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Abstract

We show that productivity at both the firm and employee (i.e., analyst and inventor) level temporarily declines upon announcements of takeover rumors that do not materialize. Such speculative news may hurt productivity because uncertainty and threat of job loss cause anxiety, distraction, and reduced commitment among employees and managers. Consistently, we observe a more pronounced productivity dip for rumored targets and when the likelihood of job loss is higher. Firm performance mirrors these results. We find no indication of reverse causality. The evidence fosters our understanding of potential real effects of speculative financial news and the costs of takeover threats.

JEL classification: D24, G00, G34, J24

Keywords: Employee commitment and distraction, Employee and firm productivity, Firm performance, Takeover speculation, Threat of job loss

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1. Introduction

> *"[Some staff] check out completely, some gather around the water-cooler, some are spending all the time polishing their CVs and interviewing, and some are so stressed they just call in sick."* – The Financial Times (2019)[1]

With the rise of the internet and social media, speculative and often unfounded news about firms have become increasingly prevalent. Corporate takeover speculation, for example, only rarely results in public bids, with 70%-90% of all takeover rumors not materializing (e.g., Ma and Zhang, 2016; Betton, Davis, and Walker, 2018; Jia et al., 2020). Consistently, Jia et al. (2020) report that 70% of takeover rumors originate from opinion pieces or speculation in the press or on the internet. One reason for this trend is the media's need to attract readership, which creates incentives to publish sensational albeit potentially untrue news (Ahern and Sosyura, 2015). Another reason is market manipulation.[2]

Against this background, it is important to understand the role that speculative news and rumors play for firms and markets. The literature suggests that rumors manipulate stock prices (e.g., van Bommel, 2003; Schmidt, 2020) and affect mergers (e.g., Ahern and Sosyura, 2015; Alperovych et al., 2021). Yet, virtually nothing is known about the operational consequences that rumors may have for the firms involved. Our study addresses this issue, examining how firm productivity changes after rumors surface in the market for corporate control. We exploit distinct features of takeover rumors. First, many rumors are highly speculative (i.e., unrelated to firm fundamentals) and thus constitute unexpected shocks to firms. Second, although rumors rarely materialize, stock prices move upon their announcement (e.g., Ahern and Sosyura, 2015; Jia et al., 2020). This implies that the market does not ignore such rumors and that they may constitute credible threats to the involved firms, while causing no direct organizational changes.

[1] See the article "Big corporate mergers take a hidden toll on staff" in *The Financial Times* (09/16/2019), which describes how employees react to takeover speculation and pending bids.
[2] The Securities and Exchange Commission (SEC) has published several alerts warning investors about the role of social media in spreading false or misleading information. See, e.g., https://www.sec.gov/oiea/investor-alerts-bulletins/ia_rumors.html.

According to academic and anecdotal evidence, takeover rumors hurt labor productivity because they have adverse effects on employees and managers, particularly anxiety, distraction, and reduced commitment. These effects appear intuitive given the uncertainty and threat of job loss and wage reductions that come with takeover rumors. In fact, rumors are rarely denied by companies (Ahern and Sosyura, 2015), and labor restructuring is known to be the key driver of M&A and the associated synergy gains (Jensen, 1988; Dessaint, Golubov, and Volpin, 2017). In this regard, Shleifer and Summers (1988) argue that takeovers are often motivated by wealth redistribution from employees to shareholders, e.g., in the form of layoffs (for empirical evidence, see, e.g., John, Knyazeva, and Knyazeva, 2015). As a result, takeover rumors can reduce employees' commitment and incentives to invest in their relationship with the firm if employees expect job loss or wage reductions. However, employees and managers may also strategically lower their effort in an attempt to thwart the takeover, or because their firms' positive stock returns following takeover rumor announcements make them feel more complacent about reaching the strike price of their stock options.

Schweiger, Ivancevich, and Power (1987) interview employees pre and post M&A and find "significant political maneuvering initiated by acquisition rumors" (p. 128), indicating that employees react to takeover speculation. Burlew, Pedersen, and Bradley (1994) interview employees in a retail firm following the announcement of a potential sale. Their results suggest that already at the pre-acquisition stage, potential takeovers can have detrimental effects on the workforce, as this time is "most likely fraught with low employee morale, increased stress, resistance to change, higher turnover, and lower productivity" (p. 22). We thus hypothesize that takeover speculation will hurt firm productivity.

We provide empirical support for our hypothesis based on ca. 10,000 speculative takeover rumors, i.e., rumors that do not result in public bids within at least two years. Using a large panel of public firms headquartered in OECD countries, we document a statistically and economically significant decline in firm productivity after takeover rumors surface. Consistent

with none of the rumors materializing, productivity rebounds over time. We denote the resulting pattern as the *rumor-induced productivity dip*.

Our main measures of firm productivity are the ratio of a firm's sales to employees as well as sales to SG&A. Yet, we also find the productivity dip using alternative measures of firm productivity. Accounting for firm and quarter fixed effects, we show that firms exhibit a significant and temporary decline in productivity in the quarter during which they become involved in takeover speculation and the two succeeding quarters.[3] To account for potential inherent differences between rumor and non-rumor firms, we use entropy balancing and propensity score matching. Alternatively, we limit our sample to firms that were involved in at least one takeover rumor over our sample period. This way, we specifically mitigate concerns that any characteristics shared exclusively among rumor firms may explain our results. We continue to find a significant dip in firm productivity.

A concern with our study is that speculative rumors may not constitute unexpected shocks to the involved firms that hurt their productivity, but rather that firms with poor past or expected productivity are more likely to become involved in takeover speculation. It is not trivial, though, to reconcile such a claim for reverse causality with our empirical strategy of examining non-materializing rumors and the resulting *temporary* decline in firm productivity. Nevertheless, we perform various tests and find no indication for this concern. First, neither do we find pre-rumor productivity trends for rumor firms, nor does firm productivity predict the occurrence of takeover rumors. The productivity dip is also robust to controls for past productivity and CEO turnover. Second, we use analyst estimates to capture market expectations of firm productivity and performance. If anything, we find that earnings and sales estimates in rumor quarters are

[3] We are unable to observe whether and when firms and other market participants learn that the takeover rumor was pure speculation (if there is any exact date at all). So we cannot test when the productivity dip should reverse. However, Figure 1 shows that the positive stock returns upon rumor announcements do not reverse quickly, indicating that the rumor stays in the market. Importantly, any negative effects on rumor firms' employees and ultimately productivity may linger because takeover rumors may serve as indications that the involved firms are "on the radar" of potential acquirers in the M&A market or may become active acquirers in the future.

higher (not lower) than in matched non-rumor quarters. Moreover, the productivity dip is robust to controls for analyst estimates and for firms actively seeking buyers or acquisition targets. Third, we hand-collect the scoop articles for all takeover rumors involving U.S. target firms and find that less than 1% mention productivity or profitability. Lastly, we neither find negative pre-rumor stock returns indicative of poor expected productivity, nor do we find any indication for deal expectation (Betton et al., 2014) or unknown merger negotiations (Eaton, Liu, and Officer, 2021) in the form of pre-rumor stock price run-ups. Average cumulative abnormal stock returns over the two months leading up to the announcements of takeover rumors amount to only 0.1%, in line with Betton, Davis, and Walker (2018) and Jia et al. (2020).

Next, studying takeover rumors that never materialize, we might happen to analyze cases of unobserved merger negotiations falling apart due to unexpected temporary declines in firm productivity. Although we find no indication of merger negotiations, such negotiations might just start with the occurrence of the rumor, accompanied by simultaneous temporary shocks to firm productivity. To address this concern, we use the scoop articles for the rumors involving U.S. target firms and attempt to identify where the rumors originate. We exploit rumors that are arguably exogenous in the sense that they are likely to be truly speculative and thus unlikely to reflect (or initiate) merger negotiations. We classify a rumor as "exogenous" if the scoop article explicitly states that the rumor is speculation or originates from social media or blogs or if the rumor's source is mentioned to be anonymous. Within the sample of firms subject to these "exogenous" rumors, we again find a dip in firm productivity after rumors surface.

Further, we show that the productivity dip loses economic and statistical significance for firms subject to multiple rumors. This result appears inconsistent with merger negotiations failing due to unexpected productivity shocks. Yet, it is in line with the notion that employees are concerned and distracted when they experience a takeover rumor for the first time because they can hardly assess if the rumor (and their management) is credible, while they learn about speculation and become less stressed when firms are repeatedly involved in takeover rumors.

While our study is concerned with how takeover rumors affect labor, the aforementioned results rely on relatively crude measures of firm productivity that may incorporate a variety of drivers of sales and costs unrelated to the productivity of employees. Therefore, we provide additional evidence at the employee level. In particular, we show that R&D employees generate fewer patents when their employers become involved in takeover rumors. Also, their patents are cited less often over the subsequent three years. In addition, we find that when takeover rumors for brokerage houses surface, affected sell-side analysts issue fewer recommendation revisions and earnings forecasts, and their forecasts become less accurate. This evidence of a rumor-induced dip in employee productivity provides strong support for our firm-level results.

We further attempt to understand what mechanisms may explain the decline in employee and ultimately firm productivity. In that regard, our results are robust to additional controls for firms' stock returns and volatility. This suggests that the dip in productivity is unlikely to reflect reductions in effort by employees who become more complacent about reaching the strike price of their stock options as (target) firms exhibit positive stock returns upon rumor announcements. Instead, we provide cross-sectional evidence that the productivity dip is more pronounced when the risk of job loss and other wealth transfers is greater. First, while we find firm and R&D employee productivity to decline for both rumored acquirers and targets, the results are more prevalent and sizeable for the latter. This result is in line with Shleifer and Summers (1988) who argue that takeovers provide the incoming management with a special opportunity to infringe on long-term contracts between the target's employees and its incumbent managers. Furthermore, we find a less pronounced dip in firm productivity for firms residing in countries with stronger employee rights and a more pronounced decline in R&D employee productivity if the overlap in R&D specialization between rumored targets and acquirers is greater.[4]

[4] We additionally provide consistent evidence that employees and managers pay attention to takeover speculation. Specifically, using the SEC's EDGAR server logs data, we show that clicks and downloads of the filings of rumor firms via IP addresses directly belonging to the rumor firms increase significantly after rumors surface.

Finally, we test if the decline in productivity translates into negative firm performance. Reduced productivity can be expected to impact a firm's income statement, evidenced by reductions in sales or increases in costs. Consistently, we find a dip in firm profitability, as measured by a firm's pre-tax return on assets and pre-tax profit margin. We also study abnormal stock returns around announcements of takeover rumors to provide an indication of potential wealth implications for shareholders. Consistent with the literature (e.g., Ahern and Sosyura, 2015), we find a significantly positive stock price reaction to rumor announcements. Yet, stock returns over the subsequent quarters mirror our results on declining productivity and profitability. We find significantly negative returns over the three to four quarters after the rumor announcement (with the difference from the third to the fourth quarter being marginal). The buy-and-hold return from 2 to 180 days after a rumor averages -4.7%. This negative return outweighs the positive announcement effect, being about twice as large in absolute terms. Hence, the market does not only reverse the initial stock price increase, but indicates negative shareholder wealth implications. While our tests are unlikely to yield causal evidence of how the productivity dip translates into firm performance, they provide prima facie evidence that the rumor-induced productivity dip can be costly for firms and investors.[5]

This study contributes to the literature on the economic consequences of rumors and speculative news. Extant work suggests that rumors can affect stock prices (e.g., van Bommel, 2003; Schmidt, 2020; Jia et al., 2020) and influence takeovers of public and private firms (Ahern and Sosyura, 2015; Alperovych et al., 2021). However, while there is significant evidence on the real effects of financial markets (Bond, Edmans, and Goldstein, 2012), virtually nothing is known about whether rumors, particularly highly speculative ones that are common in financial markets, bring about potential operational consequences for the firms involved. We

[5] We note that we cannot rule out that the negative stock price reaction we find reflects the market's updated probability that rumor firms will less likely receive takeover bids in the future. At the same time, stock prices may also reflect that rumor firms are "on the radar" of potential buyers in the market for corporate control, which should positively impact stock prices and thus run against us finding negative returns after rumors surface. The net effect is unclear. However, our results on accounting performance are not distorted by market expectations.

use speculative rumors of takeovers, i.e., disruptive events that directly affect firms' human capital, to provide evidence of such operational consequences, mainly firm productivity.[6]

Our study also contributes to a limited literature on the dark side of the threat of takeovers. An active market for corporate control is generally regarded as a value-creating governance mechanism because the threat of a takeover disciplines directors and managers (e.g., Manne, 1965; Jensen, 1988; Lel and Miller, 2015). However, some studies question the generality of such findings, arguing that firms subject to a takeover threat also incur costs, such as managerial short-termism, reduced innovation, and impaired customer relations (e.g., Stein, 1988; Fulghieri and Sevilir, 2011; Atanassov, 2013; Cen, Dasgupta, and Sen, 2016). In contrast to our paper, these studies do not examine direct operational consequences, such as firm productivity, and they consider different effects on firms' employees and managers imposed by the takeover threat. Furthermore, our study provides new insights on how the costs of the takeover threat can depend on the setting in which firms operate, particularly with respect to employee rights. In this regard, we also extend a recently emerging literature on the intersection of human capital and takeovers (see, e.g., Dey and White, 2021; Lee, Mauer, and Xu, 2018).

The results of our study have practical implications regarding the debate on reforms of takeover regulation that reduce the time over which companies can be involved in so-called "virtual bids" that often follow or coincide with takeover speculation. The 2011 takeover reform in the U.K. is an example of such a regulation. Even though we do not claim to conduct a comprehensive analysis of the costs and benefits of anti-takeover regulation, we cautiously conclude that limiting the time companies can be "in play" in takeover speculation may, on average, benefit the involved firms, employees, and shareholders.

[6] While we study takeover rumors to understand the tangible effects of speculation, firm productivity might also decline upon official takeover announcements. Yet, we note that the results may be weaker because official announcements entail less uncertainty. This expectation is consistent with Cartwright and Cooper (1993) who find that it is mostly the expectation of change and fear of future survival that causes merger-related anxiety and stress.

2. Hypothesis Development and Empirical Predictions

The main hypothesis of this paper builds on the notion that speculative news, although they are unverified and possibly spread by rumormongers, have real operational consequences because they affect an organization's human capital. Specifically, we argue that speculative takeover rumors may harm the productivity of labor and ultimately firm productivity.

According to both anecdotal and interview-based academic evidence, takeover rumors hurt firm productivity because they have adverse effects on the employees and managers of both the involved acquirer and target. The effects include anxiety and stress, distraction, as well as reduced employee morale and commitment. Schweiger, Ivancevich, and Power (1987) conduct interviews with employees pre and post M&A and find "significant political maneuvering initiated by acquisition rumors" (p. 128). This result implies that frictions are already caused by rumors, i.e., before it becomes known whether a takeover will actually go through. Consistently, Cartwright and Cooper (1993) show that it is mostly the expectation of change and fear of future survival, rather than the change itself, that causes merger-related anxiety and stress. Regarding the costs and frictions imposed by takeover rumors, Ivancevich, Schweiger, and Power (1987) present a diagnostic framework for human resource implications of M&As and conclude that there are "obvious losses in terms of tardiness, absenteeism, turnover, output, and destructive behavior" (p. 23). Burlew, Pedersen, and Bradley (1994) interview employees in a retail firm following the announcement of a potential sale. Their main results imply that already at the pre-acquisition stage, potential takeovers can have a detrimental effect on the workforce, as this time is "most likely fraught with low employee morale, increased stress, resistance to change, higher turnover, and lower productivity" (p. 22).

Psychology suggests that adverse effects of takeover rumors, such as anxiety and stress, stem from the increased level of uncertainty, particularly with regard to organizational change and job loss, that rumors bring about (e.g., Marks and Mirvis, 1985; Rentsch and Schneider, 1991). The evidence in Ahern and Sosyura (2015) suggests that there is significant uncertainty

around takeover rumors. Only about 7% of rumors in their sample elicit responses from the involved firms. Less than 4% of the rumors are denied by at least one of the involved firms, with joint denials virtually never taking place.[7] Denials also do not predict whether rumors ultimately materialize and do not affect stock returns in reaction to rumor announcements. Further, fear of job loss is warranted given that labor restructuring is a key driver of M&A and the associated synergy gains (e.g., Jensen, 1988; Dessaint, Golubov, and Volpin, 2017).[8]

Using Swedish employer-employee data, Bach et al. (2023) show that the incidence of mental health issues, including anxiety and depression, and the likelihood of outpatient care and hospitalizations increase significantly after takeovers. This finding applies to employees in both acquiring and target firms. In this regard, Krekel, Ward, and De Neve's (2019) meta-analysis indicates that employees' wellbeing positively (negatively) correlates with their productivity (turnover). The health and psychology literature has also long acknowledged that anxiety and stress are strongly and negatively related to productivity (e.g., Murphy, Duxbury, and Higgins, 2006; Wolever et al., 2012). Consistently, Roskies and Louis-Guerin (1990) find that job insecurity is associated with decreased work behavior and attitude among managers. Firm productivity may further be lower due to absenteeism and, in particular, paid sick days, which are common in most countries and several U.S. states.

Economic theories also build on the threat of layoffs and related means of redistributing wealth from employees to shareholders (e.g., wage reductions) that come with takeovers. Shleifer and Summers (1988) argue that takeovers, particularly hostile ones, are often motivated

[7] Analogous to Ahern and Sosyura (2015), we inspect the scoop articles for all 923 speculative takeover rumors involving U.S. target firms in our sample and find similar numbers. Only 36 rumors (i.e., 3.9%) are denied.

[8] Anecdotal evidence also suggests that uncertainty and fear of job loss negatively affect employees and lower firm productivity during merger rumors or before mergers are completed. In its article "Employee morale at Twitter is reportedly tanking as possible acquisition talks continue" on takeover rumors involving Twitter in 2016, *Business Insider* (on October 11, 2016) states: "Amid uncertainty of the possible acquisition, morale at Twitter has declined so much, that some employees have stopped showing up for work." Reporting on the merger between Dow Chemical and DuPont an article (on January 13, 2016) in the *Wall Street Journal* titled "Dow and DuPont Strive to Find the Right Chemistry – Planned merger hinges on keeping about 100,000 employees calm and focused" states: "Senior leaders [...] are coping with upended career prospects and attempting to keep their staff focused amid the merger of two companies with a combined value of $103 billion" and fear that the "merger process trigger[s] a "chain reaction of anxiety" among staff."

by ex-post wealth redistribution from employees to shareholders (for empirical evidence, see, Becker, 1995; John, Knyazeva, and Knyazeva, 2015; Tian and Wang, 2021). Specifically, they argue that a takeover provides the incoming management with a special opportunity to infringe on implicit long-term contracts between the employees of the target and its incumbent management, often in the form of layoffs. The same mechanism should apply to acquiring firms and their employees, even if only to a lesser extent. Hence, if employees and managers expect to lose their jobs or face adverse renegotiations should rumors materialize, takeover rumors can lower their commitment and incentives to invest in the relationship with the firm (Williamson, 1979). Less commitment and investment in the firm, in turn, can lower labor and ultimately firm productivity. Lower productivity may stem, for example, from employees and managers reducing their effort or just spending their time applying to other firms. Reduced effort may also result from managers and employees feeling more complacent about reaching the strike price of their stock options when their firms' stock price increases upon the rumor. However, they may also lower their productivity for strategic reasons, trying to thwart a takeover.[9]

Overall, based on the above evidence and theories, we hypothesize that, on average, takeover speculation will have a negative impact on firm productivity for both acquiring and target firms. More specifically, our design, i.e., the use of speculative rumors that do not result in public bids, allows for a testable empirical prediction. Given that employees and managers will realize over time that the takeover rumor was purely speculative (and that serious takeover bids do not follow), we expect the aforementioned adverse effects of takeover speculation to

[9] Furthermore, takeover speculation may hurt productivity due to reduced employee collaboration. In particular, employees' incentives to collaborate or help their colleagues can be lower because of (perceived) increases in competition among employees (e.g., Lazear, 1989) that typically result from any two companies' plans to merge. Given that collaboration and teamwork foster productivity (e.g., Hamilton, Nickerson, and Owan, 2003) and can create possible gains from complementarities in production among workers or knowledge transfer (Lazear, 1998), reduced collaboration may hurt firm productivity. In general, increased competition may also have a positive effect on employees' effort and productivity. However, if employees expect biased tournaments they may exert less effort (see, e.g., Prendergast, 1999). Mergers likely constitute biased tournaments in the sense that the acquiring firm's employees and managers tend to have a higher (lower) chance of being promoted (fired). Accordingly, the management literature has long documented the tendency of acquired managers to leave the firm (see, e.g., Hambrick and Cannella, 1993).

vanish over time. Still, however, we note that low productivity may linger if takeover rumors serve as indicators that the rumored firms are "on the radar" of potential acquirers in the M&A market or are likely to become active acquirers in the near future. Overall, we hypothesize that firm productivity declines when takeover rumors surface and later rebounds, resulting in a temporary dip in firm productivity.

The evidence and theories outlined in this section also allow us to derive empirically testable predictions regarding the cross-section of rumor firms. Ceteris paribus, we expect the rumor-induced dip in firm productivity to be more pronounced in instances in which employees have to fear job loss, wage reductions, and other wealth transfers more. Due to the asymmetry in the balance of power between acquirer and target employees, and hence greater threat of wealth transfers, the productivity dip should be more pronounced for target firms. This expectation is consistent with Shleifer and Summers (1988), according to which incoming management teams are particularly likely to violate implicit long-term contracts with target firm employees. Further, we expect a less pronounced productivity dip in rumored mergers with fewer cost synergies and when employees have stronger rights and are better organized, which can help preempt severe post-merger reorganizations and reduce fear of job loss.

3. Data, Methodology, and Summary Statistics

3.1 Firm-level data

We obtain data on 33,095 financial market-related rumors over the period 1997-2018 from Bureau van Dijk's Zephyr database. Zephyr also provides information on the rumor date, which equals the date on which a potential transaction is mentioned in the media, in a press release or elsewhere for the first time. We exclude all rumors that are not related to M&As, such as rumors referring to IPOs, joint ventures, and share buybacks.

Importantly, Zephyr defines rumors as unconfirmed reports. The unconfirmed reports relate to both takeover rumors that are purely speculative and those that materialize later on.

We are interested in the real effects of the former and hence focus on speculative takeover rumors that do not materialize. Specifically, none of the rumors in our sample result in a public bid within at least two years of the rumor announcement (as per the SDC database).

We only consider speculative rumors in which either the acquiring or target firm is headquartered in one of the 36 OECD countries. Further, we exclude rumors relating to M&As with a potential transaction value of less than USD 1 million. The described procedure results in 21,917 rumors that relate to mergers and acquisitions as well as institutional and management buy-outs. We exclude 175 duplicate entries. To match rumors with other relevant data, we rely on ISINs (International Securities Identification Numbers) as firm identifiers, as provided by Zephyr. After excluding all observations with missing ISINs, we end up with 14,115 speculative takeover rumors, predominantly from the 2000s and 2010s.

We match these rumors to the Compustat Global and Compustat North America databases to create a panel at the firm-quarter level that contains accounting and other firm data (such as industry classifications) as well as information on whether and when a firm was subject to a takeover rumor.[10] The panel includes all firms headquartered in one of the 36 OECD countries and spans the fiscal years 1994-2018. We require additional sample years to be able to estimate reliable within estimators and to compare firms pre and post rumor for rumors occurring early in the sample period. This procedure yields an initial sample of 1,884,116 firm-quarter observations, including 10,294 firm-quarters (for 6,035 distinct firms) during which speculative takeover rumors were announced.[11] Because some data in Compustat Global is missing for a

[10] To match M&A rumors from Zephyr based on ISINs, we transform CUSIPs from the Compustat North America database to ISINs using Refinitiv Eikon. For the years 1997 and 1998, for which Zephyr contains only few rumors, we do not find any positive ISIN matches with the Compustat databases.

[11] Thereof, 511 observations refer to acquirers or targets that have been rumored as such more than once in the same quarter. Another 132 observations involve more than one bidder or target. These observations do not include cases where multiple bidders are rumored to collaborate to make a joint bid, as sometimes observed for financial bidders (e.g., in LBO club deals). For robustness purposes, we exclude the aforementioned observations in untabulated regressions and find that they do not drive our results.

significant number of firm-quarters, the number of observations in our regression analyses is considerably lower and hinges on the dependent variables we use.

For robustness tests, we additionally obtain data on analyst estimates for firms' earnings per share (EPS) and sales from the Institutional Brokers' Estimate System (I/B/E/S). We merge I/B/E/S estimates with our firm panel using CUSIPs and SEDOLs (for Compustat Global) in conjunction with the quarters to which the respective estimates refer. For the years 2000 and later, we also obtain data on firms announcing to seek buyers or target firms or assets to acquire from the Capital IQ database. We merge this data with our panel using ISINs.

We complement the firm panel described above with country-level data on employee rights from the OECD database (https://data.oecd.org/). This data includes the Employment Protection Legislation (EPL) index and the collective bargaining coverage, which are available until the years 2018 and 2017, respectively. The EPL index, used by Dessaint, Golubov, and Volpin (2017) to measure employment protection, quantifies the procedures and costs related to individual and collective dismissals. Larger index values correspond to greater protection. Collective bargaining coverage is the ratio of the number of employees covered by the collective agreement and the overall number of wage earners and salaried employees per country. Data on collective bargaining is not available for some country-years, so we replace missing values by the values of the preceding years.

To provide evidence that employees actually pay attention to rumors, we use the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) server logs data, which captures all clicks or downloads of a public firm's SEC filings (see, e.g., Drake et al., 2020). This data allows us to test whether a firm subject to a takeover rumor receives more attention from its employees as approximated by the firm's filings directly clicked or downloaded from the firm's own IP addresses. We clean the data by removing all clicks and downloads by bots.[12]

[12] On EDGAR, the last triplet of an IP is anonymized (e.g., 17.200.200.abc). However, IP block information from the American Registry for Internet Numbers (ARIN) enables us to identify IP blocks that belong to specific firms

3.2 Employee-level data

For our employee-level tests, which we present in Section 6, we use I/B/E/S data to study sell-side analyst productivity and patent data from the United States Patent and Trademark Office (USPTO), retrieved from the PatentsView data platform, to study the productivity of R&D employees. The USPTO data includes information on inventors as well as patents filed in the U.S. by global firms. This data has been used in various international studies on corporate innovation (see Griffin, Li, and Xu, 2021, and the literature therein).

Regarding the USPTO data, we start with all granted patents and merge their respective assignees and inventors. Using patent assignee identifiers, we only keep patents assigned to companies (i.e., those with assignee codes 2 and 3) and then track the number of citations each patent received over the subsequent three- and five-year periods. For each inventor ID, we compile a time series based on the quarterly count of patents filed by the inventor. We insert zeros for quarters without patent filings from the first to last record of each inventor in our sample. We only include inventors who have at least 12 quarters of data available.[13] Due to the indirect association between inventors and their employers, we designate the assignee for whom the inventor most frequently filed patents during a given year-quarter as their employer.[14] The inventor-patent time series is then integrated with the takeover rumor and Compustat data for our OECD sample firms using fuzzy name matching. The resulting sample includes 5,022 unique companies, 324,911 unique inventors, and 8,322,807 observations. About 14% of the companies and 41% of the inventors in the sample are involved in at least one rumor during the sample period.

(e.g., the IP block 17.0.0.0 - 17.255.255.255 belongs to Apple Inc.). We conduct this matching process by using IP block data from the ARIN Bulk Whois database and associate it with Compustat firms through "fuzzy" name matching. This process involves harmonizing company names, e.g., by removing punctuation marks (e.g., dots, hyphens, or apostrophes) or cleaning legal form indications (e.g., "inc", "limited", "holding"). Our methodology compares to approaches adopted by other scholars, e.g., Bernard, Blackburne, and Thornock (2020).

[13] For robustness, we demand at least 20 quarters of available data. Our results (not tabulated) remain similar.

[14] For 95% of all observations we observe only one assignee for an inventor in a given quarter. In the rare case of an inventor filing the same number of patents for two different assignees, we define the assignee for whom the first patent was filed as the employer. Excluding the 5% of the observations for which we observe more than one assignee does not alter our results.

We also use the USPTO data to study R&D employees working for private firms. To identify such firms, we use the private firms mentioned in our sample of M&A rumors and rely on IPO dates from Zephyr and Compustat. We focus our analysis on firms for which we have IPO dates and study the years before these firms went public. For robustness, we use all firms for which we find no match in the Compustat Global and North America databases.[15]

In terms of the I/B/E/S data, we start with all analysts who issue earnings forecasts and recommendations. Following extant literature, we focus on next-quarter earnings forecasts for U.S. firms. To ensure data integrity, we filter out observations with missing firm identifiers ('TICKER'), estimate values ('VALUE'), and actuals ('ACTUAL'). We must also exclude all observations with lacking I/B/E/S analyst identifiers ('ANALYS') or where identifiers are "0" as such observations belong to anonymized analysts whom we cannot track. Subsequently, we retain the most recent forecast and merge the refined dataset with CRSP/Compustat. Next, we merge our data with the I/B/E/S recommendations file, using analyst identifiers from the detail history and 'AMASKCD' from the recommendations file to access analyst names and their brokerage house identifiers. To identify brokerage house names, we include brokers with at least 100 next-quarter earnings forecasts, which corresponds to 348 brokers accounting for 99% of all next-quarter earnings forecasts in our initial sample. We then manually collect brokerage house names using various search techniques, such as manual searches in Refinitiv Workspace, LinkedIn, and Zoominfo, based on analyst names and broker IDs. Using the obtained broker names, we merge the dataset with our takeover rumor data. We only include analysts who have at least 12 quarters of data available.[16] Our final sample consists of 4,828 unique analysts and a total of 986,304 earnings forecasts for 9,394 unique companies. Approximately 13% of the brokers and 38% of the analysts in the sample are subject to a takeover rumor.

[15] Using this alternative set of private firms in untabulated regressions, we find qualitatively similar results.
[16] For robustness, we demand at least 20 quarters of available data. Untabulated regressions suggest that our results do not hinge on the choice of data availability.

3.3 Methodology

To analyze how firm productivity changes upon takeover speculation, we use firm-quarter level OLS regressions estimating specifications of the regression model shown in equation (1):

$$Productivity_{it} = \beta_1 \, Rumor_i \, x \, Post_{it} + \sum_k \beta_k \, Control_{it} + Firm\ FE + Quarter\ FE \qquad (1)$$

The placeholder *Productivity* stands for two measures of firm productivity, which we use as dependent variables, namely $ln(Sales\ to\ Employees_{t-1})$ and *ln(Sales to SG&A)*.[17] The indicator variable *Rumor* equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post* is an indicator variable that equals one for the fiscal quarter *t* in which firm *i* becomes involved in a speculative takeover rumor as well as for the two subsequent quarters, and zero otherwise. *Control* is a vector of control variables at the firm-quarter level. The variables are *Capex to Total Assets*,[18] *Cash to Total Assets*, *Debt to Total Assets*, and *Firm Size*, which is the natural logarithm of total assets. We convert accounting data denoted in local currency to USD using Compustat currency files and winsorize continuous variables at the 1st and 99th percentiles. All regressions include firm and quarter fixed effects to account for unobserved variables, which are either constant over time or constant across firms. Importantly, the inclusion of firm and quarter fixed effects rules out that time-invariant industry-specific factors or time trends in our measures of firm productivity explain our results. We cluster standard errors at the firm level to allow for serial correlation in firm productivity resulting from unobservable firm characteristics.

For robustness purposes, we re-estimate equation (1) including additional controls. *Analyst EPS Estimate* equals the (three-month) average value of monthly I/B/E/S mean analyst

[17] For robustness, we use two alternative measures. *Gross Profit Margin* is defined as the difference between sales and costs of goods sold divided by sales, which rules out that our results might just reflect declines in firms' sales. *Operating Ratio* is defined as the sum of operating expenses and costs of goods sold divided by sales.

[18] Since Compustat provides capital expenditure data on year-to-date level, we transform this data to quarterly level by subtracting the value of the previous quarter from the values of the second, third, and fourth quarters, respectively. We replace missing values for capital expenditures with zero values and include an indicator variable in our regressions that accounts for this replacement.

estimates for firms' EPS. Because I/B/E/S estimates are not available for many international firms, we replace missing estimates with zero values and include an indicator variable in our regressions that accounts for this replacement. Alternatively, we use analyst sales estimates and proceed accordingly. The indicator variable *Seeking M&A* equals one if a takeover rumor occurred in the same year in which a firm announces that it seeks a buyer or a target firm (or assets) to acquire. *Stock Return* is the quarterly buy-and-hold log return of a firm's stock. *Volatility* is the volatility of a firm's daily log returns over the quarter.

Turning to our employee-level tests, we use regressions similar to equation (1). In particular, to analyze R&D employee productivity, we use the regression model in equation (2):

$$Inventor\ Productivity_{ijt} = \beta_1\ Rumor_i\ x\ Post_{ijt} + \sum_k \beta_k\ Control_{it} + Inventor\ x\ Firm\ FE + Quarter\ FE \quad (2)$$

The placeholder *Inventor Productivity* stands for a quantity- and a quality-based measure of inventor productivity, i.e., *#Patents* and *#Citations*. Since inventors often collaborate, *#Patents* is defined as the sum of team-size adjusted patents, with each patent divided by the size of the inventor team that worked on it. *#Citations* is the number of a patent's citations over the subsequent three years, adjusted for inventor team size. Using team-size adjusted inventor variables is common in the literature (see, e.g., Jaravel, Petkova, and Bell, 2018). As before, our variable of interest is *Rumor x Post*, which equals one for the fiscal quarter *t* (and for the two subsequent quarters) in which rumor firm *i*, and thus inventor *j* employed by firm *i*, becomes involved in a speculative takeover rumor, and zero otherwise. The vector *Control* includes the same firm controls as in equation (1). Besides quarter fixed effects, we include inventor x firm fixed effects to control for time-invariant inventor and firm characteristics as well as for the endogenous matching between inventors and firms.

To test whether the decline in innovator productivity is greater if innovators bear higher job loss risk, we use the measure proposed by Bekkerman et al. (2023). It captures patent

similarity between firms based on the analysis of 7.7 million publicly available patents granted by the USPTO from 1976 to 2015, and hence measures the extent to which the target and acquirer have overlap in their R&D specialization. We interact the respective variable *Patent Similarity* with our variable of interest, *Rumor x Post*.[19]

We estimate specifications of the regression model in equation (2) using a Poisson Pseudo Maximum Likelihood (PPML) estimator because our data is count data that includes many zeros (as quarters in which inventors did not file a patent are filled with zeros).[20] We winsorize variables at the 1st and 99th percentiles and cluster standard errors at the firm level.

Lastly, to analyze analyst productivity, we use the regression model in equation (3):

$$Analyst\ Productivity_{kjt} = \beta_1\ Rumor_i\ x\ Post_{ijt} + \sum_k \beta_k\ Control_{it} + Analyst\ x\ Broker\ FE + Quarter\ FE \quad (3)$$

The placeholder *Analyst Productivity* stands for the quality-based analyst productivity measure *PMAFEP* as well as for the two quantity-based productivity measures, *Portfolio Size* and *Buy/Sell Revisions*. *PMAFEP*, which we define as per Bradley, Gokkaya, and Liu (2017), captures the accuracy of analysts' earnings forecasts.[21] Negative values of *PMAFEP* indicate better than average, i.e., more accurate, analyst forecasts. *Portfolio Size* is the number of unique firms for which an analyst issues next-quarter earnings forecasts, and *Buy/Sell Revisions* is the number of an analysts' recommendation revisions to either "buy" or "strong buy" or to "sell" or "underperform" relative to all of the analyst's recommendation revisions. *Rumor x Post*

[19] We can only conduct this test for a subsample of our data because, by design, we need firm pairs, which are only available during a rumor, i.e., a maximum of five quarters from t-2 to t+2. Further, since data on patent similarity is only available until the end of 2014 and only for 75 of our rumor firm pairs, we end up with a relatively small sample size compared to our baseline regressions.

[20] We perform the regressions at the quarter level due to the low frequency of patent generation among innovator teams. With an average of 0.26 patents per quarter per team and the 90th percentile at just one patent per quarter, the data lacks the necessary variation required for parameter identification in analyses conducted at a more frequent level, such as daily or weekly.

[21] The variable is calculated as the difference between the price-scaled absolute forecast error of analyst j publishing forecasts for firm k at time t (AFEP) and its mean across all analysts publishing forecasts for firm k at time t (MAFEP), which is in turn scaled by MAFEP. The absolute forecast error is the difference between analyst j's forecast and the announced actual.

equals one for the fiscal quarter *t* (and the two subsequent quarters) in which rumor broker *i*, and thus analyst *j* employed by broker *i*, becomes involved in a speculative takeover rumor, and zero otherwise. *Control* is a vector of control variables at the analyst-quarter level. We include quarter and analyst x broker fixed effects in all regressions. The latter controls for unobserved time-invariant heterogeneity at both the analyst and broker level and also accounts for the endogenous matching between analysts and brokerage houses. Regressions explaining *PMAFEP* additionally include forecast month and firm x quarter fixed effects. The latter control for most firm characteristics. We winsorize variables at the 1st and 99th percentiles. We conduct OLS and Poisson regressions and cluster standard errors at the brokerage house level.

3.4 Summary statistics for rumors and firm-level data

Table 1 presents the summary statistics for our sample and variables described before. Panel A provides an overview of the distribution of speculative takeover rumors across countries for acquirers and targets. Overall, 4,024 acquirers and 6,270 targets are involved in rumors. Thirty percent of these rumors refer to North American companies and another 22% to companies from the other Anglo-Saxon OECD countries, i.e., Australia, Ireland, New Zealand, and the U.K. The considerable share of Anglo-Saxon countries reflects their more developed markets for corporate control. As to the other rumors in the sample, companies from the five largest economies in Continental Europe, i.e., Germany, France, Italy, Spain, and the Netherlands, as well as from Scandinavia account for another quarter of all M&A rumors. The remaining rumors mainly involve firms from Japan, Korea, Poland, Portugal, and Switzerland.

Panel B of Table 1 shows summary statistics for outcome and control variables separately for rumor firms (for which the variable *Rumor* equals one) and for non-rumor firms. The number of observations varies across variables due to data availability. For all four productivity measures, rumor firms show higher levels of productivity than non-rumor firms, inconsistent with reverse causality issues. Further, rumor firms are larger in terms of market capitalization

(3,975mn vs. 757mn) and with respect to other size measures, i.e., the number of employees, sales, and total assets. Their ratio of capital expenditures to total assets is slightly higher (0.0121 vs. 0.0118), they hold less cash (16% vs. 18% of total assets), and they use less debt (61% vs. 66% of total assets). All aforementioned differences are statistically significant.

4. Speculative Takeover Rumors as Unexpected Events

A concern regarding empirical tests of our main hypothesis is that speculative takeover rumors may not constitute unexpected events. Specifically, realized or expected low firm productivity may cause speculative rumors if it triggers the need for acquisitions or causes targets to become susceptible to predatory deals. As a result, such rumors would not serve as unexpected shocks to employees. Furthermore, results might reflect reverse causality if lower *temporary* firm productivity or expectations of *temporary* reductions in productivity cause takeover speculation (not vice versa). This concern however is difficult to reconcile with the reality of the M&A market where firms – if acquired for performance or predatory reasons – typically have problems that are not just temporary. Still, before turning to our main analysis, we first test whether takeover rumors are systematically related to productivity or pre-rumor stock returns.

First, we study firms' stock returns in the weeks leading up to the rumor announcements.[22] Betton et al. (2014) document rational deal expectation in the form of significant stock price run-ups weeks before M&A transactions are announced. Figure 1 shows cumulative average abnormal returns (CAR) for 9,379 rumors. As can be seen from the figure, there is no significant stock price run-up or negative stock return prior to rumor announcements, which would be indicative of deal or rumor expectation. In fact, Table 10 shows that CAR in the 40 trading days prior to the rumor announcement is indistinguishable from zero. This evidence provides an indication that market participants do not systematically anticipate speculative takeover rumors

[22] We conduct an even study for 9,379 speculative rumor announcements using the FTSE World index as the market portfolio and an estimation window for the market model that ranges from -241 to -41 days. We describe the event study methodology and setting in detail in Section 7.

and that those events are unexpected. Furthermore, the absence of pre-rumor stock returns is inconsistent with the notion that unobserved merger negotiations systematically precede rumor announcements. In this regard, Eaton, Liu, and Officer (2021) show that M&As, on average, are privately initiated 112 trading days before they are publicly announced and that stock price run-ups, on average, start 105 trading days prior to deal announcement.

In a next step, we consider the determinants of takeover speculation. A concern with our study is that poor productivity may trigger the need for acquisitions (for acquirers) or that targets become susceptible to predatory deals. We address the concern that pre-rumor productivity or expectations of productivity may predict the occurrence of rumors in two ways. First, we conduct regressions of the indicator variable *Rumor x Post Q0*, which equals one for rumor firms in the quarter during which the speculative takeover rumor surfaces, on four different productivity measures. Productivity measures and firm controls enter the regressions with one lag. The results, which we present in Panel A of Table 2, suggest that prior firm productivity does not predict takeover rumors for all four measures of firm productivity. However, a firm's leverage and size predict rumors. The positive coefficient on $Firm\ Size_{t-1}$ supports the notion that speculative rumors are more likely for better-known firms to which the media pay more attention. Consistently, Ahern and Sosyura (2015) find that media articles about large, recognizable firms are less accurate than articles concerning less newsworthy firms.

In addition to the above test, we hand-collect the scoop articles for all speculative rumors concerning U.S. target companies in our sample in the Lexis/Nexis database and complement the search with Google searches. We also cross-check the relevant observations with the merger rumors data published on Kenneth Ahern's website (Ahern and Sosyura, 2015). We read the scoop articles and further news for all 923 events. News sources mention target (bidder) productivity and profitability as a motivation for the speculated transaction in only 0.7% (0.2%) of all cases. This evidence further suggests that (expectations of) low productivity or profitability do not systematically trigger takeover speculation.

Finally, we study financial analysts, who play a significant role in forming expectations of market participants. We compare analysts' average I/B/E/S estimates of sales and earnings per share (EPS) for the quarter following the rumor quarter to the estimates for non-rumor quarters. If speculative takeover rumors reflect or are caused by lower *expected* productivity or profitability, we should find such evidence in analyst estimates. Panel B of Table 2 shows differences in means and medians of analyst estimates for rumor and propensity-score matched non-rumor quarters. Propensity scores are obtained from a Probit regression of the dependent variable *Rumor* on firm controls lagged by one quarter, two-digit SIC industry fixed effects, and quarter fixed effects. We use the propensity scores from the Probit regression to perform a matching based on the nearest neighbor. The results show higher – not lower – levels of sales and EPS in quarters in which takeover speculation surfaces. In untabulated tests, we find similar results if we do not match rumor and non-rumor quarters or use several nearest neighbors. Hence, if anything, rumor firms tend to be more successful. These findings are in line with papers on takeover target prediction, such as Danbolt, Siganos, and Tunyi (2016) who document that target firms have higher (not lower) free cash flows and are more (not less) profitable.

In all, the event study results as well as the analyses of rumor determinants, scoop articles, and analyst estimates together provide strong evidence that speculative takeover rumors are unexpected events that are not driven by prior or expected low firm productivity.

5. Takeover Speculation and Productivity: Firm-Level Evidence

On average, we expect takeover speculation to negatively affect firm productivity. This effect should only be temporary because we study speculative takeover rumors that do not materialize. Figure 2 provides a descriptive indication of how productivity changes around the occurrence of such rumors. The figure shows changes in the residuals of $ln(Sales\ to\ Employees_{t-1})$ and *ln(Sales to SG&A)* in event time. To compute the time-varying residuals, we estimate the regression model in equation (1) omitting our variable of interest, *Rumor x Post*. We calculate

the average residuals for pre- and post-rumor quarters for all rumor firms. Changes in residual productivity equal the absolute values of the changes in average residual productivity from one period to the next. Pre-rumor periods include the quarters t-6 to t-4 and t-3 to t-1. The rumor period spans the quarters t0, t+1 and t+2, consistent with the definition of *Rumor x Post*. The post-rumor periods include the quarters t+3 to t+5 and t+6 to t+11. We use a longer second post-rumor period to provide evidence on how firm productivity develops after a rumor.

Figure 2 reveals a consistent picture, indicative of a dip in firm productivity associated with temporary takeover speculation. In fact, both productivity measures decline from the pre-rumor to the rumor period (i.e., quarters t0 to t+2) and recover thereafter. This preliminary evidence of temporary declines in firm productivity supports our expectation.

5.1 Baseline regression results

To test whether and how firm productivity changes after speculative takeover rumors surface, we estimate our baseline regression model as outlined in equation (1). Table 3 shows regression results explaining the productivity measures, $ln(Sales\ to\ Employees_{t-1})$ and *ln(Sales to SG&A)*, based on the firm-quarter panel described above. Our main variable of interest is *Rumor x Post*. Given the hypothesis derived in Section 2, we expect a negative coefficient on this variable indicating a temporary decline in firm productivity after takeover speculation starts. The estimates in Panel A of Table 3 are in line with the descriptive results in Figure 2 and support our empirical prediction. Columns (1) and (2) show the results for $ln(Sales\ to\ Employees_{t-1})$, while columns (3) and (4) show the results for *ln(Sales to SG&A)*. In columns (2) and (4), we show results from regressions including all control variables (as described in Section 3.2), whereas the regressions shown in columns (1) and (3) omit the control variables for capital expenditures, cash, and debt because they might be directly affected by takeover rumors and hence capture part of the effect we attempt to measure. For both productivity measures, the coefficient on *Rumor x Post* is negative and statistically significant at the 5% level or better,

indicating a temporary decline in firm productivity. The coefficients also show an economically meaningful magnitude across firms. On average, rumors are associated with a 1.5% and 2% decline in sales to employees and sales to SG&A, respectively.[23]

Pre-rumor trends in firm productivity may interfere with our identification strategy. To assess pre-rumor trends, we define an indicator variable for each of the two quarters prior to the quarter in which the takeover rumor surfaces, i.e., *Pre Q1* and *Pre Q2*, and interact both with the *Rumor* indicator. We re-estimate the regression in equation (1), additionally including the variables *Rumor x Pre Q2* and *Rumor x Pre Q1*. Further, to better understand how firm productivity changes during the rumor period (i.e., quarters t0 to t+2), we replace the variable *Rumor x Post* with an indicator variable for each post-rumor quarter, i.e., *Rumor x Post Q0*, *Rumor x Post Q1*, and *Rumor x Post Q2*. Panel B of Table 3 displays the results of these model specifications. We find no indication of pre-rumor trends. The coefficients on *Rumor x Pre Q2* and *Rumor x Pre Q1* are statistically indistinguishable from zero, implying similar trends in pre-rumor productivity for rumor and non-rumor firms. Furthermore, the coefficients on the three rumor period indicators, i.e., *Rumor x Post Q0*, *Rumor x Post Q1*, and *Rumor x Post Q2*, show that firm productivity declines during the rumor-quarter and the following quarters.

To mitigate concerns of simultaneity bias beyond the tests discussed in Section 4, we also re-estimate our regressions using a lead-lag structure, considering only the two quarters after the takeover rumor quarter (Q0). We denote the variable of interest *Rumor x Post w/o Q0*. The coefficients on this variable, as shown in Panel B of Table 3, is negative and statistically significant in both columns, supporting the existence of the rumor productivity dip.

[23] We note that these estimates are for the average firm. In Section 5.2, we separately examine firms subject to one vs. multiple rumors and estimate the effect on sales to employees to be 2.8% (instead of 1.5%). Also, testing for cross-sectional variation in Section 5.3, we find considerably larger economic effects in instances in which employees have to fear job loss and other wealth transfers more. For robustness purposes, we re-estimate the above regressions using alternative firm productivity measures, namely *Operating Ratio and Gross Profit Margin*. Appendix A shows the results. The coefficients on both variables are statistically significant and have the expected sign (i.e., positive for *Operating Ratio* and negative for *Gross Profit Margin*). Again, the results are economically meaningful. For example, *Operating Ratio* increases by 5.6 percent relative to the sample mean for rumor firms.

5.2 Robustness

This section provides various tests on the robustness of our baseline results, which attempt to address endogeneity concerns beyond our efforts described in Section 4. One potential concern is that rumors might be spread in expectation of temporary productivity declines or related M&A activity. To further address this concern, we additionally include the variables *Analyst EPS Estimate* and *Seeking M&A* in our baseline regression model to capture a potential reverse causality going from business development or strategy to M&A rumors. Appendix B, Panel A, shows the regression results. While firms expected to be on an upward earnings trajectory (as indicated by EPS estimates) show higher productivity, our variable of interest, *Rumor x Post*, still shows a statistically and economically significant coefficient explaining both *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. In untabluated regressions, we find similar results using analyst sales instead of EPS estimates. Further, firms that have announced to engage in asset sales or acquisitions (i.e., *Seeking M&A*) do not seem to be systematically related to higher or lower productivity. We conclude that speculative takeover rumors caused by market expectations of positive and negative business development or by firms guiding markets towards M&A expectations are unlikely to explain our results.

Panel B of Appendix B additionally shows that our results remain qualitatively unchanged when we include quarter x country or quarter x industry fixed effects to account for country-time or industry-time specific differences that may explain both firm productivity and the occurrence of takeover speculation.[24]

[24] We perform three additional untabulated robustness tests. First, we re-estimate our regressions using a dynamic estimation approach by including the lag (either one quarter or four quarters) of the respective productivity measure as a control. The results remain qualitatively similar. Second, we might just happen to pick up the pattern of a dip in firm performance around CEO turnover, as documented in Murphy and Zimmermann (1993) and others, if turnover increases the likelihood of takeover speculation. Using CEO data provided by Brochet et al. (2021), we exclude all M&A rumors coinciding with CEO turnovers and find our results to remain qualitatively unchanged. Third, for the sample of U.S. targets, we hand-collect information on whether the rumor is denied (or not) by either the target or bidder and only find the productivity dip in case of undenied rumors. However, since only about 4% of the rumors are denied, we may just find no effect for such rumors due to lack of statistical power.

Another concern is that firms involved in speculative takeover rumors may be inherently different from non-rumor firms, and that our control variables and fixed effects may not fully capture these differences. We address this concern by estimating several matched-sample regressions. First, we use a propensity score matching (PSM) (Rosenbaum and Rubin, 1983) approach to match rumor firms to a more comparable control group. To this end, we obtain propensity scores from Probit regressions of the dependent variable *Rumor x Post* on lagged firm characteristics (i.e., the control variables in our baseline regressions), two-digit SIC industry fixed effects, and quarter fixed effects. We use the propensity scores to perform a nearest neighbor matching based on the closest propensity score. To maintain statistical independence, we implement a nearest neighbor matching without replacement. We then use the resulting PSM-matched sample to re-estimate our baseline regressions.

Columns (1) and (2) in Panel A of Table 4 present the PSM regression results. For both productivity measures, the coefficient on *Rumor x Post* is negative and significant at the 5% level or better. The estimates are slightly larger in terms of economic magnitude. Appendix C shows the covariate balance resulting from our PSM approach. The results corroborate the existence of a rumor-related dip in firm productivity. The same is true when we use an entropy-balanced sample (Hainmueller, 2012), where balancing is done on the mean and variance of firm characteristics as well as industries and year quarters. Columns (3) and (4) show the results.

Furthermore, we exploit the staggered occurrence of speculative rumors across firms and quarters and re-estimate our baseline regressions including only firms that were subject to at least one takeover rumor over the sample period (i.e., the variable *Rumor* equals 1). In this case, the group of rumor firms serves as the counterfactual and any characteristics shared exclusively by this group of firms are unlikely to explain our results. Columns (5) and (6) of Panel A show the results for this subsample. The coefficient on the variable of interest, *Post*, is negative and significant at the 5% level or better for both productivity measures. This evidence further supports the conclusion that firm productivity declines after takeover rumors surface.

Next, one may argue that by focusing on takeover rumors that never materialize, we may systematically capture unobserved merger negotiations falling apart because of temporary deteriorations in firm productivity that materialize unexpectedly. While we find no abnormal stock returns prior to rumor announcements that may indicate merger negotiations (as per Eaton, Liu, and Officer, 2021), such negotiations might happen to just start as rumors occur, and might be accompanied by a simultaneous and temporary shock to firm productivity. While this concern appears unlikely, it is also difficult to address. Nevertheless, we make use of the scoop articles for the takeover rumors involving U.S. target firms (see Section 4), attempting to identify the ultimate source of those rumors. The idea is to exploit rumors that are arguably "exogenous" in the sense that they are likely to be truly speculative and thus unlikely to reflect or initiate merger negotiations. Obtaining this information is challenging and, despite our best efforts, we are not able to identify the sources of all rumors. Yet, for a limited sample of the rumors we can obtain information about the rumor's origin.

We classify a rumor as "exogenous" if the scoop article states that the rumor is speculation or if the rumor originates from social media or blogs or if the source of the rumor is mentioned to be anonymous. We are aware that there is no perfect classification ensuring that the rumor does neither reflect nor initiate merger negotiations, but at least our approach should reduce endogeneity concerns. We re-estimate the within-treatment group regressions in Panel A of Table 4 with the restricted sample of U.S. "exogenous" rumors. The focus on U.S. firms allows us to control for additional firm characteristics (with poor coverage in Compustat Global) that may drive both rumors and firm productivity, namely firm age (i.e., the firm's life cycle) and R&D expenses (capturing "growth targets"). Panel B of Table 4 shows the results. The coefficient on *Post* is negative and significant at the 5% level or better for both productivity

measures. Hence, even with the restricted sample of rumors that are unlikely to reflect or initiate merger negotiations, we still find evidence of a rumor-related dip in firm productivity.[25]

Lastly, even though mergers are disruptive events that receive significant media attention, with most merger rumors being mentioned in the headline of the press article covering it (Ahern and Sosyura, 2015), we attempt to provide evidence that a firm's employees and managers indeed pay attention to such rumors. To this end, we examine the clicks and downloads of rumor firms' SEC filings upon rumors surfacing using the EDGAR sever logs data. We use the variable *Ln(1 + Downloads of focal rumor firm filings from EDGAR by focal rumor firm IP addresses)*, which is the natural logarithm of 1 plus the quarterly number of filings by the focal rumor firm that were clicked or downloaded from the EDGAR server by IP addresses that directly belong to the focal rumor firm. We regress this established attention measure on our variable of interest, *Rumor x Post*, along firm controls as well as firm and quarter fixed effects. Appendix E presents the results. The coefficient on *Rumor x Post* is positive and significant at the 1% level. We find that the EDGAR-based employee attention increases by at least 5% after takeover rumors surface. While being far away from a perfect test of employee attention, this approach tends to run against us finding any results because many employees will arguably use other sources to obtain information about their firm (such as the local press). Still, the results provide an indication that employees and managers pay attention to takeover speculation.[26]

[25] We provide another test to address the concern that we may just happen to analyze cases of unobserved merger negotiations falling apart due to unexpected temporary productivity shocks. The logic of the test is simple: If the rumors we analyze indeed systematically fall apart due to productivity shocks, the coefficient on *Rumor x Post* should be significantly negative for both firms subject to one rumor and firms subject to multiple rumors. However, if the dip in productivity results from rumor-induced distraction, stress, and uncertainty of employees, the coefficient on *Rumor x Post* may be expected to lose (economic and statistical) significance for firms repeatedly involved in takeover speculation. The reason is that employees will likely get used to this form of stress and learn that the rumors may just likely be pure speculation or believe management when it says so. Appendix 4 presents the results from this test. For firms involved in multiple rumors (accounting for 59% of the rumor firms), we find the coefficient on *Rumor x Post* to be insignificant (column 3) and to be marginally significant (column 4). In contrast, for firms subject to only one rumor, the coefficient on *Rumor x Post* is significant at the 5% level for both productivity measures and has a greater magnitude than in our baseline regressions in Table 3 (e.g., 2.8% instead of 1.5% decline in sales to employees). This evidence appears inconsistent with the idea that the rumors we analyze constitute potential mergers that fall apart during the negotiations process because of productivity shocks.

[26] In untabulated regressions, we test whether our measure of employee attention is directly related to firm productivity. The relevant coefficient is negative and statistically significant at the 10%-level in the specification

In sum, all of the above tests confirm our baseline result of a temporary decline in firm productivity after takeover rumors surface. We also provide evidence indicating that employees and managers pay attention to rumors, which is a requirement for them to affect productivity. Nonetheless, as a caveat, we note that what causes the rumors to occur is not perfectly observable and hence a potential source of endogeneity we cannot perfectly account for.

5.3 Cross-sectional variation in the rumor-related productivity dip

Having established our baseline results, we next exploit cross-sectional variation to identify channels through which the rumor-induced productivity dip may be mitigated or amplified. Examining potential channels serves as a test for the underlying theoretical mechanisms that explain why firm productivity declines after takeover speculation surfaces. Furthermore, testing whether cross-sectional variation in the productivity dip follows theoretical predictions also serves as another means of alleviating concerns related to reverse causality and omitted variable bias. Given our reasoning in Section 2, we expect the decline in firm productivity to vary with the degree to which employees fear job loss and other wealth transfers. Specifically, the productivity dip should be driven by or be more pronounced for target firms as well as for firms located in countries with weaker employee rights or greater cost synergies.

However, before we turn to our cross-sectional tests, we first attempt to clarify if instead another mechanism is at work. Particularly, as mentioned in Section 2, a potential mechanism through which takeover rumors may lead to a decline in firm productivity – apart from fear of job loss and distraction – is via employee stock ownership. Indeed, managers and employees may feel more complacent about reaching the strike price of their stock options, potentially lowering their incentives to exert effort. While employee stock ownership has been significantly less common outside the U.S., this mechanism may still explain our results. Since data on employee ownership is unavailable, we account for this mechanism by including a firm's stock

with our productivity measure *ln(Sales to Employees$_{t-1}$)* as dependent variable, but insignificant at conventional levels for *ln(Sales to SG&A)*.

price (i.e., the quarterly buy-and-hold return) and volatility (based on daily stock returns over the quarter) as additional controls in our baseline and matched-sample regressions. Table 5 presents the results. Across all columns, the coefficients on both *Rumor x Post* and *Post*, remain statistically significant, mostly at the 5% level or better. Moreover, the economic magnitude of most coefficient estimates is only slightly lower. We thus conclude that potential reductions in manager and employee incentives resulting from stock price increases when takeover rumors become public are unlikely to explain our results.

We now turn to the results of our cross-sectional tests, which we present in Table 6. In Panel A, we investigate the effect of rumors for target and acquirer firms separately. We replace the variable *Rumor x Post* by the variables *Rumor x Post x Target* and *Rumor x Post x Acquirer*, which equal one, respectively, for targets and acquirers in the rumor quarter and the following two quarters. While we find productivity to decline for both types of firms, target firms drive the productivity decline, at least for *ln(Sales to Employees$_{t-1}$)*. In particular, we find a significantly negative regression coefficient on *Rumor x Post x Target* for both productivity measures, while the coefficient on *Rumor x Post x Acquirer* is only statistically significant when used to explain *ln(Sales to SG&A)*. The results support our expectation and are consistent with Shleifer and Summers (1988) who argue that employees of target firms tend to be more heavily affected by takeovers. Nonetheless, in line with findings by Bach et al. (2023), we find some indication that productivity also declines for rumored acquirers.

To analyze the effects of employee rights in the cross-section of firms, we use the OECD data on collective bargaining and the employment protection legislation index (variable *EPL*) at the country level. We re-estimate our baseline regression shown in equation (1) additionally including interaction terms of *Rumor x Post* with the variables *Collective Bargaining* and *EPL*. Columns (1) and (2) in Table 6, Panel B, show the results for *ln(Sales to Employees$_{t-1}$)*, while columns (3) and (4) show the results when we use *ln(Sales to SG&A)* as the dependent variable. For brevity, we do not tabulate all interaction terms. The coefficients on *Rumor x Post x EPL*

and *Rumor x Post x Collective Bargaining* are positive in all four columns, and statistically so in columns (1) and (2). Hence, the productivity dip, at least in terms of sales to employees, is indeed amplified (muted) in countries with low (high) levels of employee rights. This result is consistent with our reasoning that takeover speculation causes fear of job loss and other wealth transfers, which has detrimental effects on employees and ultimately on firm productivity. Yet, we note that the results are only partly significant.

In additional cross-sectional analyses, which we do not tabulate for brevity, we provide further evidence for a less pronounced rumor-related dip in firm productivity in instances in which employees and managers have to fear job loss and other wealth transfers less. These instances include low-synergy industries[27] and more long-term orientation[28] in firm headquarter countries. Overall, we provide meaningful cross-sectional variation, suggesting that the decline in firm productivity relates to employees' fear of job loss and other wealth transfers.

6. Takeover Speculation and Productivity: Employee-Level Evidence

So far, we have presented robust evidence for a takeover rumor-related dip in firm productivity. The actual focus of our study however is on employee productivity, which should ultimately translate into firm productivity, as argued in Section 2. To capture the latter, we have relied on relatively crude measures, e.g., a firm's ratio of sales to the number of employees. Such measures may incorporate various drivers of sales and costs unrelated to employee productivity, thereby distorting statistical inference. In this section, we therefore provide employee-level

[27] We exploit differences in potential cost synergies across industries. We use the indicator *Low Synergy Industry*, which equals one for two-digit SIC industries for which the average values of SG&A to total assets or COGS to total assets or both are below (or equal to) the respective sample medians. The rationale is that firms in low synergy industries have less room for generating synergies by cutting labor costs and related expenses. We re-estimate our regressions including the interaction term *Rumor x Post x Low Synergy Industry*, which we expect to have a positive sign indicating that the productivity dip is weaker for firms with less room for cost synergies. The results, which we provide upon request, are consistent with our expectation.

[28] Based on the cultural data provided by Geert Hofstede (e.g., Hofstede, 2001), we use indicator *Long-Term Orientation*, which equals one for countries with an above-median value for Hofstede's short vs. long-term orientation dimension. We expect managers in countries where long-term orientation is the norm to be less likely to violate implicit long-term contracts (in the spirit of Shleifer and Summers, 1988) to make short-term profits, which should lower employees' fear of job loss and wage reductions. Consistently, we find the coefficient on *Rumor x Post x Long-Term Orientation* to be positive and statistically significant when used to explain both productivity measures. Again, the results are available upon request.

evidence using more direct measures of productivity. In particular, we leverage the public availability of patent data to examine the productivity of R&D employees around speculative takeover rumors. Understanding inventor productivity is important since patents are valuable to firms (e.g., Farre-Mensa, Hegde, and Ljungqvist, 2020). We also exploit the fact that amid the consolidation of the broker market various sell-side analysts were exposed to takeover rumors concerning the brokerage houses that employed them. While this single-industry analysis yields only a limited number of treated broker observations, analyst outcomes allow for a relatively clean measurement of individual productivity. Our analyses of employee productivity build on the data and methodology described in Sections 3.2 and 3.3.

6.1 Evidence from R&D employees

We regress the two R&D employee productivity measures, *# Patents* as well as *# Citations* on our variable of interest, *Rumor x Post* or on indicator variables that split this variable in pre- and post-treatment variables. Table 7 provides summary statistics for our patent dataset in Panel A and regression results in Panels B to D.

Panel B and Panel C, which have identical structures, present the results from regressions explaining the dependent variables *# Patents* and *# Citations*, respectively. Figure 3 illustrates the results graphically by plotting coefficient estimates for pre- and post-treatment indicator variables from regressions similar to those in column (2) of each panel. The results suggest that, similar to the pattern we observe at the firm level, employee productivity significantly decreases after takeover rumors surface and later rebounds (i.e., the productivity dip). More specifically, in column (1) of both panels we find a negative coefficient on *Rumor x Post*, which is significant at the 1% level. The coefficient estimates are economically meaningful, indicating a temporary decline in the number of patents and in the number of patent citations over the subsequent three years of 7% (= exp(-0.0721) - 1) and 7.8%, respectively. Columns (2) and (3) of both panels show that there are no considerable pre-rumor trends in inventor productivity. They further

suggest that the productivity decline takes about a quarter to show up, consistent with the notion that it takes time in the innovation process before diminished inventor productivity manifests.[29]

Columns (4) and (5) of both panels provide results on cross-sectional tests, which are again consistent with our firm-level evidence. In column (4), we show that for both rumored targets and rumored acquirers the productivity measures *# Patents* and *# Citations* temporarily decline. As expected, the coefficients are larger for rumored targets, with the difference between the coefficients (i.e., *Rumor x Post x Target* vs. *Rumor x Post x Acquirer*) being statistically significant in Panel B. In column (5), the significantly negative coefficient on the interaction term *Rumor x Post x Patent Similarity* indicates that our results are driven by takeover rumors involving firms with a greater potential for cost synergies and labor restructuring as measured by their overlap in R&D specialization.

In Panel D, we provide additional evidence for R&D employees working for private firms. To this end, we re-estimate the regressions shown in columns (1), (2) and (4) of Panels B and C. We omit firm controls and the test on patent similarity due to lack of private firm data. The results echo our results for public firms, with both *# Patents* and *# Citations* decreasing temporarily when takeover rumors surface, especially for rumored targets.

6.2 Evidence from sell-side analysts

We regress the three analyst productivity measures, *PMAFEP*, *Portfolio Size*, and *Buy/Sell Revisions* on our variable of interest, *Rumor x Post* or on pre- and post-treatment indicators. Table 8 provides summary statistics for our analyst samples in Panel A and regression results in Panel B. Figure 4 illustrates the results by plotting coefficient estimates for pre- and post-treatment indicators from regressions similar to those in columns (2) and (4) of Panel B.

[29] We perform several robustness tests for the patent regressions, which we do not tabulate for brevity. Importantly, we find similar results when we use entropy balancing or when do not adjust our dependent variables for the size of the inventor team. Further, in Panel C we find similar results when we examine the number of citations over the subsequent five instead of three years.

Both Panel B and Figure 4 show a temporary dip in analyst productivity as takeover rumors surface. In contrast to the results for R&D employees, but consistent with intuition, the productivity dip for analysts shows up and reverses faster. Accordingly, we only find the coefficient on *Rumor x Post Q0* to be significant at the 5% level and to have the expected sign (see columns 2, 4 and 6), whereas the coefficient on *Rumor x Post* is statistically insignificant. In particular, in the quarter during which the takeover rumor surfaces, analysts issue less accurate EPS forecasts (column 2), issue EPS forecasts for fewer firms (column 4) and fewer recommendation revisions (column 6). The economic significance of our estimates is moderate. The largest estimate is for *PMAFEP*, which corresponds to 3.15% of the interquartile range.[30]

Overall, the results in this section suggest that employee productivity, both in terms of quantity and quality, significantly declines as takeover rumors surface and rebounds afterwards. Thus, we find strong support for our firm-level evidence and for the hypothesized mechanisms through which employee productivity may decline and translate into lower firm productivity.

7. Firm Performance around Takeover Speculation

The previously presented evidence suggests that the decline in productivity around speculative takeover rumors is economically meaningful and only completely reverses months after the rumor first surfaced. This evidence raises the question of whether the productivity dip translates into negative firm performance. While, intuitively, one would expect reduced productivity to be costly for firms (e.g., because it raises unit costs or leads to fewer patents), it is difficult to quantify the exact costs of the documented productivity dip. In this section, we provide some indications studying accounting and stock market measures of firm performance.

As a first test, we study accounting performance measured by pre-tax return on assets (ROA) and pre-tax profit margin, which relate a firm's pre-tax income to total assets and sales,

[30] In untabulated regressions, we use entropy balancing and find similar results for the dependent variables *PMAFEP* and *Portfolio Size*, while we fail to confirm the results for *Buy/Sell Revisions*. Furthermore, we do not find statistically significant differences between rumored targets and acquirers, which may however be an issue of statistical power given that our dataset comprises only 45 unique treated brokerage houses.

respectively. Since reduced productivity eventually impacts the income statement, evidenced by relatively prompt reductions in sales or increases in costs, firm profitability can be expected to decline. To test how profitability changes as takeover speculation surfaces, we re-estimate the regression model in equation (1) with the two profitability measures on the left-hand side of the equation. Table 9 presents the regression results. The coefficient on *Rumor x Post* is negative and statistically significant at the 5% level or better, indicating that the profitability of firms declines when they get involved in takeover speculation. This profitability dip appears economically meaningful, accounting for 18% of the mean value of the variable *Pre-Tax ROA* (and 7% for *Pre-Tax Profit Margin*).

As a second test, we study firms' stock market performance using an event study around announcements of takeover rumors. While stock returns will incorporate any price-relevant information, especially over a longer period of time, this analysis may shed some light on the potential implications of takeover speculation for short- and mid-term shareholder wealth. To conduct the event study, we obtain total return data from the Refinitiv Datastream database. The data is available for 9,379 distinct speculative takeover rumor announcements. We use the FTSE World index as the market portfolio for which the daily total return data is available from 1994 onwards. We use this data to calculate buy-and-hold abnormal returns (BHAR). We calculate the daily BHAR for each firm as the difference between the realized and the expected buy-and-hold return, where the latter equals the contemporaneous total return of the FTSE World index. For robustness, we also calculate cumulative average abnormal returns (CAR) using the standard market model approach. To measure short- and mid-term stock returns, we calculate BHAR and CAR for the event day (t=0) as well as for longer event windows, which start on the second trading day after the rumor announcement (t=2) and end on days 180 and 240 after the rumor. We winsorize returns at the 1st and 99th percentiles.

Table 10 presents the results. In line with the literature (e.g., Pound and Zeckhauser, 1990; Ahern and Sosyura, 2015) we find statistically significant positive BHAR and CAR of about

2.2% upon rumor announcements (i.e., on event day t=0). The positive stock market reaction indicates that the average speculative rumor appears credible to investors, even though it does not materialize ex post. This finding implies that speculative rumors are likely to constitute takeover threats that employees and managers will seriously care about.

As shown in Figure 1, we find no indication for deal anticipation in the form of pre-rumor stock price run-ups or negative returns. BHAR and CAR over the two months leading up to the rumor announcement amount to only 0.5% and 0.1%, respectively. This result is consistent with the evidence in Betton, Davis, and Walker (2018) and again supports the notion that speculative takeover rumors are unexpected events, unlikely to reflect significant changes in firm fundamentals or ongoing merger negotiations.

Turning to mid-term post-rumor stock performance, both BHAR and CAR turn negative in the quarters after the rumor announcements, with the difference in returns from the third to the fourth quarter being only marginal. Specifically, as the probability of a public takeover bid announcement or other information that solidifies the rumor fade over time, short-term market reactions to the rumor dissipate and the BHAR (CAR) over the next 180 trading days, i.e., the treatment period in our panel regressions, is -4.7% (-4.9%). The negative returns outweigh the positive announcement effect of the rumor, being more than twice as large in absolute values. Thus, the market does not just reverse the stock price increase in reaction to takeover rumors as they become increasingly unlikely to materialize, but indicates significant shareholder wealth destruction. In untabulated analyses, we find that the decline in stock returns occurs for both rumored targets and acquirers, and is significantly stronger for targets for which we also document a more pronounced productivity dip.

Overall, the productivity dip we document coincides with declines in firm profitability and with negative stock returns beyond just the reversal of positive rumor announcement effects. While it is impossible to unambiguously relate longer term stock returns to specific events, the negative stock market reaction is consistent with the decline in firm profitability,

which directly affects firm value. As a caveat, we note that we cannot rule out that the negative stock price reaction we find reflects the market's updated probability that rumor firms will less likely receive takeover bids in the future. At the same time, though, stock prices may also reflect that rumor firms are "on the radar" of potential buyers in the market for corporate control, which should positively impact firm value and run against us finding negative returns after rumors surface. We acknowledge that our tests are unlikely to yield causal evidence of how reduced productivity translates into lower firm performance. Yet, at a minimum, they provide prima facie evidence that the rumor-induced productivity dip can be costly for firms and investors.

8. Conclusion

Although speculative journalism has been on the rise for years and speculative news are prevalent in financial markets, relatively little is known about their real implications for the firms involved. This study uses a large sample of speculative non-materializing takeover rumors to provide robust evidence that productivity at both the firm and employee level temporarily declines after takeover speculation surfaces. Firm profitability and stock returns mirror this productivity dip, indicating that it may translate into lower firm performance and thus be costly for investors. The productivity dip is more pronounced for target firms and when risk of job loss is greater, but is unobservable among firms experiencing multiple rumors. The evidence is consistent with theory and anecdotal evidence suggesting that takeover speculation causes anxiety and stress, distraction, and reduced employee commitment. Nevertheless, and despite our efforts to rule out reverse causality and omitted variables concerns, we caution against over-interpreting our results since part of the M&A rumor process is unobservable.

This study provides a first step towards a better understanding of the real effects of speculative news and rumors. In this sense, our paper contributes to the debate on the regulation of speculation in the market for corporate control, such as the 2011 UK anti-takeover reform. The results imply that limiting the time over which firms can be "in play" in takeover rumors

may benefit rumor firms and potentially their employees and shareholders. Furthermore, this study provides new insights on the potential costs of the takeover threat and highlights the critical role of human capital in corporations and the market for corporate control.

REFERENCES

Ahern, K.R., and Sosyura, D., 2015, Rumor has it: Sensationalism in financial media, *Review of Financial Studies* 28, 2050-2093.

Alperovych, Y., Cumming, D., Czellar, V., and Groh, A.P., 2021, M&A rumors about unlisted firms, *Journal of Financial Economics* 142, 1324-1339.

Atanassov, J., 2013, Do hostile takeovers stifle innovation? Evidence from antitakeover legislation and corporate patenting, *Journal of Finance* 68, 1097-1131.

Bach, L., Baghai, R., Bos, M., and Silva, R., 2023, How do mergers affect the mental health of employees, ECGI Working Paper No. 793/2021.

Becker, B., 1995, Union rents as a source of takeover gains among target shareholders, *Industrial and Labor Relations Review* 49, 3-19.

Bernard, D., Blackburne, T., and Thornock, J., 2020, Information flows among rivals and corporate investment, *Journal of Financial Economics* 136, 760-779.

Betton, S., Davis, F., and Walker, T., 2018, Rumor rationales: The impact of message justification on article credibility, *International Review of Financial Analysis* 58, 271-287.

Betton, S., Eckbo, B.E., Thompson, R., and Thorburn, K.S., 2014. Merger negotiations with stock market feedback, *Journal of Finance* 69, 1705-1745.

Bond, P., Edmans, A., and Goldstein, I., 2012, The real effects of financial markets, *Annual Review of Financial Economics* 4, 339-360.

Bradley, D., Gokkaya, S., and Liu, X., 2017, Before an analyst becomes an analyst: Does industry experience matter?, *Journal of Finance* 72, 751-792.

Brochet, F., Limbach, P., Schmid, M., and Scholz-Daneshgari, M., 2021, CEO tenure and firm value, *The Accounting Review* 96, 47-71.

Burlew, L.D., Pederson, J.E., and Bradley, B., 1994, The reaction of managers to the preacquisition stage of a corporate merger: A qualitative study, *Journal of Career Development* 21, 11-22.

Cartwright, S., and Cooper, C.L., 1993, The psychological impact of merger and acquisition on the individual: A study of Building Society managers, *Human Relations* 46, 327-347.

Cen, L., Dasgupta, S., and Sen, R., 2016, Discipline or disruption? Stakeholder relationships and the effect of takeover threat, *Management Science* 62, 2820-2841.

Danbolt, J., Siganos, A., and Tunyi, A., 2016, Abnormal returns from takeover prediction modelling: Challenges and suggested investment strategies. *Journal of Business Finance and Accounting* 43, 66-97.

Dessaint, O., Golubov, A., and Volpin, P., 2017, Employment protection and takeovers, *Journal of Financial Economics* 125, 369-388.

Dey, A., and White, J.T., 2021, Labor mobility and antitakeover provisions, *Journal of Accounting and Economics* 71, 101388.

Drake, M., Johnson, B., Roulstone, D., and Thornock, J., 2020, Is there information content in information acquisition?, *The Accounting Review* 95, 113-139.

Eaton, G., Liu, T., and Officer, M., 2021, Rethinking measures of mergers & acquisitions deal premiums, *Journal of Financial and Quantitative Analysis* 56, 1097-1126.

Farre-Mensa, J., Hegde, D., and Ljungqvist, A., 2020, What is a patent worth? Evidence from the US patent "lottery", *Journal of Finance* 75, 639-682.

Fulghieri, P., and Sevilir, M., 2011, Mergers, spinoffs, and employee incentives, *Review of Financial Studies* 24, 2207-2241.

Griffin, D., Li, K., and Xu, T., 2021, Board gender diversity and corporate innovation: International evidence, *Journal of Financial and Quantitative Analysis* 56, 123-154.

Hainmueller, J., 2012, Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies, *Political Analysis* 20, 25-46.

Hambrick, D.C., and Cannella, Jr., A.A., 1993, Relative standing: A framework for understanding departures of acquired executives, *Academy of Management Journal* 36, 733-762.

Hamilton, B.H., Nickerson, J.A., and Owan, H., 2003, Team incentives and worker heterogeneity: An empirical analysis of the impact of teams on productivity and participation, *Journal of Political Economy* 111, 465-497.

Hofstede, G., 2001, *Culture's consequences: Comparing values, behaviors, institutions, and organizations across nations*. 2nd ed., Beverly Hills, CA: Sage Publications.

Ivancevich, J.M., Schweiger, D.M., and Power, F.R., 1987, Strategies for managing human resources during mergers and acquisitions, *Human Resource Planning* 10, 19-35.

Jaravel, X., Petkova, N., and Bell, A., 2018, Team-specific capital and innovation, *American Economic Review* 108, 1034-1073.

Jensen, M.C., 1988, Takeovers: Their causes and consequences, *Journal of Economic Perspectives* 2, 21-48.

Jia, W., Redigolo, G., Shu, S., and Zhao, J., 2020, Can social media distort price discovery? Evidence from merger rumors, *Journal of Accounting and Economics* 70, 101334.

John, K., Knyazeva, A., and Knyazeva, D., 2015, Employee rights and acquisitions, *Journal of Financial Economics* 118, 49-69.

Krekel, C., Ward, G., and De Neve, J.-E., 2019, Employee wellbeing, productivity, and firm performance, Saïd Business School WP 2019-04.

Lazear, E.P., 1989, Pay equality and industrial politics, *Journal of Political Economy* 97, 561-580.

Lazear, E.P., 1998, *Personnel Economics for Managers*, New York: Wiley.

Lee, K.H., Mauer, D.C., and Xu, E.Q., 2018, Human capital relatedness and mergers and acquisitions, *Journal of Financial Economics* 129, 111-135.

Lel, U., and Miller, D.P., 2015, Does takeover activity cause managerial discipline? Evidence from international M&A laws, *Review of Financial Studies* 28, 1588-1622.

Ma, L., and Zhang, F., 2016, Investor reaction to merger and acquisition rumors, Working paper, David Eccles School of Business, University of Utah.

Manne, H.G., 1965, Mergers and the market for corporate control, *Journal of Political Economy* 73, 110-120.

Marks, M.L., and Mirvis, P.H., 1985, Merger syndrome: Stress and uncertainty, *Mergers & Acquisitions*, Summer, 50-55.

Murphy, S.A., Duxbury, L., and Higgins, C., 2006, The individual and organizational consequences of stress and depression in the workplace: a case study, *Canadian Journal of Community Mental Health* 25, 143-157.

Murphy, K., and Zimmermann, J., 1993, Financial performance surrounding CEO turnover, *Journal of Accounting and Economics* 16, 273-315.

Panchal, S., and Cartwright, S., 2001, Group differences in post-merger stress, *Journal of Managerial Psychology* 16, 424-433.

Pound, J., and Zeckhauser, R., 1990, Clearly heard on the street: The effect of takeover rumors on stock prices, *Journal of Business* 63, 291-308.

Prendergast, C., 1999, The provision of incentives in firms, *Journal of Economic Literature* 37, 7-63.

Rentsch, J.R., and Schneider, B., 1991, Expectations for postcombination organizational life: A study of responses to merger and acquisition scenarios, *Journal of Applied Social Psychology* 21, 233-252.

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

Roskies, E., and Louis-Guerin, C., 1990, Job insecurity in managers: Antecedents and consequences, *Journal of Organizational Behavior* 11, 345-359.

Schmidt, D., 2020, Stock market rumors and credibility, *Review of Financial Studies* 33, 3804-3853.

Schweiger, D.M., Ivancevich, J.M., and Power, F.R., 1987, Executive actions for managing human resources before and after acquisition, *Academy of Management Executive* 1, 127-138.

Shleifer, A., and Summers, L., 1988, Breach of trust in hostile takeovers, in: *Corporate takeovers: Causes and consequences*, ed.: Auerbach, A.J., Chicago: University of Chicago Press.

Stein, J., 1988, Takeover threats and managerial myopia, *Journal of Political Economy* 96, 61-80.

Tian, X., and Wang, W., 2021, Hard marriage with heavy burdens: Organized labor as takeover deterrents, *Review of Corporate Finance Studies* 10, 306-346.

Van Bommel, J., 2003, Rumors, *Journal of Finance* 58, 1499-1519.

Williamson, O. E., 1979, Transaction cost economies: The governance of contractual relations, *Journal of Law and Economics* 22, 233-261.

Wolever, R.Q., Bobinet, K.J., McCabe, K., Mackenzie, E.R., Fekete, E., Kusnick, C. A., and Baime, M., 2012, Effective and viable mind-body stress reduction in the workplace: a randomized controlled trial, *Journal of Occupational Health Psychology* 17, 246-258.

FIGURES

Figure 1: Abnormal returns around announcements of speculative takeover rumors

This figure shows event study results for 9,340 speculative takeover rumors. Cumulative average abnormal returns (y-axis) are reported for day t-40 to day t+15, which are defined relative to the rumor announcement date t0. Daily abnormal returns for each firm are calculated as the difference between the realized and the expected total return. Expected returns are calculated using the market model with an estimation window from -220 to -41 trading days and the FTSE World index. Takeover rumor data is from the Zephyr database. Total return data is from the Refinitiv Datastream database.

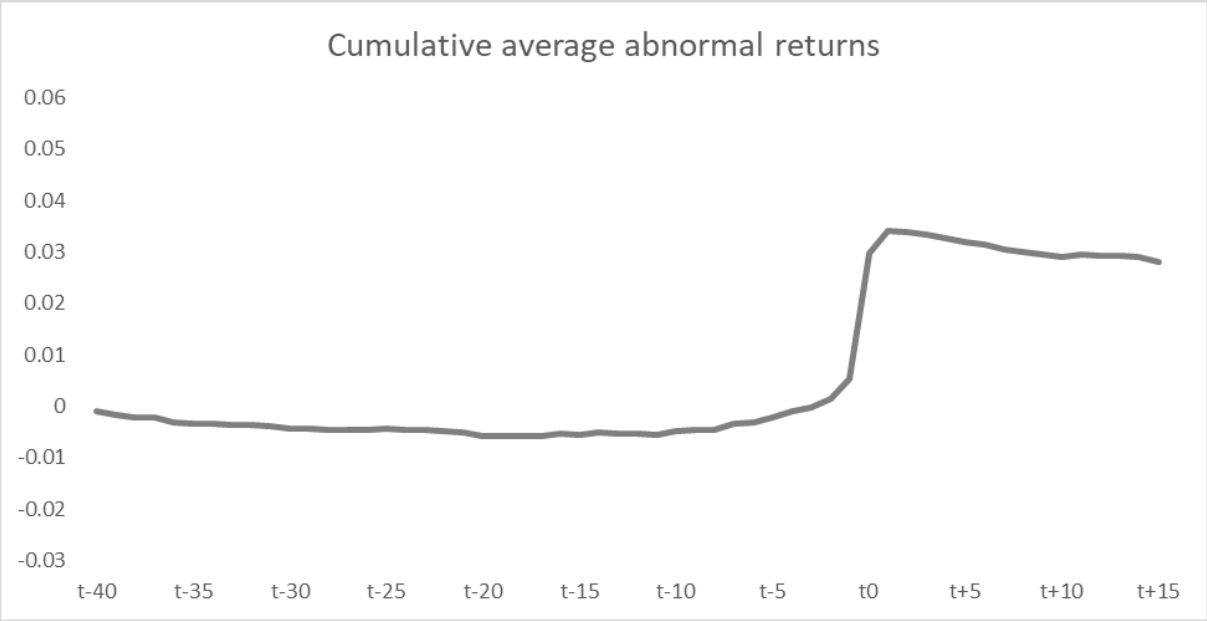


Figure 2: Changes in residual firm productivity around announcements of speculative takeover rumors (rumor firms only)

This figure shows changes in the residuals of firm productivity measures (y-axis), i.e., *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)* around speculative takeover rumors. We compute time-varying residuals from regressions similar to those shown in Table 3, Panel A, where we omit the variable *Rumor x Post*. We calculate the average residuals and their 95% confidence intervals for pre- and post-rumor quarters for all firms involved in speculative takeover rumors. Changes in residual productivity equal the absolute values of changes of average residual productivity from one period to the next, with pre-rumor periods including the quarters t-6 to t-4 and t-3 to t-1 before the rumor quarter t0. The rumor period spans the quarter t0 (during which the rumor is announced) and the quarters t+1 and t+2. The post-rumor periods include the quarters t+3 to t+5 and t+6 to t+11.

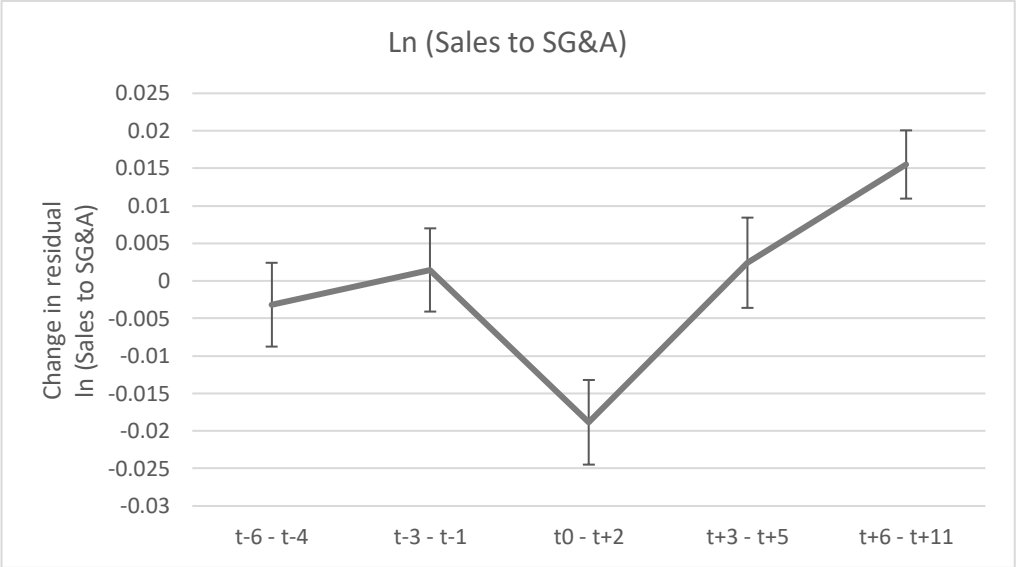
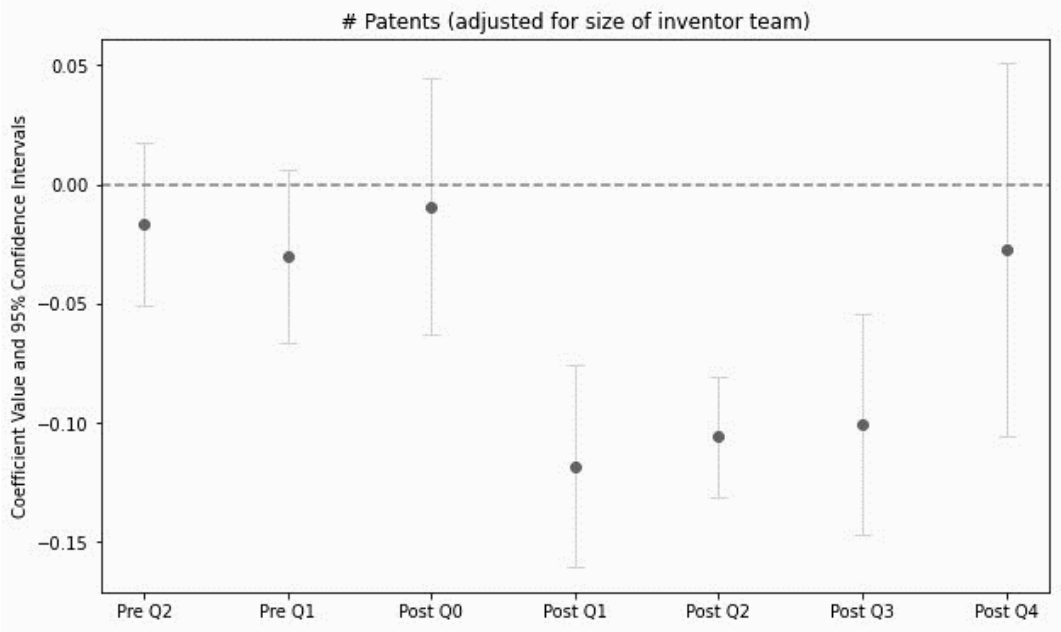


Figure 3: Inventor productivity around announcements of speculative takeover rumors

This figure illustrates how inventor productivity, measured by the number of patents (i.e., quantity) and the number of patent citations over the subsequent three years (i.e., quality), changes around speculative takeover rumors. The plots show coefficient estimates and 95% confidence intervals for the variables *Rumor x Pre Q2*, …, *Rumor x Post Q1*, …, *Rumor x Post Q4* from regressions similar to those shown in column (2) in Panels B and C of Table 7.



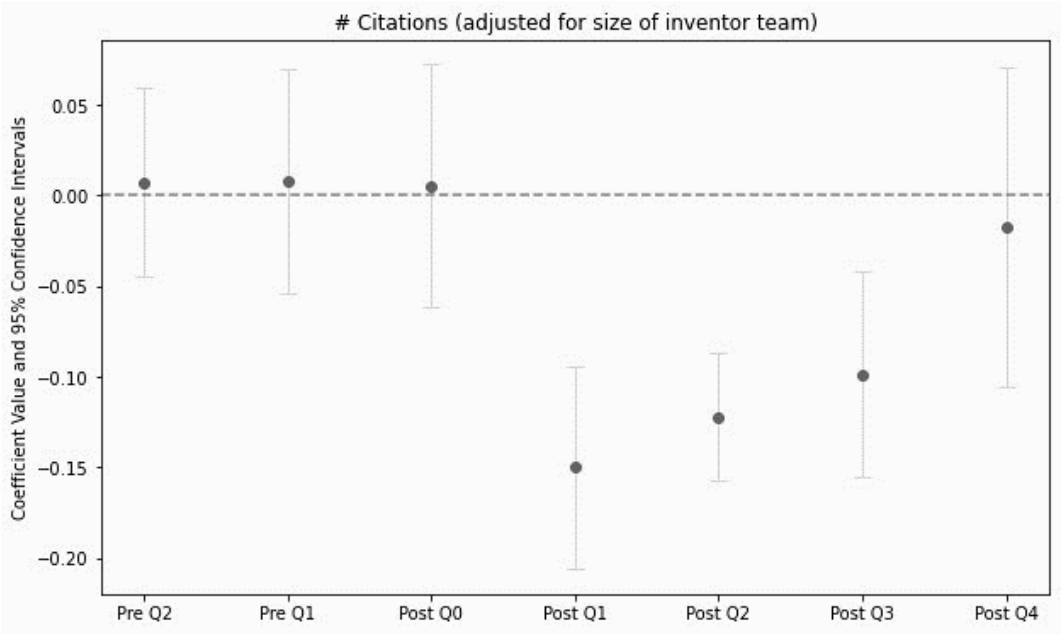
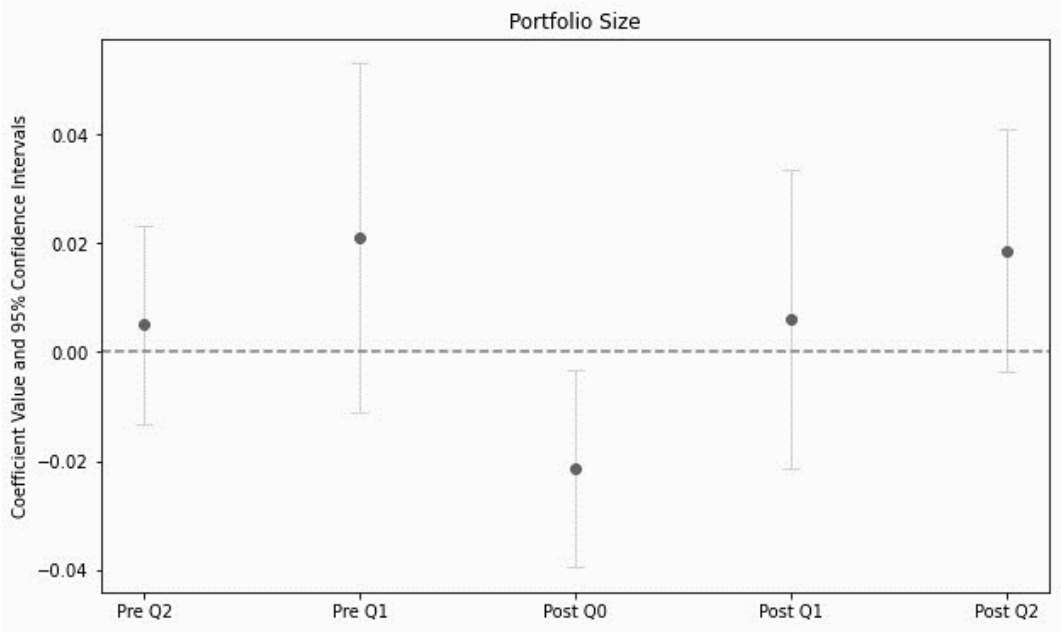
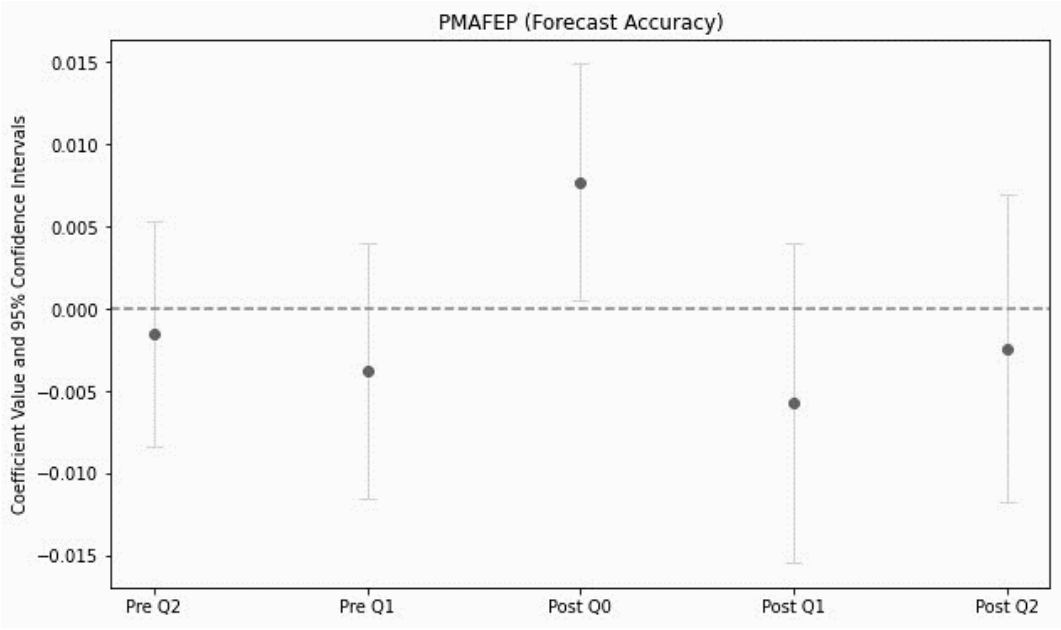


Figure 4: Analyst productivity around announcements of speculative takeover rumors

This figure illustrates how analyst productivity, measured by portfolio size (i.e., quantity) and earnings forecast accuracy (i.e., quality), changes around speculative takeover rumors. The plots show coefficient estimates and 95% confidence intervals for the variables *Rumor x Pre Q2*, …, *Rumor x Post Q0*, …, *Rumor x Post Q2* from the regressions in columns (2) and (4) of Table 8.





TABLES

Table 1: Summary statistics

Panel A: Distribution of speculative takeover rumors

This table reports the geographical distribution of speculative takeover rumors (with at least USD 1 mil. deal value) from the Zephyr database which are related to listed acquirers and targets matched with the Compustat universe. Targets and acquirers included in the sample are headquartered in one of the thirty-six OECD countries.

OECD countries	Number of rumors	Rumors related to targets	Rumors related to acquirers
Australia	915	508	407
Austria	107	65	42
Belgium	93	58	35
Canada	654	380	274
Chile	55	37	18
Czech Republic	25	18	7
Denmark	77	53	24
Estonia	5	4	1
Finland	87	53	34
France	502	262	240
Germany	598	408	190
Greece	59	36	23
Hungary	29	16	13
Iceland	7	3	4
Ireland	65	36	29
Israel	257	149	108
Italy	483	313	170
Japan	310	144	166
Latvia	10	9	1
Lithuania	20	18	2
Luxembourg	35	17	18
Mexico	55	28	27
Netherlands	165	111	54
New Zealand	63	45	18
Norway	135	98	37
Poland	448	213	235
Portugal	100	79	21
Republic of Korea	297	177	120
Slovakia	4	2	2
Slovenia	36	28	8
Spain	414	263	151
Sweden	200	139	61
Switzerland	231	112	119
Turkey	80	57	23
United Kingdom	1,209	790	419
United States of America	2,464	1,541	923
Total	**10,294**	**6,270**	**4,024**

Panel B: Summary statistics for firms involved and not involved in takeover speculation

This table reports the descriptive statistics for rumor firms, i.e., firms with at least one speculative takeover rumor (either as acquirer or target) in the Zephyr database. The firm characteristics are from the Compustat Global and Compustat North America databases and are stated in USD millions. The number of employees is stated in thousands. The market value in USD millions is from the Refinitiv Datastream database. All variables are obtained on a quarterly basis except for the number of employees, which is available on an annual basis only and is lagged by one fiscal year. Variables are winsorized at the 1st and 99th percentiles. *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)* are defined as the ratio of a firm's total sales to the number of its employees in the previous fiscal year and to the firm's selling, general and administrative expense (SG&A), respectively. *Gross Profit Margin* is defined as the difference between sales and costs of goods sold divided by sales. *Operating Ratio* is defined as the sum of operating expenses and costs of goods sold divided by sales. *Differences between firms involved and those not involved in speculative takeover rumors are statistically significant.*

Firms involved in rumors

	N	Mean	P25	P50	P75	SD
Raw Variables						
Employees$_{t-1}$	233,006	13.28	0.33	2.20	11.20	25.70
Market Value	277,633	3,975.50	66.24	465.11	2,864.25	8,412.63
Sales	265,166	778.81	12.79	98.54	576.61	1,632.92
Total Assets	320,485	7,508.64	87.36	610.94	3,931.47	18,729.98
Control Variables						
Capex to Total Assets	320,356	0.01	0.00	0.00	0.01	0.02
Cash to Total Assets	317,367	0.16	0.03	0.08	0.20	0.20
Debt to Total Assets	320,186	0.61	0.36	0.56	0.74	0.65
Firm Size (ln(Total Assets))	320,356	6.31	4.47	6.42	8.28	2.76
Stock Return	284,593	-0.01	-0.12	0.01	0.12	0.29
Volatility	284,593	0.03	0.02	0.02	0.04	0.03
Outcome Variables						
Gross Profit Margin	245,901	0.05	0.20	0.36	0.56	2.55
ln(Sales to Employees$_{t-1}$)	185,021	11.21	10.60	11.16	11.79	1.09
ln(Sales to SG&A)	209,967	1.50	0.91	1.49	2.20	1.22
Operating Ratio	253,524	2.09	0.77	0.89	0.97	7.87
Pre-Tax ROA	294,691	-0.02	-0.01	0.01	0.02	0.18
Pre-Tax Profit Margin	254,166	-1.37	-0.04	0.05	0.14	9.28

Firms not involved in rumors

	N	Mean	P25	P50	P75	SD
Raw Variables						
Employees$_{t-1}$	877,712	3.25	0.08	0.42	1.98	10.00
Market Value	985,201	757.21	17.99	78.76	361.29	2,806.62
Sales	1,070,935	177.81	1.96	14.59	82.07	635.21
Total Assets	1,318,451	1,829.02	20.14	117.68	605.33	8,144.32
Control Variables						
Capex to Total Assets	1,315,573	0.01	0.00	0.00	0.01	0.02
Cash to Total Assets	1,300,355	0.18	0.03	0.09	0.24	0.23
Debt to Total Assets	1,313,804	0.66	0.28	0.52	0.75	0.96
Firm Size (ln(Total Assets))	1,315,573	4.69	3.02	4.77	6.41	2.56
Stock Return	1,236,888	-0.02	-0.13	-0.00	0.11	0.30
Volatility	1,236,888	0.04	0.02	0.03	0.05	0.04
Outcome Variables						
Gross Profit Margin	962,516	-0.15	0.18	0.35	0.56	3.15
ln(Sales to Employees$_{t-1}$)	649,787	10.92	10.35	10.90	11.52	1.15
ln(Sales to SG&A)	801,434	1.23	0.72	1.32	1.97	1.29
Operating Ratio	987,846	2.75	0.78	0.91	1.04	9.56
Pre-Tax ROA	1,146,640	-0.06	-0.03	0.003	0.02	0.27
Pre-Tax Profit Margin	991,997	-2.17	-0.14	0.04	0.13	11.36

Table 2: Predicting speculative takeover rumors

Panel A: Speculative takeover rumors and pre-rumor firm characteristics

Panel A reports regression results on the relation between a firm's involvement in a speculative takeover rumor and preceding firm productivity. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post Q0* is an indicator variable that equals one for the fiscal quarter in which a firm becomes involved in a rumor. Firm productivity measures and control variables are lagged by one quarter. Firm productivity variables, which we define in Table 1, include *ln(Sales to Employees$_{t-1}$), ln(Sales to SG&A), Operating Ratio, and Gross Profit Margin*. The control variable *Firm size* is defined as the natural logarithm of a firm's total assets. Variables are winsorized at the 1st and 99th percentiles. Accounting data is from the Compustat Global and Compustat North America databases. M&A rumor data is from the Zephyr database. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	Rumor x Post Q0			
	(1)	(2)	(3)	(4)
ln(Sales to Employees$_{t-1}$)$_{t-1}$	**-0.0003**			
	(-1.623)			
ln(Sales to SG&A)$_{t-1}$		**-0.0001**		
		(-0.793)		
Operating Ratio$_{t-1}$			**0.0000**	
			(1.027)	
Gross Profit Margin$_{t-1}$				**-0.0000**
				(-1.257)
Capex to Total Assets$_{t-1}$	-0.0067	-0.0066	-0.0052	-0.0056
	(-1.182)	(-1.406)	(-1.227)	(-1.276)
Cash to Total Assets$_{t-1}$	-0.0015*	-0.0004	-0.0004	-0.0006
	(-1.718)	(-0.539)	(-0.589)	(-0.951)
Debt to Total Assets$_{t-1}$	0.0004**	0.0006***	0.0004***	0.0005***
	(2.500)	(3.676)	(3.444)	(3.917)
Firm Size$_{t-1}$	0.0018***	0.0018***	0.0017***	0.0017***
	(7.797)	(9.208)	(10.736)	(10.560)
Firm FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	796,751	936,333	1,144,090	1,115,680
R-squared	0.002	0.002	0.002	0.002

Panel B: Analyst estimates for treated and PSM-matched untreated observations

Panel B reports summary statistics as well as difference-in-means and Wilcoxon median tests for sales and EPS estimates referring to the takeover rumor quarter and other fiscal quarters of a propensity score matched sample. The number of speculative takeover rumors is significantly smaller than in the baseline regressions in Panel A because analyst estimates are not available for many international firms. Propensity scores are obtained from a Probit regression of the dependent variable *Rumor* on firm control variables lagged by one quarter, (two-digit SIC) industry fixed effects, and quarter fixed effects. We use the propensity scores from the Probit regression to perform a nearest neighbor matching without replacement. *Analyst Sales Estimate* is the natural logarithm of the average value of monthly I/B/E/S estimates on *Sales* for the next quarter. *Analyst EPS Estimate* is the average value of monthly I/B/E/S estimates on *EPS* for the next quarter. All variables are winsorized at the 1st and 99th percentiles. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	Takeover rumor quarters			**Matched quarters**			**Differences**	
	N	*Mean*	*Median*	*N*	*Mean*	*Median*	*Mean*	*Median*
Analyst Sales Estimate	3,536	6.30	6.59	3,536	6.13	6.38	0.17***	0.21***
Analyst EPS Estimate	3,461	0.50	0.30	3,461	0.47	0.33	0.03**	-0.03

Table 3: Takeover speculation and firm productivity

Panel A: Baseline estimation results

Panel A reports regression results on the relation between speculative takeover rumors and firm productivity measures for the sample of firms from OECD countries that spans the years 1994-2018. *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. The variables *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*, defined in Table 1, measure firm productivity. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	ln(Sales to Employees$_{t-1}$)		**ln(Sales to SG&A)**	
	(1)	(2)	(3)	(4)
Rumor x Post	**-0.0154****	**-0.0152****	**-0.0197*****	**-0.0204*****
	(-2.273)	**(-2.246)**	**(-2.977)**	**(-3.101)**
Capex to Total Assets		1.1142***		-0.5481***
		(10.009)		(-4.906)
Cash to Total Assets		-0.2245***		-0.5161***
		(-8.673)		(-22.689)
Debt to Total Assets		-0.0140**		-0.0005
		(-2.049)		(-0.079)
Firm Size	0.1683***	0.1620***	0.1952***	0.1841***
	(29.147)	(26.875)	(37.801)	(34.865)
Firm FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	819,847	819,847	965,070	965,070
R-squared	0.088	0.091	0.041	0.050

Panel B: Assessment of pre-rumor trends and lead-lag estimation results

This panel reports regression results on the relation between speculative takeover rumors and firm productivity measures for the sample of firms from OECD countries that spans the years 1994-2018. Columns (1) and (2) show the results from regressions testing for pre-rumor trends along with the separate results for each post-rumor quarter. *Pre Q1* and *Pre Q2* are indicator variables that equal one for each of the two fiscal quarters prior to a speculative takeover rumor, and zero otherwise. *Post Q0*, *Post Q1*, and *Post Q2* are indicator variables that equal one for each of the three post-rumor quarters, and zero otherwise. *Post w/o Q0* is an indicator that equals one for the two quarters after the rumor quarter (Q0), and zero otherwise. The variables *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*, defined in Table 1, measure firm productivity. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**	**ln(Sales to Employees$_{t-1}$)**	**ln(Sales to SG&A)**
	(1)	(2)	(3)	(4)
Rumor x Pre Q2	**-0.0042**	**0.0030**		
	(-0.563)	**(0.400)**		
Rumor x Pre Q1	**-0.0110**	**-0.0066**		
	(-1.523)	**(-0.839)**		
Rumor x Post Q0	-0.0151**	-0.0209***		
	(-2.081)	(-2.776)		
Rumor x Post Q1	-0.0117	-0.0209***		
	(-1.602)	(-2.628)		
Rumor x Post Q2	-0.0151**	-0.0119		
	(-2.042)	(-1.486)		
Rumor x Post w/o Q0			**-0.0127***	**-0.0174****
			(-1.845)	**(-2.422)**
Controls and FE as in Panel A	Yes	Yes	Yes	Yes
Observations	819,847	965,070	819,847	965,070
R-squared	0.091	0.050	0.091	0.050

Table 4: Matched samples and "exogenous" rumors

Panel A: Propensity score matching, entropy balancing, and within-treatment group estimation

Panel A reports results from different matched-sample approaches. Columns (1) and (2) report regression results for a propensity score matched sample. Propensity scores are obtained from a Probit regression of the dependent variable *Rumor* x *Post* on firm control variables lagged by one quarter, (two-digit SIC) industry fixed effects, and quarter fixed effects. We use the propensity scores from the Probit regression to perform a nearest neighbor matching without replacement. Columns (3) and (4) report regression results for an entropy balanced sample using the entropy balancing method proposed by Hainmueller (2012). This sample is weighted based on the entropy balance technique, so that mean and variance for firm control variables, (two-digit SIC) industries, and fiscal quarters are the same for the takeover rumor and non-rumor observations. Columns (5) and (6) report within-treatment group regression results on the relation between speculative takeover rumors and firm productivity measures for rumored firms only, i.e., for those firms that were subject to a speculative takeover rumor at least once over the sample period. The results presented in this table stem from the same regression model as that shown in Panel A of Table 3. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post* is an indicator variable that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Firm productivity variables, defined in Table 1, include *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	Propensity score matching		Entropy balancing		Within-treatment group estimation	
	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**	**ln(Sales to Employees$_{t-1}$)**	**ln(Sales to SG&A)**	**ln(Sales to Employees$_{t-1}$)**	**ln(Sales to SG&A)**
	(1)	(2)	(3)	(4)	(5)	(6)
Rumor x Post	**-0.0160****	**-0.0219*****	**-0.0137****	**-0.0250*****		
	(-2.386)	**(-3.334)**	**(-2.481)**	**(-4.169)**		
Post					**-0.0152****	**-0.0254*****
					(-2.360)	**(-3.928)**
Controls and fixed effects as in Table 3	Yes	Yes	Yes	Yes	Yes	Yes
Observations	420,835	481,696	819,117	963,701	181,648	202,572
R-squared	0.123	0.050	0.883	0.859	0.115	0.057

Panel B: Results for U.S. targets subject to "exogenous" speculative rumors (within-treatment group estimation)

Panel B reports regression results on the relation between speculative takeover rumors and firm productivity measures for rumored U.S. target firms only, i.e., for those firms that were subject to a speculative exogenous takeover rumor at least once over the sample period. Information on rumors and rumor sources is hand-collected from the scoop articles covering the rumor on the internet or in newspapers. Rumors are defined as exogenous if the article states that the rumor is speculation or if the rumor originates from social media or if the source of the rumor is mentioned to be anonymous. *Post* is an indicator variable that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Firm productivity variables, defined in Table 1, include *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**
	(1)	(2)
Post	**-0.1311*** **	**-0.0945** **
	(-2.692)	**(-2.269)**
Capex to Total Assets	0.3454	0.0085
	(0.224)	(0.007)
Cash to Total Assets	0.2637	-0.3532
	(0.933)	(-1.413)
Debt to Total Assets	0.0509	-0.4674***
	(0.294)	(-3.071)
Firm Size	0.1330**	0.0713
	(2.077)	(1.354)
Firm Age	-0.1677*	-0.0066
	(-1.986)	(-0.100)
R&D to Total Assets	1.3177	1.3033
	(0.947)	(0.870)
Firm FE	Yes	Yes
Quarter FE	Yes	Yes
Observations	3,687	3,154
R-squared	0.362	0.140

Table 5: The value of employee stock options and the productivity dip – Controlling for stock returns and volatility

This table reports results from re-estimations of the baseline regressions shown in Panel A of Table 3 as well as the matched-sample regressions in Table 4 with additional controls for stock returns and stock return volatility. Panels A and B, respectively, report the results for the dependent variables *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*, which measure firm productivity and are defined in Table 1. *Stock Return* is the quarterly buy-and-hold return of a firm's stock. *Volatility* is the volatility of a firm's daily log returns over the quarter. *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Panel A: Sales to employees

	ln(Sales to Employees$_{t-1}$)				
	Baseline	PSM	Entropy	Treated only	"Exogenous" only
	(1)	(2)	(3)	(4)	(5)
Rumor x Post	**-0.0131***	**-0.0117***	**-0.0124****	**-0.0138****	**-0.1275****
	(-1.899)	**(-1.715)**	**(-2.208)**	**(-2.106)**	**(-2.649)**
Stock Return	0.1144***	0.1048***	0.0458***	0.0977***	0.0783***
	(36.288)	(21.437)	(5.404)	(12.734)	(2.717)
Volatility	-1.1690***	-1.2420***	-1.1966***	-1.2816***	-0.2550
	(-15.679)	(-9.390)	(-7.637)	(-6.799)	(-0.210)
Controls and FE as before	Yes	Yes	Yes	Yes	Yes
Observations	748,115	381,936	747,348	171,930	3,631
R-squared	0.095	0.124	0.884	0.120	0.363

Panel B: Sales to SG&A

	ln(Sales to SG&A)				
	Baseline	PSM	Entropy	Treated only	"Exogenous" only
	(1)	(2)	(3)	(4)	(5)
Rumor x Post	**-0.0191*****	**-0.0212*****	**-0.0245*****	**-0.0227*****	**-0.0877****
	(-2.915)	**(-3.245)**	**(-3.951)**	**(-3.510)**	**(-2.222)**
Stock Return	0.0848***	0.0723***	0.0249***	0.0661***	0.0074
	(28.161)	(15.944)	(2.681)	(8.954)	(0.234)
Volatility	-0.7416***	-1.1325***	-0.7624***	-1.0800***	-1.4531
	(-10.719)	(-10.079)	(-4.734)	(-5.917)	(-1.090)
Controls and FE as before	Yes	Yes	Yes	Yes	Yes
Observations	842,824	427,028	841,602	184,112	3,095
R-squared	0.047	0.046	0.866	0.049	0.143

Table 6: Takeover speculation and firm productivity – Cross-sectional variation

Panel A reports regression results on the relation between speculative takeover rumors and firm productivity measures for target and acquirer firms separately. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post x Target* (*Post x Acquirer*) equals one for the fiscal quarter in which a target (acquirer) firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Panel B reports regression results on the relation between speculative takeover rumors and firm productivity measures and the interaction with measures of employee rights (i.e., collective bargaining coverage and the degree of employment protection). *Collective Bargaining* measures the percentage of employees with the right to bargain as reported by OECD. Thus, it is a ratio of the number of employees covered by the collective agreement and the overall number of wage earners and salaried employees. The mean and median values of this variable are 29.74 and 16.70, respectively. *EPL* is the Employment Protection Legislation index provided by OECD that quantifies the procedures and costs related to individual and collective dismissals. Larger values of this index correspond to higher employee protection. The mean and median values of this variable are 1.48 and 1.31, respectively. Firm productivity variables, defined in Table 1, are *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. Firm controls and fixed effects are identical to those used in Table 3. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Panel A: Targets vs. acquirers

	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**
	(1)	(2)
Rumor x Post x Target	**-0.0282*** **	**-0.0177** **
	(-3.442)	**(-2.214)**
Rumor x Post x Acquirer	**0.0102**	**-0.0231** **
	(0.956)	**(-2.199)**
Controls and FE as in Table 3	Yes	Yes
Target - Acquirer (p-val.)	0.0040***	0.6792
Observations	819,847	965,070
R-squared	0.091	0.050

Panel B: Fear of job loss (measured by collective bargaining and employment protection legislation)

	ln(Sales to Employees$_{t-1}$)		**ln(Sales to SG&A)**	
	(1)	(2)	(3)	(4)
Rumor x Post x Collective Bargaining	**0.0005** **		**0.0001**	
	(2.277)		**(0.380)**	
Rumor x Post x EPL		**0.0122***		**0.0062**
		(1.807)		**(0.969)**
Rumor x Post	**-0.0334*** **	**-0.0362*** **	**-0.0238** **	**-0.0325*** **
	(-2.996)	**(-2.684)**	**(-2.488)**	**(-2.605)**
Other interaction terms	Yes	Yes	Yes	Yes
Controls and FE as in Table 3	Yes	Yes	Yes	Yes
Observations	819,814	704,465	964,668	846,896
R-squared	0.091	0.082	0.050	0.048

Table 7: Takeover speculation and employee productivity – Evidence from inventors

Panel A: Summary statistics

Panel A reports summary statistics for the inventor-firm panel at the year-quarter level. Inventor and patent data are from the United States Patent and Trademark Office (USPTO). Firm data is from Compustat Global, Compustat North America, and Datastream. Takeover rumor data is from Zephyr. The sample period is 1997-2018. *# Patents* is the sum of team-size adjusted patents per quarter, with each patent divided by the size of the inventor team that worked on it. *# Citations* is the number of patent citations over the subsequent three years adjusted for the size of the inventor team that worked on each patent. The adjustment of patent data by inventor team size follows the literature (e.g., Jaravel, Petkova, and Bell, 2018). Firm controls are defined as before (see Tables 2 and 5). Variables are winsorized at the 1st and 99th percentiles. *Differences between inventors and firms involved and those not involved in speculative takeover rumors are statistically significant.*

	Inventors / firms involved in rumors					
	N	**Mean**	**P25**	**P50**	**P75**	**SD**
# Patents	4,527,970	0.09	0.00	0.00	0.00	0.24
# Citations	4,527,970	0.09	0.00	0.00	0.00	0.36
Capex to Total Assets	4,527,970	0.01	0.01	0.01	0.02	0.01
Cash to Total Assets	4,527,970	0.18	0.08	0.13	0.24	0.14
Debt to Total Assets	4,527,970	0.16	0.06	0.16	0.22	0.12
Firm Size	4,527,970	10.60	9.54	11.22	11.69	1.82
Stock Return	4,386,176	0.01	-0.06	0.03	0.11	0.17
Volatility	4,391,731	0.02	0.01	0.02	0.02	0.01
Patent Similarity	85,018	0.17	0.09	0.12	0.13	0.12

	Inventors / firms not involved in rumors					
	N	**Mean**	**P25**	**P50**	**P75**	**SD**
# Patents	3,794,837	0.09	0.00	0.00	0.00	0.24
# Citations	3,794,837	0.09	0.00	0.00	0.00	0.37
Capex to Total Assets	3,794,837	0.02	0.01	0.01	0.02	0.01
Cash to Total Assets	3,794,837	0.20	0.07	0.13	0.27	0.19
Debt to Total Assets	3,794,837	0.14	0.04	0.13	0.21	0.13
Firm Size	3,794,837	8.62	7.33	8.85	10.22	2.11
Stock Return	2,927,181	0.00	-0.10	0.02	0.13	0.23
Volatility	2,937,596	0.03	0.02	0.02	0.03	0.02

Panel B: Regression results for the number of patents (as a quantity measure of inventor productivity)

Panel B reports results from Poisson Pseudo Maximum Likelihood (PPML) regressions explaining inventor productivity as measured by the variable *# Patents*, which is the sum of inventor team-size adjusted patents per quarter. *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. *Pre Q1* and *Pre Q2* are indicator variables that equal one for each of the two fiscal quarters prior to a speculative takeover rumor, and zero otherwise. *Post Q0*, *Post Q1*, and *Post Q2* are indicator variables that equal one for each of the three post-rumor quarters, and zero otherwise. *Post x Target* (*Post x Acquirer*) equals one for the fiscal quarter in which a target (acquirer) firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. The variable *Patent Similarity*, which is proposed and provided by Bekkerman et al. (2023), measures innovation similarity between firms. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include quarter and inventor x firm fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	# Patents				
	(1)	(2)	(3)	(4)	(5)
Rumor x Post	**-0.0721*** **				0.1185
	(-4.792)				(0.9975)
Rumor x Pre Q2		-0.0080	-0.0051		
		(-0.4152)	(-0.2900)		
Rumor x Pre Q1		-0.0210	-0.0281*		
		(-1.182)	(-1.762)		
Rumor x Post Q0		**-0.0069**	**-0.0068**		
		(-0.2248)	**(-0.2203)**		
Rumor x Post Q1		**-0.1100*** **	**-0.1145*** **		
		(-4.771)	**(-4.770)**		
Rumor x Post Q2		**-0.1021*** **	**-0.1040*** **		
		(-5.904)	**(-6.395)**		
Rumor x Post x Target				**-0.1472*** **	
				(-4.063)	
Rumor x Post x Acquirer				**-0.0588*** **	
				(-2.896)	
Patent Similarity					0.3704
					(0.9920)
Rumor x Post x Patent Similarity					**-0.8095*** **
					(-2.889)
Capex to Total Assets	1.769**	1.688**	1.637*	1.775**	-44.05**
	(2.297)	(2.146)	(1.794)	(2.330)	(-2.061)
Cash to Total Assets	-0.0277	-0.0333	0.0066	-0.0272	-1.548
	(-0.4627)	(-0.5528)	(0.0999)	(-0.4493)	(-0.9446)
Debt to Total Assets	-0.1663	-0.1619	-0.1025	-0.1654	1.098
	(-1.359)	(-1.325)	(-0.8408)	(-1.365)	(0.3381)
Firm Size	0.0066	0.0072	0.0052	0.0066	-0.0907
	(0.2107)	(0.2285)	(0.1206)	(0.2108)	(-0.0586)
Stock Return			-0.0213		
			(-1.013)		
Volatility			0.3958		
			(0.7565)		
Inventor x Firm FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Target - Acquirer (p-val.)				0.0414**	
Observations	8,322,807	8,322,807	7,283,425	8,322,807	39,189
Pseudo R-squared	0.23103	0.23098	0.23240	0.23107	0.36650

Panel C: Regression results for the number of citations (as a quality measure of inventor productivity)

Panel C reports results from Poisson Pseudo Maximum Likelihood (PPML) regressions explaining inventor productivity as measured by the variable *# Citations*, which is the number of patent citations over the subsequent three years adjusted for the size of the inventor team that worked on each patent. *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. *Pre Q1* and *Pre Q2* are indicator variables that equal one for each of the two fiscal quarters prior to a speculative takeover rumor, and zero otherwise. *Post Q0*, *Post Q1*, and *Post Q2* are indicator variables that equal one for each of the three post-rumor quarters, and zero otherwise. *Post x Target* (*Post x Acquirer*) equals one for the fiscal quarter in which a target (acquirer) firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. The variable *Patent Similarity*, which is proposed and provided by Bekkerman et al. (2023), measures innovation similarity between firms. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include quarter and inventor x firm fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	# Citations				
	(1)	(2)	(3)	(4)	(5)
Rumor x Post	**-0.0814*** **				0.0410
	(-4.094)				(0.3311)
Rumor x Pre Q2		0.0157	0.0195		
		(0.5938)	(0.7909)		
Rumor x Pre Q1		0.0160	0.0100		
		(0.5602)	(0.3756)		
Rumor x Post Q0		**0.0072**	**0.0073**		
		(0.2153)	**(0.2117)**		
Rumor x Post Q1		**-0.1434*** **	**-0.1504*** **		
		(-4.834)	**(-5.338)**		
Rumor x Post Q2		**-0.1180*** **	**-0.1278*** **		
		(-6.219)	**(-7.415)**		
Rumor x Post x Target				**-0.1433** **	
				(-2.525)	
Rumor x Post x Acquirer				**-0.0672*** **	
				(-2.924)	
Patent Similarity					0.6419
					(1.527)
Rumor x Post x Patent Similarity					**-0.8409*** **
					(-3.118)
Capex to Total Assets	3.605***	3.494***	3.377***	3.614***	-100.2
	(4.615)	(4.457)	(3.870)	(4.643)	(-1.573)
Cash to Total Assets	0.1125	0.1117	0.1518	0.1137	0.2025
	(1.215)	(1.218)	(1.456)	(1.223)	(0.1218)
Debt to Total Assets	-0.1569	-0.1559	-0.1809	-0.1577	-2.719
	(-1.221)	(-1.219)	(-1.422)	(-1.232)	(-0.6317)
Firm Size	0.0278	0.0286	0.0304	0.0278	1.799
	(0.7123)	(0.7280)	(0.5930)	(0.7159)	(1.009)
Stock Return			-0.0113		
			(-0.5726)		
Volatility			0.7994		
			(1.312)		
Inventor x Firm FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Target - Acquirer (p-val.)				0.1841	
Observations	6,574,962	6,574,962	5,886,568	6,574,962	23,920
Pseudo R-squared	0.17815	0.17822	0.17895	0.17815	0.30026

Panel D: Regression results for private firms involved in takeover speculation

Panel D reports results from Poisson Pseudo Maximum Likelihood (PPML) regressions explaining private firm inventor productivity as measured by the variables *# Patents* (i.e., the sum of inventor team-size adjusted patents per quarter) and *# Citations* (i.e., the number of patent citations over the subsequent three years adjusted for the size of the inventor team that worked on each patent). *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. *Pre Q1* and *Pre Q2* are indicator variables that equal one for each of the two fiscal quarters prior to a speculative takeover rumor, and zero otherwise. *Post Q0*, *Post Q1*, and *Post Q2* are indicator variables that equal one for each of the three post-rumor quarters, and zero otherwise. *Post x Target* (*Post x Acquirer*) equals one for the fiscal quarter in which a target (acquirer) firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include quarter and inventor x firm fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	# Patents			**# Citations**		
	(1)	(2)	(3)	(4)	(5)	(6)
Rumor x Post	**-0.2270*** **			**-0.4529*** **		
	(-2.633)			**(-4.156)**		
Rumor x Pre Q2		0.1174			0.4007**	
		(1.231)			(2.435)	
Rumor x Pre Q1		0.0606			0.0787	
		(0.4387)			(0.4352)	
Rumor x Post Q0		**-0.0338**			**-0.2977***	
		(-0.2702)			**(-1.806)**	
Rumor x Post Q1		**-0.5157*** **			**-0.7203*** **	
		(-4.782)			**(-5.418)**	
Rumor x Post Q2		**-0.1349**			**-0.1999**	
		(-1.190)			**(-1.497)**	
Rumor x Post x Target			**-0.5390*** **			**-0.6626*** **
			(-2.695)			**(-3.344)**
Rumor x Post x Acquirer			**-0.0625**			**-0.2797*** **
			(-0.7866)			**(-3.201)**
Inventor x Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Target - Acquirer (p-val.)			0.0344**			0.0835*
Observations	328,310	328,310	328,310	255,312	255,312	255,312
Pseudo R-squared	0.26344	0.26380	0.26359	0.26677	0.26768	0.26691

Table 8: Takeover speculation and employee productivity – Evidence from analysts

Panel A: Summary statistics

Panel A reports summary statistics for the analyst samples used in the analyst-level regressions, which are based on I/B/E/S data for analysts and brokers as well as Zephyr data for takeover rumors. The sample period is 1997-2018. *PMAFEP* measures analyst EPS forecast accuracy and is defined as in Bradley, Gokkaya, and Liu (2017). It is calculated as the difference between the price-scaled absolute forecast error of analyst j publishing forecasts for firm k at time t (AFEP) and its mean across all analysts publishing forecasts for firm k at time t (MAFEP), which is in turn scaled by MAFEP. The absolute forecast error is the difference between analyst j's forecast and the announced actual. *Portfolio Size* is the number of companies for which the analyst issued an earnings estimate for the quarter (in the recommendations sample this variable equals the number of companies for which the analyst updated recommendations during the quarter). *Buy/Sell Revisions* is the number of recommendation revisions to either "buy" or "strong buy" or to "sell" or "underperform" relative to all recommendation revisions. *Forecast Distance* is the number of days between the earnings forecast and the earnings report date. *Firm Experience* is the number of years since the analyst first issued an earnings forecast for the firm. *Broker Experience* is the number of years the analyst has issued earnings estimates for the brokerage firm. Variables are winsorized at the 1st and 99th percentiles. *Differences between analysts involved and those not involved in speculative takeover rumors are statistically significant.*

PMAFEP sample

	Analysts involved in rumors						Analysts not involved in rumors					
	N	**Mean**	**P25**	**P50**	**P75**	**SD**	**N**	**Mean**	**P25**	**P50**	**P75**	**SD**
PMAFEP	242,677	-0.01	-0.15	0.00	0.10	0.44	743,627	-0.01	-0.15	0.00	0.11	0.44
Forecast Distance	243,966	48.29	19.00	44.00	83.00	31.00	748,577	53.10	22.00	57.00	84.00	30.95
Firm Experience	243,966	3.52	1.00	2.00	5.00	3.75	748,577	3.47	1.00	2.00	5.00	3.69
Portfolio Size	243,966	9.89	6.00	9.00	13.00	5.48	748,577	9.22	6.00	9.00	12.00	4.93
Broker Experience	243,966	4.79	2.00	4.00	7.00	3.75	748,577	4.72	2.00	4.00	7.00	3.98

Portfolio Size sample

	N	**Mean**	**P25**	**P50**	**P75**	**SD**	**N**	**Mean**	**P25**	**P50**	**P75**	**SD**
Portfolio Size	30,188	6.43	3.00	5.00	9.00	4.59	94,366	6.30	3.00	6.00	9.00	4.24
Broker Experience	30,188	4.12	1.00	3.00	6.00	3.50	94,366	4.10	1.00	3.00	6.00	3.65

Recommendations sample

	N	**Mean**	**P25**	**P50**	**P75**	**SD**	**N**	**Mean**	**P25**	**P50**	**P75**	**SD**
Buy/Sell Revisions	72,832	0.55	0.00	0.50	1.00	0.39	329,622	0.59	0.33	0.67	1.00	0.39
Portfolio Size	98,901	1.05	1.00	1.00	1.00	0.21	451,998	1.02	1.00	1.00	1.00	0.17
Broker Experience	150,775	3.95	1.00	3.00	6.00	3.51	720,143	3.59	1.00	3.00	5.00	3.30

Panel B: Regression results for analyst productivity measures

Panel B reports the results from OLS (columns 1, 2, 5 and 6) or Poisson (columns 3 and 4) regressions explaining analyst productivity measures, i.e., *PMAFEP*, *Portfolio Size*, and *Buy/Sell Revisions*. *PMAFEP* measures analyst EPS forecast accuracy and is defined as in Bradley, Gokkaya, and Liu (2017). Greater values of this variable indicate lower analyst forecast accuracy. *Portfolio Size* is the number of companies for which the analyst issued an earnings estimate for the quarter. *Buy/Sell Revisions* is the number of recommendation revisions to either "buy" or "strong buy" or to "sell" or "underperform" relative to all recommendation revisions. *Rumor* is an indicator variable that equals one for analysts who experience at least one takeover rumor (at the brokerage house employing them) over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a brokerage house becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. *Pre Q1* and *Pre Q2* are indicator variables that equal one for each of the two fiscal quarters prior to a takeover rumor, and zero otherwise. *Post Q0*, *Post Q1*, and *Post Q2* are indicator variables that equal one for each of the three post-rumor quarters, and zero otherwise. All regressions include analyst x broker and quarter fixed effects. The regressions in columns (1) and (2) additionally include firm x quarter and forecast month fixed effects. Control variables (defined in Panel A) vary depending on the sample used to conduct the regressions. Variables are winsorized at the 1st and 99th percentiles. Standard errors are clustered at the brokerage house (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	PMAFEP		**Portfolio Size**		**Buy/Sell Revisions**	
	(1)	(2)	(3)	(4)	(5)	(6)
Rumor x Post	**-0.0017**		**0.0033**		**-0.0041**	
	(-0.5880)		**(0.2098)**		**(-0.8789)**	
Rumor x Pre Q2		-0.0015		0.0050		-0.0061
		(-0.4286)		(0.5341)		(-0.9242)
Rumor x Pre Q1		-0.0038		0.0209		-0.0092
		(-0.9598)		(1.276)		(-1.285)
Rumor x Post Q0		**0.0077****		**-0.0214****		**-0.0086****
		(2.100)		**(-2.322)**		**(-2.228)**
Rumor x Post Q1		-0.0057		0.0060		0.0008
		(-1.148)		(0.4281)		(0.1543)
Rumor x Post Q2		-0.0024		0.0186		0.0024
		(-0.5049)		(1.639)		(0.3321)
Forecast Distance	0.0016***	0.0016***				
	(22.89)	(22.87)				
Firm Experience	-0.0008***	-0.0008***				
	(-3.008)	(-3.008)				
Portfolio Size	6.94e-5	7.36e-5			-0.0032***	-0.0032***
	(0.2316)	(0.2451)			(-5.173)	(-5.181)
Broker Experience	0.2150***	0.2146***	0.3380***	0.3380***	-0.0022	-0.0022
	(3.577)	(3.565)	(9.893)	(9.888)	(-0.7199)	(-0.7160)
Analyst x Broker FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm x Quarter FE	Yes	Yes	No	No	No	No
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Forecast Month FE	Yes	Yes	No	No	No	No
Observations	986,304	986,304	124,554	124,554	402,454	402,454
Pseudo/Adj. R-squared	0.051	0.051	0.285	0.285	0.212	0.212

Table 9: Takeover speculation and firm profitability

This table reports regression results on the relation between speculative takeover rumors and firm profitability measures for our full sample. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post* is an indicator variable that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Firm profitability measures include the variables *Pre-Tax ROA* and *Pre-Tax Profit Margin*. *Pre-Tax ROA* is defined as the ratio of pre-tax income and total assets. *Pre-Tax Profit Margin* is defined as the ratio of pre-tax income and sales. All variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	Pre-Tax ROA	**Pre-Tax Profit Margin**
	(1)	(2)
Rumor x Post	**-0.0095*** **	**-0.1416** **
	(-9.166)	**(-2.060)**
Capex to Total Assets	-0.3076***	-5.4574***
	(-15.788)	(-4.103)
Cash to Total Assets	-0.0306***	-3.2420***
	(-9.075)	(-11.842)
Debt to Total Assets	-0.1226***	-0.6513***
	(-80.736)	(-7.424)
Firm Size	0.0435***	0.7921***
	(55.330)	(16.117)
Firm FE	Yes	Yes
Quarter FE	Yes	Yes
Observations	1,426,295	1,181,158
R-squared	0.291	0.010

Table 10: Stock returns around announcements of speculative takeover rumors

This reports event study results for 9,379 distinct speculative takeover rumors. Average buy-and-hold abnormal returns (BHAR) are reported for seven event windows along with the test statistic on their significance. Daily BHAR for each firm are calculated as the difference between the realized and the expected buy-and-hold total return. Expected returns are calculated using the market-adjusted return model and the FTSE World index. All BHAR are winsorized at the 1st and 99th percentiles. The table also reports cumulative average abnormal returns (CAAR) for 9,340 rumors for the most important event windows along with the test statistic of their significance. Daily AR for each firm is calculated as the difference between the realized and the expected total return. Expected returns are calculated using the market model with an event window from -220 to -40 trading days and the FTSE World index. Total returns are from the Refinitiv Datastream database. All CAAR are winsorized at the 1st and 99th percentiles. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Buy-and-hold abnormal returns

Event window	BHAR	t-statistic
(2...240)	-0.0497	-11.0012***
(2...180)	**-0.0469**	**-12.3057*** **
(1...1)	0.0036	6.6713***
(0...0)	**0.0227**	**27.9768*** **
(-1...-1)	0.0034	9.3116***
(-40...-2)	**0.0051**	**2.5659** **

Cumulative average abnormal returns

Event window	CAAR	t-statistic
(2...180)	**-0.0486**	**-7.7109*** **
(0...0)	**0.0224**	**27.6504*** **
(-40...-2)	**0.0014**	**0.6351**

APPENDICES

Appendix A: Alternative firm productivity measures

This table reports regression results on the relation between speculative takeover rumors and alternative firm productivity measures, i.e., *Operating Ratio* and *Gross Profit Margin* (defined in Table 1 and below). *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	Operating Ratio ***= (Oper. Exp. + COGS)/Sales*** (1)	**Gross Profit Margin** ***= (Sales - COGS)/Sales*** (2)
Rumor x Post	**0.1176****	**-0.0313***
	(2.099)	**(-1.913)**
Capex to Total Assets	4.5837***	-1.4669***
	(4.004)	(-4.283)
Cash to Total Assets	3.2833***	-1.1561***
	(13.725)	(-14.472)
Debt to Total Assets	0.2224***	-0.0008
	(3.073)	(-0.034)
Firm Size	-0.7394***	0.1784***
	(-17.407)	(12.750)
Firm FE	Yes	Yes
Quarter FE	Yes	Yes
Observations	1,178,145	1,148,894
R-squared	0.011	0.008

Appendix B: Additional controls and fixed effects

Panel A: Controlling for analyst estimates and firms seeking M&A

This panel reports regression results on the relation between speculative takeover rumors and firm productivity measures additionally controlling for analyst sales estimates and for firms seeking M&A. The variable *Seeking M&A* equals one if a takeover rumor occurred in the same year in which a firm announces that it seeks a buyer or a target firm (or assets) to acquire, and zero otherwise. Information on firms seeking buyers or targets is retrieved from Capital IQ. *Analyst EPS Estimate* is the average value of monthly I/B/E/S estimates on earnings per share (EPS) for the next quarter. We replace missing I/B/E/S estimates with zero values and include an indicator variable in our regressions that accounts for this replacement. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post* is an indicator variable that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Firm productivity variables, defined in Table 1, include *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**
	(1)	(2)
Rumor x Post	**-0.0225*** **	**-0.0274*** **
	(-2.797)	**(-3.562)**
Analyst EPS Estimate	0.3428***	0.2187***
	(27.936)	(20.405)
Seeking M&A	0.0049	0.0151
	(0.386)	(1.184)
All controls and FE as in Table 3	Yes	Yes
Observations	819,847	965,070
R-squared	0.098	0.052

Panel B: Baseline estimation results with firm and quarter x industry or firm and quarter x country fixed effects

This panel reports regression results on the relation between speculative takeover rumors and firm productivity measures accounting for *Quarter* x *Industry* fixed effects (in columns 1 and 2) or *Quarter* x *Country* fixed effects (in columns 3 and 4). Industries refer to one-digit SIC industries. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post* is an indicator variable that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Firm productivity variables, defined in Table 1, include *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**	**ln(Sales to Employees$_{t-1}$)**	**ln(Sales to SG&A)**
	(1)	(2)	(3)	(4)
Rumor x Post	**-0.0168** **(-2.502)**	**-0.0231***** **(-3.507)**	**-0.0186***** **(-2.774)**	**-0.0201***** **(-3.056)**
Firm controls as in Table 3	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Quarter x Industry FE	**Yes**	**Yes**	No	No
Quarter x Country FE	No	No	**Yes**	**Yes**
Observations	819,656	964,231	819,847	965,070
R-squared	0.104	0.060	0.097	0.066

Appendix C: Covariate balance for PSM-matched sample

This table reports mean values and difference-in-means tests for takeover rumor and matched observations from the PSM-matched sample to assess covariate balance. We use the observations obtained from the baseline regression explaining *ln(Sales to SG&A)* in Table 3. *Year Quarter* is a count variable that captures the quarter fixed effects we use for the PSM matching. Variables are winsorized at the 1st and 99th percentiles. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Variables	**(1)** **Rumor sample**	**(2)** **Matched sample**	**(3)** **Difference (t-statistic)**
Variables used for matching:			
Capex to Total Assets$_{t-1}$	0.0123	0.0123	-0.0000 (-0.1181)
Cash to Total Assets$_{t-1}$	0.1440	0.1399	0.0041 (2.3125)**
Debt to Total Assets$_{t-1}$	0.5923	0.6004	-0.0081 (-1.6324)
Firm Size$_{t-1}$	7.1430	7.1505	-0.0074 (-0.2770)
Year Quarter	209.7816	209.5746	0.2070 (1.2141)
Pre-rumor growth rates for dep. variables:			
ln(Sales to Employees$_{t-1}$) growth rate$_{t-2 \text{ to } t-1}$	0.0005	0.0005	0.0000 (0.0316)
ln(Sales to SG&A) growth rate$_{t-2 \text{ to } t-1}$	0.0136	0.0907	-0.0771 (-0.7473)

Appendix D: Firms subject to one vs. multiple rumors

This table reports regression results on the relation between speculative takeover rumors and firm productivity measures for firms subject to one rumor (columns 1 and 2) as well as for firms subject to multiple rumors (columns 3 and 4). *Rumor* is an indicator variable that equals one for firms that have at least one rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. Firm productivity variables, defined in Table 1, include *ln(Sales to Employees$_{t-1}$)* and *ln(Sales to SG&A)*. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

Treated group:	Firms subject to one rumor only		Firms subject to multiple rumors	
	ln(Sales to Employees$_{t-1}$)	**ln(Sales to SG&A)**	**ln(Sales to Employees$_{t-1}$)**	**ln(Sales to SG&A)**
	(1)	(2)	(3)	(4)
Rumor x Post	**-0.0280****	**-0.0252****	**-0.0063**	**-0.0164***
	(-2.535)	**(-2.470)**	**(-0.727)**	**(-1.889)**
Capex to Total Assets	1.1141***	-0.5480***	1.1147***	-0.5478***
	(10.008)	(-4.905)	(10.013)	(-4.903)
Cash to Total Assets	-0.2245***	-0.5161***	-0.2245***	-0.5161***
	(-8.671)	(-22.687)	(-8.672)	(-22.688)
Debt to Total Assets	-0.0140**	-0.0005	-0.0140**	-0.0005
	(-2.050)	(-0.082)	(-2.050)	(-0.081)
Firm Size	0.1619***	0.1840***	0.1619***	0.1840***
	(26.864)	(34.855)	(26.865)	(34.852)
Firm FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	819,847	965,070	819,847	965,070
R-squared	0.091	0.050	0.091	0.050

Appendix E: Takeover speculation and employee attention (U.S. firms only)

This table reports regression results on the relation between a firm's involvement in a speculative takeover rumor and attention paid to the rumor firm by its own employees, as approximated by rumor firm filings downloaded from the EDGAR server by IP addresses of the rumor firm. *Rumor* is an indicator variable that equals one for firms that have at least one speculative takeover rumor over the sample period, and zero otherwise. *Post* is an indicator that equals one for the fiscal quarter in which a firm becomes involved in a rumor as well as for the two subsequent quarters, and zero otherwise. *Ln(1 + Downloads of focal rumor firm filings from EDGAR via focal rumor firm IP addresses)* is the natural logarithm of 1 plus the number of filings by the focal rumor firm that were downloaded from the EDGAR server via IP addresses that belong to the focal rumor firm. Variables are winsorized at the 1st and 99th percentiles. All regression specifications include firm and quarter fixed effects. Standard errors are clustered at the firm (i.e., treatment unit) level. ***, **, and * denote statistical significance at the 1%-, 5%-, and 10%-level, respectively.

	Ln(1 + Downloads of focal rumor firm filings from EDGAR via focal rumor firm IP addresses)	
	(1)	(2)
Rumor x Post	**0.0501*** **	**0.0544*** **
	(3.166)	**(2.968)**
Capex to Total Assets	-0.0076	-0.2351
	(-0.047)	(-0.925)
Cash to Total Assets	-0.0414*	-0.0870**
	(-1.817)	(-2.477)
Debt to Total Assets	0.0080***	0.0048
	(2.584)	(0.922)
Firm Size	0.0472***	0.0614***
	(6.103)	(5.987)
Firm Age		-0.0635***
		(-2.683)
R&D to Total Assets		0.5952***
		(3.571)
Firm FE	Yes	Yes
Quarter FE	Yes	Yes
Observations	320,721	257,781
R-squared	0.057	0.062

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