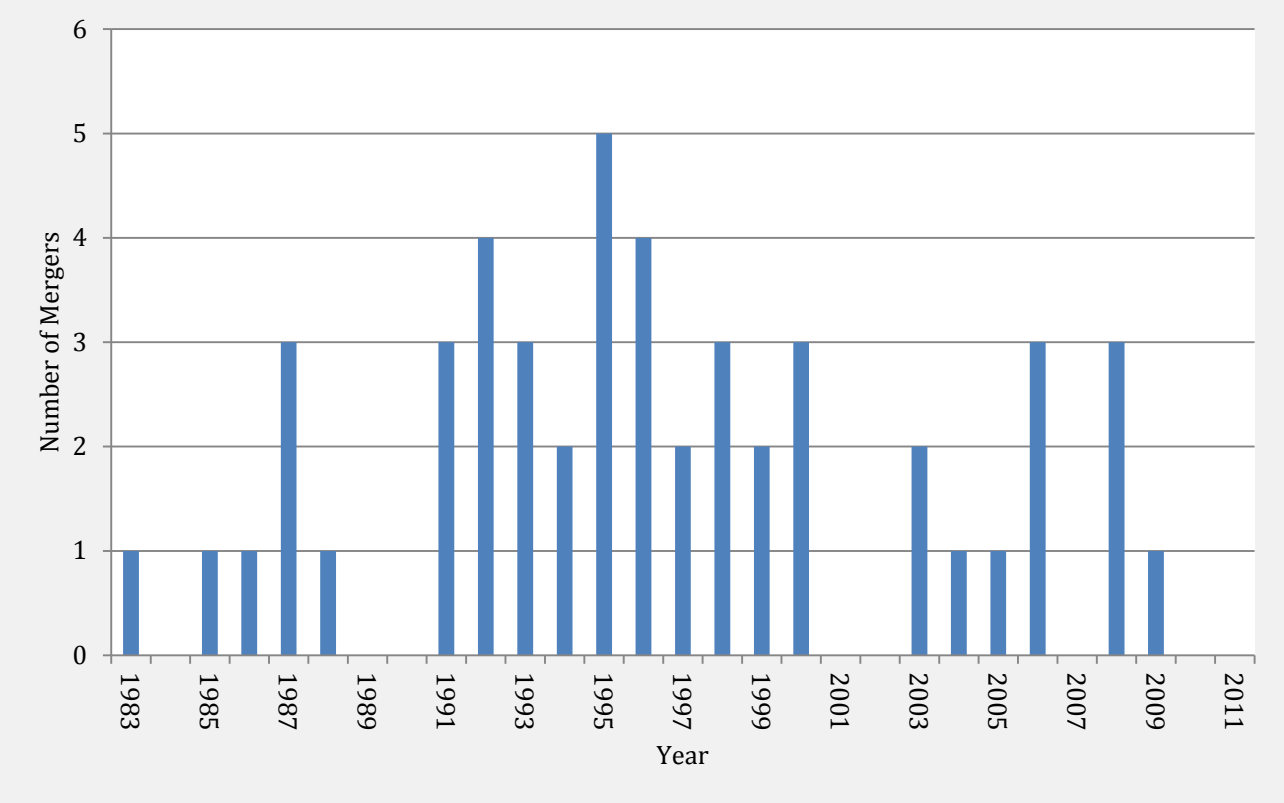

Figure 2
Frequency of financial institution mergers in the DiD analysis
This figure plots the number of financial institution mergers in our DiD sample that were announced in each year between 1983 and 2011.

Table 1
Summary statistics and sample characteristics

A. Summary statistics

Variable	Mean	P25	Median	P75	SD	N
CrossDummy	0.415	0.000	0.000	1.000	0.493	103,512
NumConnected	2.285	0.000	0.000	2.000	5.521	103,512
NumCross	0.604	0.000	0.000	1.000	0.852	103,512
AvgNum	1.043	0.000	0.000	1.000	2.218	103,512
TotalCrossOwn	0.064	0.000	0.000	0.096	0.100	103,512
$MktShareGrow_{t+1}$	0.002	-0.002	0.000	0.003	0.066	103,512
Assets (in $ billions)	1.038	0.022	0.090	0.429	3.566	103,512
Tobin q	1.932	1.032	1.361	2.106	1.670	103,512
CashAssets	0.179	0.025	0.089	0.256	0.213	103,512
Leverage	0.173	0.006	0.120	0.282	0.186	103,512
ROA	0.057	0.030	0.106	0.165	0.219	103,512
R&DCapital	0.125	0.000	0.000	0.195	0.203	103,512
CapexAssets	0.062	0.019	0.041	0.079	0.068	103,512
AcqAssets	0.020	0.000	0.000	0.005	0.056	103,512
PPEGrowth	0.192	0.022	0.088	0.223	0.446	103,512
BlockOwn	0.114	0.000	0.073	0.181	0.131	103,512
InstOwn	0.368	0.107	0.315	0.595	0.288	100,280
BlockDummy	0.691	0.000	1.000	1.000	0.462	103,512
Num13D	0.144	0.000	0.000	0.000	0.506	59,863

B. Characteristics of cross-held and non-cross-held firms

Variable	Cross-held		Non-cross-held			
	Mean (1)	Median (2)	Mean (3)	Median (4)	Difference (1)-(3)	Difference (2)-(4)
$MktShareGrow_{t+1}$	0.003	0.000	0.000	0.000	0.003***	0.000***
Assets (in $ billions)	1.257	0.163	0.883	0.051	0.374***	0.112***
Tobin q	1.915	1.396	1.944	1.337	-0.029***	0.059***
CashAssets	0.207	0.114	0.159	0.076	0.048***	0.038***
Leverage	0.169	0.112	0.175	0.126	-0.006***	-0.014***
ROA	0.071	0.108	0.048	0.104	0.023***	0.004***
R&DCapital	0.148	0.020	0.109	0.000	0.039***	0.020***
CapexAssets	0.060	0.039	0.064	0.043	-0.004***	-0.004***
AcqAssets	0.024	0.000	0.018	0.000	0.006***	0.000***
PPEGrowth	0.181	0.090	0.200	0.087	-0.019***	0.003***
BlockOwn	0.188	0.163	0.061	0.000	0.127***	0.163***
InstOwn	0.528	0.531	0.247	0.160	0.281***	0.371***
BlockDummy	1.000	1.000	0.472	0.000	0.528***	1.000***
Num13D	0.127	0.000	0.165	0.000	-0.038***	0.000***

C. Distribution of cross-held and non-cross-held firms in industries

Fama-French 12 industry	Fraction of firm-years across industries		
		Non-cross-held	
	Cross-held	Block-held	Non-block-held
Consumer nondurables	23.97%	45.45%	30.58%
Consumer durables	33.76%	39.85%	26.39%
Manufacturing	35.47%	40.58%	23.95%
Energy	44.16%	19.40%	36.44%
Chemicals and allied products	26.90%	43.56%	29.54%
Business Equipment	55.98%	17.13%	26.89%
Telephone and television transmission	47.17%	25.22%	27.62%
Utilities	39.35%	21.06%	39.59%
Shops	39.42%	34.21%	26.37%
Health care, medical equipment, and drugs	48.50%	19.61%	31.88%
Finance	42.98%	25.12%	31.90%
Other	41.16%	31.03%	27.81%

This table reports summary statistics based on the sample of U.S. public firms from 1980 to 2014. Panel A provides summary statistics. *CrossDummy* is a dummy variable that equals one if a firm is cross-held in any of the four quarters prior to the fiscal year-end, and zero otherwise. *NumConnected* is the average number of same-industry rivals that share any common institutional blockholder with the firm in the four quarters prior to the fiscal year-end. *NumCross* is the average number of unique institutions that cross-hold a firm in the four quarters prior to the fiscal year-end. *AvgNum* is the average number of rivals block-held by the cross-holding institutions during the fiscal year. *TotalCrossOwn* is the sum of all cross-holding institutions' average percentage holdings in a firm itself. $MktShareGrow_{t+1}$ is the difference between a firm's market share in the next year and that in the current year. Other variables include inflation-adjusted total assets in real 1982-1984 dollars (*Assets*), Tobin's q (*Tobin q*), cash and equivalents over assets (*CashAssets*), leverage (*Leverage*), return on assets (*ROA*), R&D capital scaled by book equity (*R&DCapital*), capital expenditures over assets (*CapexAssets*), acquisition expenditures over assets (*AcqAssets*), growth in property, plant, and equipment (*PPEGrowth*), the average percentage ownership by institutional blockholders (*BlockOwn*), the percentage ownership by institutional investors (*InstOwn*), a dummy to indicate whether a firm is block-held in any of the four quarters prior to the fiscal year-end (*BlockDummy*), and the number of initial 13D filings targeting the firm during the fiscal year (*Num13D*). Panel B summarizes the characteristics of cross-held and non-cross-held firm-years. Panel C presents the distribution of cross-held firms, non-cross-held but block-held firms, and non-block-held firms across the Fama-French 12 industries. ***, **, and * indicate that a two-sample *t*-test or a nonparametric median test is significant at the 1%, 5%, and 10% levels, respectively.

Table 2
OLS regression of future market share growth on cross-ownership

A. CrossDummy *as a measure of cross-ownership*

Dep. variable	*MktShareGrow*$_{t+1}$			
	(1)	(2)	(3)	(4)
CrossDummy	0.004***	0.004***	0.005***	0.005***
	(5.641)	(5.588)	(5.784)	(4.172)
LnAssets		-0.002***	-0.001**	-0.002**
		(-3.909)	(-2.518)	(-2.073)
Tobin q		0.001***	0.001***	0.001***
		(3.815)	(4.002)	(3.513)
CashAssets		0.002	0.002	0.002
		(1.051)	(1.144)	(0.715)
Leverage		0.002	0.002	0.006*
		(1.105)	(1.024)	(1.698)
ROA		-0.002	-0.001	-0.002
		(-1.095)	(-0.924)	(-1.179)
R&DCapital		0.001	0.001	-0.001
		(0.461)	(0.461)	(-0.359)
CapexAssets		-0.006	-0.003	-0.015**
		(-1.157)	(-0.657)	(-2.084)
AcqAssets		0.028***	0.030***	0.027***
		(5.286)	(5.589)	(4.130)
PPEGrowth		0.002***	0.002***	0.002***
		(3.678)	(3.295)	(2.828)
BlockOwn		0.001	0.006	0.005
		(0.250)	(1.341)	(1.031)
InstOwn			-0.004	-0.006
			(-1.214)	(-1.408)
BlockDummy			-0.002**	-0.002
			(-2.154)	(-1.337)
LnNum13D				0.003**
				(2.285)
Firm FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes
Observations	103,512	103,512	100,280	59,353
R-squared	0.099	0.100	0.100	0.119

B. Alternative measures of cross-ownership

Dep. variable	*MktShareGrow*$_{t+1}$					
	(1)	(2)	(3)	(4)	(5)	(6)
LnNumConnected	0.002***					
	(4.399)					
LnNumCross		0.006***				
		(4.317)				
LnAvgNum			0.002***			

			(3.828)			
TotalCrossOwn				0.021***		
				(3.979)		
LastCrossDummy					0.002**	
					(2.414)	
AllCrossDummy						0.002**
						(1.961)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	59,353	59,353	59,353	59,353	59,353	59,353
R-squared	0.118	0.119	0.118	0.118	0.118	0.118

C. Robustness tests

Dep. var.	*MktShareGrow*$_{t,t+1}$ (*or MktShareGrow*$_{t,t+3}$ in Model (8))							
	FIC500	Manu	Refine	Drop5	Block	SP500	Alter	3-year
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CrossDummy	0.011***	0.006***	0.004**	0.003***	0.006***	0.008**	0.036***	0.012***
	(8.274)	(3.474)	(2.236)	(2.901)	(4.396)	(2.125)	(3.588)	(3.825)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	52,041	27,284	31,004	48,739	47,845	9,037	58,579	43,962
R-squared	0.070	0.125	0.127	0.206	0.133	0.080	0.182	0.251

D. Activist versus nonactivist institutions

Dep. variable	*MktShareGrow*$_{t+1}$				
	(1)	(2)	(3)	(4)	(5)
CrossDummy_13D	0.005***				
	(3.156)				
CrossDummy_Non13D	0.001				
	(0.506)				
LnNumConnected_13D		0.003***			
		(3.140)			
LnNumConnected_Non13D		0.001			
		(1.223)			
LnNumCross_13D			0.005***		
			(2.851)		
LnNumCross_Non13D			0.002		
			(1.058)		
LnAvgNum_13D				0.003***	
				(2.912)	
LnAvgNum_Non13D				0.000	
				(0.177)	
TotalCrossOwn_13D					0.034***
					(2.925)
TotalCrossOwn_Non13D					0.012

					(1.327)
Controls	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	47,349	47,349	47,349	47,349	47,349
R-squared	0.122	0.122	0.122	0.122	0.122
Wald-test F-stat	4.231	3.249	3.260	4.227	3.869
p-value	0.040	0.072	0.071	0.040	0.049

This table reports the OLS regression results of future market share growth on cross-ownership measures and controls. *LnAssets* is the natural logarithm of total assets. *LnNum13D* is the natural logarithm of one plus the number of initial 13D filings targeting the firm during the fiscal year. *LnNumConnected* is the natural logarithm of one plus the average number of same-industry rivals that share any common institutional blockholder with the firm in the four quarters prior to the fiscal year-end. *LnNumCross* is the natural logarithm of one plus the average number of unique institutions that cross-hold a firm in the four quarters prior to the fiscal year-end. *LnAvgNum* is the natural logarithm of one plus the average number of rivals block-held by the cross-holding institutions during the fiscal year. *LastCrossDummy* is a dummy that equals one if a firm is cross-held in the last fiscal quarter. *AllCrossDummy* is a dummy that equals one if a firm is cross-held in all four quarters over the fiscal year. Definitions of other variables are given in Table 1. Panel A reports OLS results using *CrossDummy* as the measure for cross-ownership. Panel B analyzes alternative measures for cross-ownership. Panel C reports robustness test results. Panel D decomposes cross-ownership into that held by activist institutions (i.e., those that filed at least one 13D during the past three years) and that by nonactivist institutions and compares their coefficients by using a Wald test. Each regression includes a separate intercept. The estimations correct for error heteroscedasticity and within-firm error clustering. We report *t*-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 3
Regression of other performance measures on cross-ownership

Dep. variable	$BHAR_{t+1}$	CAR_{t+1}	NOP_{t+1}	NPM_{t+1}	ROA_{t+1}
	(1)	(2)	(3)	(4)	(5)
CrossDummy	0.036**	0.021**	0.009**	0.009**	0.003*
	(2.555)	(2.289)	(2.131)	(2.111)	(1.679)
Controls	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	58,752	59,204	58,756	58,756	59,351
R-squared	0.222	0.202	0.657	0.662	0.684

This table reports the results of OLS regressions of one-year-ahead abnormal stock performance and industry-adjusted operating performance on cross-ownership measures and controls. To measure abnormal stock performance, we calculate one-year-ahead buy-and-hold abnormal returns (*BHAR*) and cumulative abnormal returns (*CAR*) using the Fama-French-Carhart four-factor model over the twelve months immediately following a fiscal year-end using monthly returns. We use monthly stock returns over the prior 36 months to estimate factor loadings. *NOP* is the industry-adjusted net operating profitability (net income before extraordinary items and discontinued operations, plus tax expense and interest expense net of interest income, divided by sales). *NPM* is the industry-adjusted net profit margin (net income before extraordinary items and discontinued operations divided by sales). *ROA* is the industry-adjusted return on assets (operating income after depreciation divided by assets). Each regression includes a separate intercept and the same set of control variables as in Column (4) of Table 2, panel A. The estimations correct for error heteroscedasticity and within-firm error clustering. We report *t*-statistics in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 4
Quasi-natural experiment of institution mergers

A. Baseline DiD test of the effect of institution mergers on market share growth

Dep. variable	*AvgMktShareGrow*				
	(1)	(2)	(3)	(4)	(5)
*Treat * Post*	0.008***	0.007**	0.008**	0.007**	0.009**
	(3.190)	(2.409)	(2.429)	(2.046)	(2.245)
Post	-0.004***	-0.003**	-0.003**	-0.003**	-0.004***
	(-5.477)	(-2.301)	(-2.414)	(-2.439)	(-3.514)
Treat			-0.003*	-0.003	
			(-1.719)	(-1.344)	
LnAssets		-0.002	-0.001	-0.000	0.001
		(-0.789)	(-0.441)	(-0.159)	(0.448)
Tobin q		0.001	0.001	0.001	0.001
		(0.949)	(0.795)	(1.202)	(1.186)
CashAssets		0.022***	0.016**	0.017***	0.026***
		(2.923)	(2.495)	(2.920)	(3.216)
Leverage		-0.007	-0.005	-0.004	-0.000
		(-1.092)	(-0.746)	(-0.624)	(-0.044)
ROA		0.000	0.003	0.002	-0.006
		(0.071)	(0.578)	(0.409)	(-1.237)
R&DCapital		0.005	0.008	0.007	0.000
		(0.491)	(0.836)	(0.705)	(0.052)
CapexAssets		0.033*	0.039**	0.043**	-0.012
		(1.891)	(2.214)	(2.255)	(-0.592)
AcqAssets		0.013	-0.001	0.005	0.024**
		(0.568)	(-0.067)	(0.243)	(2.067)
PPEGrowth		-0.001	-0.001	-0.002	0.005
		(-0.379)	(-0.283)	(-1.004)	(1.690)
BlockOwn		0.010	0.009	0.010	0.013
		(0.834)	(0.815)	(0.856)	(1.432)
InstOwn		-0.005	-0.006	-0.006	-0.005
		(-0.628)	(-0.656)	(-0.787)	(-0.645)
BlockDummy		0.000	-0.001	-0.001	-0.007
		(0.016)	(-0.265)	(-0.138)	(-1.201)
LnNum13D_New		0.000	-0.000	-0.001	
		(0.063)	(-0.012)	(-0.215)	
Missing13D		0.002	0.003	0.002	
		(0.572)	(0.678)	(0.484)	
LnNum13D					-0.001
					(-0.249)
Firm-merger FEs	Yes	Yes	No	No	Yes
Firm FEs	No	No	Yes	Yes	No
Merger FEs	No	No	Yes	Yes	No
Industry FEs	No	No	No	Yes	No
Observations	9,230	8,326	8,326	8,326	5,125
R-squared	0.520	0.521	0.407	0.442	0.499

B. DiD test of the effect of institution mergers on cross-ownership

Dep. variable	*CrossDummy*		*LnNumConnected*	
	(1)	(2)	(3)	(4)
*Treat * Post*	0.244***	0.271***	0.258***	0.303***
	(5.825)	(5.743)	(4.014)	(4.779)
Post	0.045	0.046	0.069	0.067
	(1.101)	(1.066)	(1.276)	(1.151)
Controls	No	Yes	No	Yes
Firm-merger FEs	Yes	Yes	Yes	Yes
Firm FEs	No	No	No	No
Merger FEs	No	No	No	No
Industry FEs	No	No	No	No
Observations	9,230	8,326	9,230	8,326
R-squared	0.874	0.873	0.915	0.912

This table reports the multivariate difference-in-differences (DiD) test results on the effect of institution mergers on product market performance and cross-ownership. We define a firm as a treatment if it is block-held by one of the merging institutions during the quarter immediately before the merger announcement date and at least one of its same-industry rivals are block-held by the other party to the merger during the same pre-merger quarter. We classify a firm as a control if it is block-held by the same institution (that holds the treatment) and none of its same-industry rivals are block-held by the other party to the merger during the same pre-merger quarter. *Treat* is a dummy variable that equals one if a firm is a treatment stock and zero if it is a control. *Post* is a dummy that equals one for the post-event period and zero for the pre-event period. Panel A reports results using market share growth as the dependent variable. We drop the event (merger) year in our analysis and calculate the average annual market share growth (*AvgMktShareGrow*) for treatments and controls during the three years before and the three years after the merger separately. We measure control variables at year -4 for the pre-merger period and at year 0 for the post-merger period. Panel B reports results using *CrossDummy* and *LnNumConnected* as the dependent variables. *CrossDummy* is defined as a dummy variable that equals one if the merging institutions hold at least one same-industry rival block at the quarter-end immediately before the merger announcement date (for the pre-event period) or at the first quarter-end after the deal closing date (for the post-event period). *LnNumConnected* is defined as the natural logarithm of one plus the number of same-industry rivals that are blockheld by the merging institutions at the quarter-end immediately before the merger announcement date (for the pre-event period) or at the first quarter-end after the deal closing date (for the post-event period). *LnNum13D_New* is the same as *LnNum13D* except that missing values are replaced with zeros. *Missing13D* is a dummy variable that equals one if the 13D information is missing. Table 1 provides the variable definitions. Each regression has a separate intercept. Standard errors are clustered by institution merger. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5
Robustness tests for the difference-in-differences analysis of institution mergers

A. Defining control firms as same-industry rivals block-held by nonmerging institutions

Dep. variable	*AvgMktShareGrow*			
	(1)	(2)	(3)	(4)
*Treat * Post*	0.006**	0.007**	0.007*	0.007*
	(2.173)	(2.179)	(1.963)	(1.858)
Post	0.002**	0.003***	0.003***	0.003***
	(2.183)	(2.790)	(3.591)	(3.775)
Treat			-0.001	-0.001
			(-0.511)	(-0.362)
Controls	No	Yes	Yes	Yes
Firm-merger FEs	Yes	Yes	No	No
Firm FEs	No	No	Yes	Yes
Merger FEs	No	No	Yes	Yes
Industry FEs	No	No	No	Yes
Observations	11,880	8,817	8,817	8,817
R-squared	0.470	0.503	0.328	0.354

B. DiD tests on the propensity-score-matched sample

Dep. variable	*AvgMktShareGrow*			
	(1)	(2)	(3)	(4)
*Treat * Post*	0.011***	0.012***	0.012**	0.012**
	(3.672)	(3.383)	(2.624)	(2.632)
Post	-0.007***	-0.008**	-0.008**	-0.008**
	(-2.864)	(-2.285)	(-2.087)	(-2.094)
Treat			-0.004	-0.005
			(-0.388)	(-0.512)
Controls	No	Yes	Yes	Yes
Firm-merger FEs	Yes	Yes	No	No
Firm FEs	No	No	Yes	Yes
Merger FEs	No	No	Yes	Yes
Industry FEs	No	No	No	Yes
Observations	1,404	1,303	1,303	1,303
R-squared	0.497	0.513	0.500	0.503

This table reports the results of robustness tests for the difference-in-differences (DiD) analysis of institution mergers, following the first four model specifications of Table 4, panel A. Panel A reports the results of robustness DiD tests that define control firms as the same-industry rivals to the treatments not block-held by the merging institutions but block-held by some nonmerging institutions during the quarter before the merger. Panel B uses a propensity-score-matched sample of treatment and control firms. All variables are defined in previous tables. Each regression has a separate intercept. Standard errors are clustered by institution merger. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6
Possible sources of product market gains: Explicit collaborative activities

A. Pairs of control firms as defined in the baseline DiD analysis

Dep. variable	*LnNumSame*		
	(1)	(2)	(3)
*Treat * Post*	0.011**	0.014**	0.017**
	(1.986)	(1.976)	(2.020)
Post	-0.005	-0.011	-0.006
	(-1.416)	(-1.408)	(-0.869)
Treat			-0.010
			(-1.566)
Controls	No	Yes	Yes
Pair FEs	Yes	Yes	No
Merger FEs	No	No	Yes
Industry FEs	No	No	Yes
Observations	1,016	956	956
R-squared	0.667	0.680	0.110

B. Pairs of control firms as defined in panel A of Table 5

Dep. variable	*LnNumSame*		
	(1)	(2)	(3)
*Treat * Post*	0.013*	0.017*	0.015*
	(1.865)	(1.923)	(1.815)
Post	-0.001	0.001	0.000
	(-1.000)	(0.091)	(0.063)
Treat			0.001
			(0.324)
Controls	No	Yes	Yes
Pair FEs	Yes	Yes	No
Merger FEs	No	No	Yes
Industry FEs	No	No	Yes
Observations	1,432	1,313	1,313
R-squared	0.636	0.645	0.139

This table reports test results on sources of product market gains in the form of same-industry joint ventures, strategic alliances, or acquisitions between pairs of treatment or control firms. We define treatment pairs as pairwise combinations of any two treatment firms involved in the same institution merger as defined in our baseline DiD sample. We then match each treatment pair to three control pairs with the closest average size (book assets) and average Tobin's q in the event (merger) year and retain all unique control pairs in the regressions. In panel A, we define control pairs as pairwise combinations of control firms in our baseline DiD analysis (as defined in panel A of Table 4) that are involved in the same merger and operate in the same industry. In panel B, we define control pairs as pairwise combinations of same-industry rivals to the firms in the treatment pair not block-held by the merging institutions but block-held by some nonmerging institutions during the quarter before the merger (as defined in panel A of Table 5). We then treat each pair of firms as one unit of observation and analyze the natural logarithm of one plus the number of same-industry joint ventures, strategic alliances, or acquisitions between two firms in a treatment or control pair (*LnNumSame*) in the three years before and three years after the institution merger. We use the same set of control variables (which are averaged at the pair level) as in previous tables, which are measured at year -4 for the pre-merger period and at year 0 for the post-merger period. Definitions of other variables are given in previous tables. Each regression has a separate intercept and different layers of fixed effects depending on model specifications. Standard errors are clustered by firm pair. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7
Possible sources of product market gains: Innovation productivity and operating profitability

A. Innovation productivity

Dep. variable	*PatentLagRD*			
	(1)	(2)	(3)	(4)
*Treat * Post*	0.013**	0.013**	0.012**	0.012**
	(2.086)	(2.250)	(2.125)	(2.110)
Post	-0.015***	-0.023***	-0.023***	-0.022***
	(-2.840)	(-3.520)	(-8.427)	(-8.300)
Treat			-0.000	0.002
			(-0.007)	(0.274)
Controls	No	Yes	Yes	Yes
Firm-merger FEs	Yes	Yes	No	No
Firm FEs	No	No	Yes	Yes
Merger FEs	No	No	Yes	Yes
Industry FEs	No	No	No	Yes
Observations	4,974	4,325	4,325	4,325
R-squared	0.854	0.863	0.838	0.844

B. Profit margin and ROA

Dep. variable	*NOP*		*NPM*		*ROA*	
	(1)	(2)	(3)	(4)	(5)	(6)
*Treat * Post*	0.025**	0.028**	0.031**	0.031**	0.009**	0.008*
	(2.370)	(2.368)	(2.292)	(2.028)	(2.260)	(1.996)
Post	-0.018***	-0.011***	-0.019***	-0.011**	-0.011***	-0.004***
	(-9.258)	(-2.822)	(-8.053)	(-2.347)	(-11.187)	(-2.822)
Controls	No	Yes	No	Yes	No	Yes
Firm-merger FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,210	8,264	9,210	8,264	9,230	8,284
R-squared	0.797	0.814	0.794	0.810	0.825	0.836

This table reports DiD results on innovation productivity and operating profitability for treatment and control firms as defined in our baseline DiD sample (in Table 4). Panel A presents the results on innovation productivity. Panel B presents the results on industry-adjusted operating profit margin and ROA. All dependent variables are measured during a three-year period before or after the merger year. We use the same set of control variables as in previous tables, which are measured at year -4 for the pre-merger period and at year 0 for the post-merger period. *PatentLagRD* is the number of patents generated in a year over the total amount of R&D expenditures in the previous year. *NOP* is the industry-adjusted net operating profitability (net income before extraordinary items and discontinued operations, plus tax expense and interest expense net of interest income, divided by sales). *NPM* is the industry-adjusted net profit margin (net income before extraordinary items and discontinued operations divided by sales). *ROA* is the industry-adjusted return on assets (operating income after depreciation divided by assets). Definitions of other variables are given in previous tables. Each regression has a separate intercept and different layers of fixed effects depending on model specifications. Standard errors are clustered by institution merger. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8
Stock returns tests

A. Average CARs around initial Schedule 13D filings

	CAPM alpha	*Fama-French-Carhart four-factor alpha*
	(1)	(2)
CARs of cross-held blocks (1)	0.022**	0.021**
	(2.592)	(2.212)
CARs of non-cross-held blocks (2)	-0.002	0.003
	(0.918)	(1.544)
CARs of corporate customers of cross-held firms (3)	0.008	0.009
	(1.645)	(1.486)
Difference (1 – 2)	0.024***	0.018***
	(3.861)	(2.669)
Difference (1 – 3)	0.014	0.012
	(0.864)	(0.689)

B. Average CARs around institution mergers

	CAPM alpha	*Fama-French-Carhart four-factor alpha*
	(1)	(2)
CARs of treatment stocks (1)	0.017**	0.016*
	(2.091)	(1.876)
CARs of control stocks (2)	0.000	0.002
	(0.274)	(1.199)
Difference (1 – 2)	0.017***	0.014**
	(2.620)	(2.103)

This table reports the results of two event studies. Panel A reports the average cumulative abnormal returns (CARs) of various groups of stocks surrounding the filing of an initial 13D form on a newly acquired block by an institution. *Cross-held Blocks* are stocks already block-held by the 13D-filing institution that are in the same industry as the newly acquired block. *Non-cross-held blocks* are stocks already block-held by the 13D-filing institution that are not in the same industry as the newly acquired block. *Corporate Customers of Cross-held Firms* are stocks of the corporate customers of the cross-held firms, identified using the Compustat industry segment file. Panel B reports the average CARs of treatment and control stocks in our baseline DiD sample surrounding the announcement of the institution mergers. For both panels, we use a 12-day event window, from day -1 to +10, with day 0 as the filing/announcement date. We adjust the returns using the CAPM and the Fama-French-Carhart four-factor model. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Appendix

Table A1. List of financial institution mergers

This table provides the list of financial institution mergers used in the paper. For each merger, we report the name of the acquiring and target institutions, the announcement date, the effective date, and whether the merger is between two banks.

Acquirer institution	Target institution	Announcement date	Effective date	Bank merger
Chase Manhattan Corp.	Lincoln First Banks Inc.	21 Dec 1983	1 Jul 1984	1
Citizens & Southern GA Corp	Citizens & Southern Corp., SC	17 Sep 1985	31 Mar 1986	1
PNC Financial Corp.	Citizens Fidelty Bk & Tr	30 Jun 1986	27 Feb 1987	1
Fleet Finl Group	Norstar Trust Co.	18 Mar 1987	1 Jan 1988	1
Sovran Financial Corp.	Commerce Union Bank	27 Apr 1987	1 Nov 1987	1
PNC Financial Corp.	Central Bancorp	31 Jul 1987	29 Feb 1988	1
Boatmen's Bancshares Inc.	Centerre Bancorp	4 May 1988	26 Dec 1988	1
Chemical Banking Corp.	Manufacturers Hanover Co.	15 Jul 1991	31 Dec 1991	1
PNC Financial Corp.	First Natl Bank/Penn	16 Sep 1991	23 Jul 1992	1
Banc One Corp.	Affiliated Bksh/Colorado	30 Dec 1991	2 Nov 1992	1
NBD Bancorp Inc.	INB Financial Corp.	18 Mar 1992	15 Oct 1992	1
Bank of Boston Corp.	Multibank Financial Corp.	9 Sep 1992	13 Jul 1993	1
Mellon Bank Corp.	Boston Company Inc.	14 Sep 1992	21 May 1993	1
Equitable Companies Inc.	Alliance Capital Mgmt.	23 Nov 1992	22 Jul 1993	0
Marshall & Ilsley Corp.	Valley Trust Co/Wisc	20 Sep 1993	31 May 1994	1
First Union Corp.	Lieber & Co.	18 Oct 1993	1 Jul 1994	0
Banc One Corp.	Liberty Natl B&T/Louisvl	3 Nov 1993	15 Aug 1994	1
First Union Corp.	Evergreen Asset Mgmt.	6 Mar 1994	30 Jun 1994	0
KeyCorp	Spears Benzak Salomon	28 Nov 1994	12 Apr 1995	0
Fleet Financial Group Inc.	Shawmut Natl Corp.	21 Feb 1995	30 Nov 1995	1
Barclays Bank Plc	Wells Fargo Nikko Investment	13 Apr 1995	30 Aug 1995	1
TCW Group Inc	Continental Asset Mgmt.	16 Jun 1995	16 Jun 1995	0
First Union Corp.	First Fidelity Bancorp	19 Jun 1995	2 Jan 1996	1
First Bank System Inc.	FirsTier Financial Inc.	7 Aug 1995	16 Feb 1996	1
Franklin Resources Inc.	Heine Securities Corp.	25 Jun 1996	1 Nov 1996	0
LGT Asset Mgmt Inc.	Chancellor Capital Mgmt.	10 Jul 1996	31 Oct 1996	0
First Union Corp.	Keystone Invt Mgmt Co.	6 Sep 1996	12 Dec 1996	0
Banc One Corp.	Liberty Bancorp Inc.	30 Dec 1996	2 Jun 1997	1
Mellon Bank Corp.	Ganz Capital Mgmt. Inc.	20 Jan 1997	20 May 1997	0
First Bank System Inc.	U.S. Bancorp	20 Mar 1997	1 Aug 1997	1
Travelers Group Inc.	Citicorp	6 Apr 1998	8 Oct 1998	0
NationsBank Corp.	BankAmerica Corp.	13 Apr 1998	30 Sep 1998	1
SunTrust Banks Inc.	Crestar Financial Corp.	20 Jul 1998	31 Dec 1998	1
Credit Suisse Asset Mgmt	Warburg Pincus Asset Mgmt.	15 Feb 1999	6 Jul 1999	0
Fleet Boston Corp.	BankBoston Corp.	14 Mar 1999	1 Oct 1999	1
AXA Financial Inc.	Sanford C Bernstein & Co Inc.	20 Jun 2000	2 Oct 2000	0
JP Morgan Chase & Co.	Chase Manhattan Corp.	13 Sep 2000	31 Dec 2000	1
Franklin Resources Inc.	Fiduciary Trust Company Intl.	25 Oct 2000	10 Apr 2001	0
Wells Fargo & Co.	Benson Associates LLC	26 Aug 2003	26 Aug 2003	0
Bank of America Corp.	Fleet Boston Corporation	27 Oct 2003	1 Apr 2004	1
Wells Fargo & Co.	Strong Financial Corp.	26 Jun 2004	3 Jan 2005	0
Transamerica Invt Mgmt.	WestCap Investors LLC	19 Jun 2005	4 Aug 2005	0
J.P Morgan Chase & Co.	BNY-Consumer Business	31 Mar 2006	2 Oct 2006	1
Morgan Stanley Group Inc	FrontPoint Partners LLC	31 Oct 2006	4 Dec 2006	0
Bank of NY Trust Co.	Mellon Bank	3 Dec 2006	2 Jul 2007	1
RiverSource Investments	J. & W. Seligman & Co. Inc.	7 Jul 2008	7 Nov 2008	0
Bank of America Corp.	Merrill Lynch & Co. Inc.	14 Sep 2008	1 Jan 2009	1
Barclays Bank Plc	Lehman Brothers Inc.	16 Sep 2008	22 Sep 2008	1
BlackRock Inc.	Barclays Bank Plc	16 Sep 2009	1 Dec 2009	0

Table A2. Tests to verify the parallel trend assumption

This table presents tests for parallel trends. Panel A reports the mean and median change in market share growth for firms in the treatment and control groups going back up to six years prior to the event year. The first row in the table reports statistics for changes in market share growth going back two years prior to the event year (changes in market share growth from year *t*-2 to *t*-1). Similarly, the subsequent rows of the table report statistics for changes in market share growth going back farther in time. The table also reports *p*-values associated with test statistics for differences in means (standard *t*-test) and in medians (Pearson's χ^2) across groups. Panel B performs a placebo test using year -4 as the "pseudo-event" year. We use the same set of treatment and control firms identified in our main baseline DiD analysis and analyze their average market share growth during a seven-year window symmetrically around the hypothetical "event" year (year -4). Table 4 provides the variable definitions. Panel B follows the same model specifications as in the first four columns of panel A of Table 4. Each regression has a separate intercept. Standard errors are clustered by institution merger. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

A. Trends in market share growth for treatment and control firms

Chg_MktShareGrow	Treatment		Control		*p*-value of difference	
	Mean	Median	Mean	Median	*t*-test	Pearson χ^2
	(1)	(2)	(3)	(4)	(1)-(3)	(2)-(4)
Year -2 to year -1	-0.002	0.000	0.000	0.000	0.395	0.854
Year -3 to year -1	0.001	0.000	0.001	0.000	0.871	0.140
Year -4 to year -1	-0.001	0.000	0.001	0.000	0.366	0.528
Year -5 to year -1	-0.001	-0.000	0.002	0.000	0.372	0.194
Year -6 to year -1	-0.001	0.000	0.002	0.000	0.430	0.767

B. Placebo tests using year -4 as the "event" year

Dep. variable	*AvgMktShareGrow*			
	(1)	(2)	(3)	(4)
*Treat * Post*	-0.005	-0.006	-0.006	-0.006
	(-0.741)	(-0.885)	(-0.975)	(-1.015)
Post	0.002	0.002	0.001	0.001
	(1.148)	(0.779)	(0.566)	(0.784)
Treat			0.003	0.003
			(0.810)	(0.754)
Controls	No	Yes	Yes	Yes
Firm-merger FEs	Yes	Yes	No	No
Firm FEs	No	No	Yes	Yes
Merger FEs	No	No	Yes	Yes
Industry FEs	No	No	No	Yes
Observations	8,519	7,702	7,702	7,702
R-squared	0.517	0.521	0.405	0.432