Simultaneous Information Releases and Capital Market Feedback: Evidence from Patent Tuesdays *

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Abstract

We examine whether the simultaneous release of information affects managers' ability to gather decision-relevant information from market prices. Using the plausibly exogenous timing of patent grant disclosures by the United States Patent and Trademark Office as a source of variation in the simultaneous release of value-relevant information, we show that the market's response to patent grants is more informative for managerial decisions if the firm receives fewer patent grants on the same day. This effect is more pronounced for patents that relate to relatively more risky innovative strategies for which feedback is arguably more important. Firms with more distinct information releases also produce more valuable and higher quality innovations in the future. Taken together, our results suggest that bundling the release of multiple pieces of information at once potentially impedes managers' ability to benefit from the market's feedback.

JEL classification: D83, G14, M40, O30

Keywords: Information bundling; Information release; Patent disclosure; Patent grant; Capital market feedback; Corporate innovation; Corporate investment; Managerial learning

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Abstract

We examine whether the simultaneous release of information affects managers' ability to gather decision-relevant information from market prices. Using the plausibly exogenous timing of patent grant disclosures by the United States Patent and Trademark Office as a source of variation in the simultaneous release of value-relevant information, we show that the market's response to patent grants is more informative for managerial decisions if the firm receives fewer patent grants on the same day. This effect is more pronounced for patents that relate to relatively more risky innovative strategies for which feedback is arguably more important. Firms with more distinct information releases also produce more valuable and higher quality innovations in the future. Taken together, our results suggest that bundling the release of multiple pieces of information at once potentially impedes managers' ability to benefit from the market's feedback.

1 Introduction

We study how the simultaneous versus separate release of information affects managers' ability to gather decision-relevant information from market prices. While it is well known that market prices can affect real firm decisions by providing valuable feedback to managers (Edmans et al., 2012, 2015; Grossman, 1976), there is still considerable debate about how market feedback interacts with disclosure. The recent theoretical and empirical literature suggests that disclosure may both solicit or impede market feedback (e.g., Arya et al., 2017; Bae et al., 2021; Goldstein and Yang, 2019; Jayaraman and Wu, 2019, 2020; Luo, 2005; McClure et al., 2022; Pinto, 2022). However, whether disclosure allow managers to extract valuable feedback from market prices may not only depend on its effect on the information contained in prices, but also on managers' ability to attribute price signals to specific pieces of information. If multiple pieces of information are released all at once, prices will reflect the market's assessment of the combined disclosure, and managers may find it difficult to infer feedback related to a specific piece of information (Ramanan, 2015). By releasing pieces of information separately, managers may be able to obtain clearer signals from the market, which is more useful for subsequent decision making. However, releasing those pieces all at once could also facilitate price formation and, hence, provide better feedback signals to managers.

Despite theoretical predictions, there is little empirical evidence on whether and how the amount of information released at a time affects managers' ability to gather feedback from market prices. We believe that two challenges explain this gap in the literature. First, in equilibrium, firms optimize their disclosure policies to derive maximum benefit from market feedback vis-à-vis other disclosure incentives. For example, the extant literature documents that managers often coordinate the timing of information releases to achieve certain reporting objectives (e.g., Chapman et al., 2019; Kothari et al., 2009; Lansford, 2006; Miller, 2002; Segal and Segal, 2016). Recent studies have also documented that managers may strategically issue or withhold voluntary disclosures to facilitate learning from stock prices (Bae et al., 2021; Chen et al., 2021; Fox et al., 2021). Identifying the effect of simultaneous versus separate information releases thus requires an exogenous source of variation in disclosures across firms over time. Second, separating the effect of feedback from that of other sources of information that simultaneously affect corporate decision making requires the identification of distinct pieces of information and, more importantly, the ability to track managers' subsequent decision making back to the specific feedback obtained for each piece of information.

To overcome these challenges, we focus on corporate investments in innovation and take advantage of several features of the United States Patent and Trademark Office's (USPTO's) disclosure mechanism for firm-specific patent information. The context of corporate innovation provides a setting in which feedback effects are likely to affect corporate decision making. The success of research and development activities is inherently uncertain and depends critically on factors outside the control of the firm, such as technological advances and key market developments (see, e.g., Kumar and Li, 2018; Manso, 2011). Prior research has documented that when making such decisions under uncertainty, disclosures can enhance opportunities to learn from other sources of information, such as stock prices (e.g., Ferracuti and Stubben, 2019, for a more detailed discussion). Extracting market participants' collective assessment of past and ongoing investments may thus be a valuable source of information concerning the viability of ongoing innovative activities and potential future investment opportunities. In fact, Bai et al. (2016) document that the real effects of prices are salient in R&D-type investments.

The setting of corporate innovation also allows us to exploit several institutional features for identification. When the USPTO grants a new patent to a firm, information about this patent is first published in the Official Gazette, the official journal of the USPTO. This publication also marks the point in time when information about the success of the firm's patent application becomes public to the market. Patent grants represent the release of value-relevant information about a firm's investment activities that is already known by the firm itself (e.g., Austin, 1993; Kogan et al., 2017; Martens, 2021; Pakes, 1985).[1] Moreover, the exact timing of the release of this information is determined by the USPTO's patent application and examination process and not by the firm itself. More importantly, since the Official Gazette is published weekly on Tuesdays, it is possible for multiple patent grants to be published at the same time if a firm previously had multiple patent applications pending. These "Patent Tuesdays" thus allow us to use the timing of patent grant disclosures by the USPTO as a plausibly exogenous source of variation in the simultaneous/separate release of firm-specific value-relevant information. If the simultaneous release of information impedes managers' ability to obtain a clear signal of the market's assessment of a particular piece of information, stock price reactions around the grant date should be less predictive of managers' subsequent decision making if the firm receives multiple patent grants on the same day.

We first test whether market reactions around patent grants exhibit differential predictive ability for firms' subsequent investments in innovation. Kogan et al. (2017) show that the stock market response to news about patents can serve as an indicator of the perceived economic value of a past investment in innovation. The market's response to a particular innovation on the grant date thus likely includes valuable information for manager decisions regarding future investments in innovation. We exploit the fact that patents include citations of prior technological advances on which the innovation is based. These citations not only refer to patents granted to other companies but also include references to the firms' own work. This unique feature allows us to track how firm-specific future investments in innovation relate to specific past investments and the feedback received regarding these investments upon publication of the patent. If the simultaneous release of information impairs managers' ability to gather feedback from market prices, the market's assessment of the

[1] If a patent application is successful, firms receive a notice of allowance with the request to pay certain fees within a specific time frame. The patent itself is then issued and published once the firm has paid the corresponding issuance fees.

economic value of a patent on the grant date should be more predictive for specific future follow-up investments if there are fewer other potentially relevant pieces of firm-specific information disclosed at the same time. Consistent with this notion, we find that the market's signal for a patent's economic value is more likely to indicate that the patent will be cited in future patent applications if fewer patents are issued at once or if these patents relate to fewer unique technology classes. These results are robust to alternative definitions of the treatment variable, alternative measures of patent value, the presence of other simultaneous information releases, and structural differences in patenting behavior.

We also test whether the effect of separate information releases is more pronounced for patents that relate to more exploratory technologies. Not all patents represent the fundamental search for new technologies that have the potential to transform businesses and markets. In fact, firms often file patents to utilize, refine, and protect existing technologies against potential workarounds from competitors (e.g., Almeida et al., 2018; Benner and Tushman, 2003; Manso, 2011; March, 1991). The relevance of market feedback to managerial learning thus likely depends on the nature of the patent and the underlying innovation. In particular, since investments in new technologies are typically riskier than investments that refine existing technologies, managers are more likely to incorporate a broader set of information into their decision process (e.g., Bai et al., 2016; Ferracuti and Stubben, 2019; Fleming, 2001). Supporting the managerial learning channel, we find that a firm's ability to extract clearer signals from the market's response seems to be more relevant for patents that relate to more specific or exploratory innovative activities, i.e., the clarity of market feedback is more important for managerial decision making if it concerns relatively riskier innovative strategies.

In our second set of tests, we abstract from market reactions to specific patents and examine the relation between simultaneous vs. separate information releases and subsequent innovative activities at the firm level. Even if the interaction of information releases and market feedback affects specific investment choices, this does not necessarily imply that a firm will invest in more valuable innovative activities in the future. We explore whether those firms that are able to gather more precise feedback because their patent information is released separately rather than simultaneously also subsequently exhibit more valuable investment portfolios or higher scientific quality. Based on all weekly patent release dates on which a firm received at least one patent, we construct a yearly measure of firm exposure to simultaneous vs. separate information releases. We find that firms with more separate information releases subsequently invest in innovation that receives higher market valuations and more citations and is thus more important. These findings are robust to the number of patents received in a year, firm fixed effects and industry-specific time trends. We also construct an alternative definition of what constitutes a separate piece of information based on unique technology classes and obtain consistent results.

Finally, we investigate whether the simultaneous vs. separate release of information also affects other firms' ability to extract timely information from stock price reactions to competitors' actions and disclosures (Arya and Ramanan, 2021; Foucault and Fresard, 2014; Xiong and Yang, 2021). Consistent with the notion of competitor learning, we find that the market's response to patent grants has higher predictive ability for future patent citations by other firms if fewer pieces of information (i.e., other patent grants for the same firm) are released simultaneously. Similarly, an industry's overall exposure to separate information releases is significantly positively associated with the average valuation of the future patent portfolios of firms within the industry. These findings suggest that the structure of information releases not only affects firms' own ability to extract information from the market but also affects other firms and competitors.

Taken together, our findings indicate that managers find it easier to infer feedback from the market's response to information releases if the response can be tracked back to specific pieces of firm-specific information and if there are fewer contemporaneous events impeding the formation of feedback in market prices. At the same time, market reactions that can be attributed to specific pieces of information may also convey more valuable information to competitors and other firms.

These findings are important given the recent efforts to better understand the mechanisms that facilitate or reduce managers' ability to gather decision-relevant information from capital markets. While several studies have examined the effect of capital market feedback on firm behavior (e.g., Bai et al., 2016; Chen et al., 2007; Dessaint et al., 2019; Martens and Sextroh, 2021), less is known about how disclosures affect the availability and relevance of feedback. While some studies have documented that managers may use voluntary disclosures to solicit market feedback (e.g., Bae et al., 2021; Fox et al., 2021; Jayaraman and Wu, 2020), others have suggested that additional disclosures may in fact reduce managerial learning from market prices if it discourages informed trading (e.g., Chen et al., 2021; Gao and Liang, 2013; Goldstein and Yang, 2019; Goldstein et al., 2022; Jayaraman and Wu, 2019; McClure et al., 2022; Pinto, 2022). We complement this literature by documenting that the effect of disclosures on price informativeness for managerial decisions also depends on managers' ability to infer a clear feedback signal from the market's response to a disclosure. In fact, disclosure regulations that mandate the release of multiple pieces of information all at once may potentially impede managers' ability to benefit from the market's feedback.

Our results also provide yet another perspective on managerial preferences for "bundling" information, for example, when releasing information about new strategic initiatives or managerial forecasts concurrently with earnings announcements. Prior research has provided evidence that such information bundling often occurs for strategic reasons, e.g., to bury bad news with other corporate news, to manage investor perceptions by releasing optimistic guidance, or to reduce potential detrimental effects of information overload (e.g., Billings and Cedergren, 2015; Bliss et al., 2018; Chapman et al., 2019; Kothari et al., 2009; Rawson et al., 2020). Taking into account potential feedback effects, however, managers may also prefer to unbundle information if the objective is to maximize the feedback that can be extracted from the market's response to a particular disclosure. In addition, more precise market feedback may also convey valuable and timely information to competitors. The trade-off between bundling and unbundling specific pieces of information may thus be more nuanced than previously thought of.

We also contribute to the ongoing debate about the benefits and costs the disclosure of firms' innovative activities. While recent literature in economics and management has generally documented that patent disclosures increase informational efficiency (e.g., Graham and Hegde, 2015; Hegde et al., 2018), recent studies have also suggested that the potential benefits and costs of innovation-related disclosures warrant a more nuanced investigation (e.g., Dyer et al., 2020; Glaeser, 2018). Kim and Valentine (2021), for example, show that while patent disclosures impose proprietary costs, mandated disclosures may also facilitate innovation through information spillovers from rivals. Glaeser and Landsman (2021) document that firms in more competitive industries may actually voluntarily seek to provide credible patent-related disclosures to deter competitors. Additionally, Saidi and Zaldokas (2021) find that patent disclosures reduce the cost to firms of switching lenders, resulting in a lower cost of debt. Moreover, recent studies have also suggested that the proprietary costs imposed by even more general disclosure requirements result in fundamental externalities for firms' innovative activities (e.g., Breuer et al., 2021). Our results suggest that increased informational efficiency through disclosure regulations, such as the mandatory disclosure of patents, also affects corporate decision making by shaping the information flowing from capital markets back to firms.

Finally, our study should also be of interest for academics and practitioners interested in the determinants of corporate innovation (e.g., Acharya et al., 2014; Atanassov, 2013; Balsmeier et al., 2017; Chemmanur et al., 2014; Fang et al., 2014; Reeb and Zhao, 2021; Sunder et al., 2017). In this context, it extends the debate on organizational learning processes that foster technological change (e.g., March, 1991; Tseng, 2022). In particular, our findings suggest that firms are likely to use feedback on realized innovations as an input when determining ongoing and future investments in innovation.

2 Related Literature

A considerable debate on disclosure regulation centers on the question of how informational efficiency ultimately affects real efficiency. We study a potentially important factor to consider when debating how disclosure regulations and informational efficiency ultimately affect real efficiency: feedback effects from financial markets.

The general idea behind feedback effects is that market participants produce information that is reflected in prices. Decision makers in the real economy observe these prices, extract critical information, and act accordingly. While feedback effects originate in the informational role of market prices, there are various reasons why managers may find this information useful (see, e.g., Edmans et al., 2012, for a more comprehensive discussion). Feedback effects can emerge when market participants collectively form a better assessment of the implications of an investment opportunity for firm value than managers (e.g., Edmans et al., 2015; Grossman, 1976; Hayek, 1945). The price-formation process observed in capital markets may then reveal new information to the manager, which in turn could facilitate managerial learning and affect subsequent decision making (Bond et al., 2012; Dye and Sridhar, 2002).[2]

Empirical evidence generally supports the feedback role of financial markets. Luo (2005), for example, studies acquisition announcements and finds that if the market responds negatively, managers may decide to cancel the deal. Chen et al. (2007) and Bakke and Whited (2010) present evidence consistent with managers incorporating information from stock prices into their investment decisions. Goldstein et al. (2021) survey Chinese public companies and provide direct evidence that firms pay attention to the stock market to gather feedback that guides investment decisions. Feedback effects have also been documented to be relevant in

[2]Even if market prices do not contain any new information for decision makers, they may still act correspondingly. On the one hand, managers whose compensation is tied to market prices, for example, have an incentive to take actions that are also reflected in the firms' stock price. On the other hand, decision makers may irrationally use market prices as an anchor when making real decisions.

the context of corporate innovation, as they may help to resolve constraints emerging from secondary markets, such as economic upswings or downturns (e.g., Mace, 2020), by providing information about the firms' relative economic condition and innovative positioning. Kumar and Li (2018), for example, examine the generation of information by stock markets and the corresponding feedback effects on firm-level innovation-related investment. They document a positive association between the idiosyncratic volatility of stock returns and the response rate of subsequent innovation-related investment. Taken together, prior literature has documented that financial markets do not only *reflect* what firms are doing, but also have the potential to *affect* what firms are doing.

Despite evidence about the relevance of capital market feedback to various corporate decisions, it is ambiguous whether and how corporate disclosures affect the ability of managers to learn from these signals. On the one hand, theoretical and empirical studies suggest that increased levels of disclosure trigger feedback effects if the disclosure facilitates discovery of previously unknown information that is impounded in market prices (Bae et al., 2021; Jayaraman and Wu, 2020). On the other hand, corporate disclosures could also potentially crowd out informed trading, which would reduce the amount of private information in market prices and, hence, managers' ability to extract previously unknown information (Gao and Liang, 2013; Goldstein and Yang, 2019; Jayaraman and Wu, 2019).

In this study, we investigate whether managers' ability to extract information from market prices depends on the amount of information disclosed at the same time. On the one hand, if the pieces of information are complements, releasing these pieces at once could facilitate price formation and, hence, provide better feedback to managers. Similarly, releasing multiple pieces of information during a prescheduled event could positively affect the investor attention given to that information and thus decrease overall processing costs, which in turn may improve the signal available from market prices (see, e.g., Blankespoor et al., 2020, for a review). On the other hand, releasing multiple pieces at once may also impair investor decision making and, hence, the quality of market feedback if it results in information overload (Casey Jr, 1980; Einhorn, 1971; Iselin, 1988; Malhotra, 1982). Additionally, when multiple pieces of information are released at the same time, prices will reflect only the aggregate response but will not contain feedback related to individual pieces of value-relevant information. By releasing information separately, however, managers may be able to obtain a clearer signal of market feedback, which is also more useful for subsequent decision making (Ramanan, 2015). Whether the simultaneous vs. separate release of information affects managers' ability to gather decision-relevant information from market prices is thus ultimately an empirical question.

3 Data and Identification of Simultaneous Information Releases

3.1 Measuring simultaneous versus separate information releases

We use the plausibly exogenous timing of patent grant disclosures by the USPTO as a source of variation in the simultaneous release of value-relevant information. The simultaneous release of information by firms is also common when, e.g., the announcement of a new product or strategy is combined with information about recent financial performance. However, firms typically have the choice whether to release separate pieces of information all at once or to delay the dissemination of one piece of information until a later date. In equilibrium, firms optimize their disclosure policies to derive the maximum benefit from market feedback vis-à-vis other disclosure incentives. Prior literature, for example, suggests that managers adapt their corporate disclosure practices, such as voluntary management guidance, to the signals observed in the market (e.g., Cao et al., 2020; Chapman and Green, 2018; Langberg and Sivaramakrishnan, 2010; Zuo, 2016). Additionally, managers strategically bundle information releases to achieve specific reporting objectives (e.g., Kothari et al., 2009; Lansford, 2006; Miller, 2002; Segal and Segal, 2016). Identification thus requires a source of exogenous variation in information releases that is free from firm-specific disclosure incentives or even considerations related to the elicitation of market feedback, especially as these may be correlated with firm-specific drivers of future investment.

A patent grant represents a firm-specific piece of value-relevant information that is not published by the firm itself but by the USPTO as the relevant regulatory authority. At the same time, patents still constitute a firm-specific disclosure since it is the firm's choice to apply for a patent and to accept any corresponding publications by the USPTO. Patent grants are announced via the Official Gazette, the official journal of the USPTO. The journal is published weekly on Tuesdays, unless there is a federal holiday, and includes information on each patent granted during the previous week. These "Patent Tuesdays" come with several institutional features that allow us to exploit plausibly exogenous variation in the simultaneous vs. separate release of individual pieces of firm-specific information that are news to the market but already known by the firm.[3]

While firms decide whether and when to apply for a patent, the grant itself is subject to the USPTO's patent application and examination process. This process involves a number of formal steps and rounds of communication between the applicant and the examiner. The average total pendency, i.e., the time from the filing of an application until either the patent is granted or the application is abandoned, is approximately 24 months but can take considerably longer (United States Patent and Trademark Office, 2020). Due to the length of the process, any strategic considerations regarding the timing of application filings hardly affect the timing of patent grant announcements. Within our sample, approximately 73.3 percent of all patent applications are filed concurrently with other applications from the same firm, but only 4.4 percent of these applications are also granted at the same time. Additionally, patent grants are fairly evenly distributed across weeks.[4] Even though firm actions may influence the length of the application process, if and when a patent is granted is ultimately

[3]One may argue that patent-related information is already known to the market prior to the actual patent grant. In particular, since the enactment of the American Inventor's Protection Act (AIPA) in 2000, firms have been required to disclose their patent applications 18 months after filing, regardless of whether the application is eventually granted. However, patent grants still constitute considerable news to the market, as the uncertainty about patent rights and the associated economic benefits is resolved. In addition, the majority of our patent grant sample is from the pre-AIPA period.

[4]See Online Appendix Figures OA.1 and OA.2 for additional descriptive statistics.

determined by the examiners at the USPTO. Similarly, although the patent itself is only issued and announced by the USPTO once the applicant pays the required fees within a specific period of time, the date of the patent issuance still largely depends on the administrative processes within the USPTO.[5] As such, the timing of firm-specific patent grant disclosures by the USPTO and, more importantly, the degree to which these disclosures are released separately or all at once, is plausibly exogenous to firms' own disclosure strategies.

We construct two measures based on patent grants issued on the same day to capture the degree to which individual pieces of information are released separately or simultaneously with other pieces of information. For one, we exploit variation in the number of firm-specific patent grants published by the USPTO on the same release date. If a firm has multiple patents pending and these patents are granted close together in time, it is possible for these patents to be published in the same issue of the Official Gazette. In that case, multiple separate pieces of value-relevant information would be released at once, and the market price would reflect only an aggregate response to the combined information release. Firms should find it more difficult to attribute an aggregate market's response to a specific piece of patent information. Instead, if the firm receives only one patent grant on a release day, the market price reflects the reaction to a specific piece of information, i.e., the firm can obtain a clearer signal of the market's assessment of the past investment activity associated with the particular patent granted (see Figure 1).

[5] Prior to issuing a patent, the applicant receives a *Notice of Allowance* (NOA) from the USPTO with the request to pay the corresponding issuance fees within 90 days. As a consequence, it is possible that firms strategically time the payment of fees to affect the timing of patent grants. Descriptive statistics on the timing of NOAs, fee payments and patent grants, however, suggest that this is hardly the case (see Online Appendix OA.1). For one, there is considerable variation in the time between fee payment and issue date. For another, even if fees are paid simultaneously, there is a high change these patents will be issued in different weeks. This suggests that the ultimate timing of patent grants still largely depends on administrative processes within the USPTO, which is hardly influenced by firm-specific actions. A related concern is that, since firms receive the NOA before the actual patent issuance, they voluntarily disclose the successful application already earlier. Again, this seems rarely to be the case. Lansford (2006), for example, reviews more than 10,000 patent-related articles issued by companies between January 1990 and November 2000 to identify different types of patent-related disclosures. He finds only 203 instances of companies voluntarily disclosing an NOA, although more than 400,000 patents were issued during the same time period. Similarly, Carter et al. (2016) search 176,232 8-K filings between 1996 and 2006 and find that only 92 of them mention the term "Notice of Allowance".

For another, we use the number of unique USPTO technology classes of patents issued on the same day as an alternative definition of what constitutes a separate piece of information (see Figure 2). Irrespective of the number of patents a firm receives on a given day, managers may also extract feedback on more aggregated information levels. For example, a firm that receives multiple patents for innovations in the same technology class on the same day may still be able to extract relatively clear feedback about its activities in that particular technology class or scientific area even though specific feedback for individual patents may be limited. In addition, patents from the same technology class may in fact be complementary. Releasing multiple patents from the same technology class on the same time may thus even enhance potential feedback effects from the market. In addition, focusing on technology classes to measure simultaneous information releases also has several benefits for identification as further discussed below.

We use the inverse of the number of patents granted to firm i on release day t and the number of unique technology classes these patents relate to, respectively, to capture firm-specific variation in the degree to which individual pieces of information are released separately or simultaneously over time:

$$Separate\ info\ release_{PATENT,i,t} = \frac{1}{\#Patents_{i,t}}$$

$$Separate\ info\ release_{TECH,i,t} = \frac{1}{\#USPTO\ Technology\ Classes_{i,t}}$$

For for $Separate\ info\ release_{PATENT,i,t}$, a value close to one indicates that the firm received only a few patents on a particular release day, while a measure closer to zero marks release days with multiple firm-specific patent grants. Similarly, for $Separate\ info\ release_{TECH,i,t}$, a value close to one indicates that the patents the firm received on a particular release day relate to the same USPTO technology class, while a measure closer to zero indicates the degree to which patents released on the same day relate to different technology classes. The fewer the number of patents granted on the same day or the fewer the corresponding number of unique technology classes, the higher the firms' ability to learn from the market's response to a specific piece of information. Both measures are non-linear, which corresponds to the notion that the marginal effect of releasing an additional piece of information should be larger the fewer pieces are already released at once. The more information is released at once, the lower the marginal effect of releasing an additional piece of information on managerial learning.[6]

3.2 Data and sample

Our analyses are based on a sample of all granted patents of public US firms between 1926 and 2020, which we obtain from the Kogan et al. (2017) patent database. We merge this sample with data about patent citations from Patentsview.org. In addition, we obtain firm-specific data from CRSP, Compustat, and the Capital IQ Key Developments database. We use these data to construct both the patent-level sample and the firm–year-level sample used in the following analyses. Both samples differ slightly in the pool of patents included since we require more data for the patent-level analysis (e.g., technology class, innovative specificity, explorativeness). Consequently, the patent-specific sample for the patent-level analysis includes 1,964,350 patents granted between 1976 and 2020, while the final sample for the firm-level analysis includes 32,119 firm-years between 1962 and 2017.

We employ patent-level as well as firm-year-level analyses to investigate whether the simultaneous release of information affects managers' ability to learn from market prices.

[6]Additional robustness tests show that our results are robust to using a linear measure to capture the extent of separate information releases.

4 Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making

4.1 Main specification

We first focus on patent-level analyses to examine whether firm decision making is affected by the market's response to the release of value-relevant information about patents and whether this response depends on managers' ability to attribute the market's feedback to a specific piece of information. To identify the link between firm-specific investments over time, we focus on firms' references to their own prior technological advances in textit-subsequent patent applications (i.e., self-citations). If managers take the market's response around the publication of patent grants into account in their decision-making, future patent applications should include more (fewer) references to patents that received a more (less) favorable market reaction. More importantly, if the separate release of information results in more informative market reactions, those reactions should then also be more predictive of future self-citation behavior.

We estimate the following regression model on the level of the individual patent to investigate the relation between information releases, the informativeness of market prices, and subsequent corporate decision making:

$$\begin{aligned} & log(1 + Self - citations_{PATENT,10y}) \\ &= \beta_1 log(Patent\ valuation) + \beta_2 Separate\ info\ release_{PATENT/TECH,i,t} \\ &+ \beta_3 log(Patent\ valuation)\ \times\ Separate\ info\ release_{PATENT/TECH,i,t} \\ &+ \sum Controls_{i,t} + \sum Firm_i\ \times\ Tech\ class_j + \sum Date_t\ \times\ Tech\ class_j \\ &+ \sum Industry_s\ \times\ Year_t \left[+ \sum Number\ of\ patents_{i,t} \right] + \epsilon \qquad (1) \end{aligned}$$

The dependent variable, *Self-citations*$_{PATENT,10y}$, is defined as the number of citations that patent p receives in future patent applications by the same firm within 10 years after the patent grant. To capture the market's feedback on firm-specific investments in innovation, *Patent valuation*, we rely on the patent-level estimates of the market's evaluation of the economic importance of corporate innovations developed by Kogan et al. (2017). They show that the stock market response to patent grants can serve as an indicator of the perceived economic value of a past investment in innovation and then develop patent-specific estimates of the market's assessment of the private economic value of an innovation. More specifically, the Kogan et al. (2017) measure is based on a firm's idiosyncratic return defined as the firm's stock return minus the return on the market portfolio after the patent grant, adjusted by the unconditional probability of a successful patent application. If firms learn from the market's response, the coefficient on *log(Patent valuation)* should be positive ($\beta_1 > 0$); i.e., the more positive the market's reaction to a patent grant is, the more likely it is that the firm will invest in similar activities as captured by citations in future patent applications.

The main coefficient of interest is that on the interaction term *log(Patent valuation)* $\times$ *Separate info release*$_{PATENT/TECH,i,t}$ (β_3). This coefficient represents the incremental ability of the market response to patent grants to predict future self-citations if the patent release coincides with fewer releases of other firm-specific value-relevant pieces of information (i.e., fewer concurrent patent grants or related technology classes for the same firm). If the amount of value-relevant information released at once negatively affects managers' ability to learn from market prices, the firm's response to patent valuations should be more pronounced if the market's signal can be clearly attributed to a specific piece of information (i.e., $\beta_3 > 0$).

Estimating equation [1] on the individual patent-level allows us to include various fixed effects to control for firm-, technology-, or industry-specific developments. First, we include firm $\times$ technology class fixed effects control for structural differences in citation behavior within a firm across technology classes (e.g., core technology classes and peripheral technology classes). Second, technology class $\times$ grant day fixed effects avoid truncation bias since patents that are granted earlier have more time to accumulate forward self-citations. Third, we include industry × year fixed effects to control for changes within an industry that affect innovation quality and subsequent investment (e.g., shifts in industry-wide innovative strategies). Finally, we include a vector of standard control variables that have been shown to affect corporate investment in innovation (see Reeb and Zhao, 2021, for a discussion). Thus, our patent-level tests generally exploit patent-specific residual variation in market valuations and the amount of information released at the same time irrespective of firm-, technology-, or industry-specific developments.

One remaining concern for inference is that our estimates may capture systematic measurement error in *log(Patent valuation)* that is increasing with the number of patents released on the same day. The true economic value of patents is not observable. Kogan et al. (2017)'s estimates are based on the assumption that the market knows the true economic value of patents. However, if the amount of information released at the same time affects market participants' processing of that information, the estimate of total patent value may be affected by how many patents are released at once. As a result, prices will be a noisier measure of patent value the more patents are issued on the same day. While we argue that this noise in the market's signal is one potential mechanism of how simultaneous releases could affect managers' ability to learn from market prices, one may argue that the interaction term between *log(Patent valuation)* and $\textit{Separate info release}_{PATENT}$ indicates the amount of measurement error in patent valuations associated with the number of patents released at once and not differences in managerial learning.

To address this concern, we do not only measure simultaneous information releases based on the number of patents issued ($\textit{Separate info release}_{PATENT,i,t}$), but also based on the number of unique technology classes a given number of patents relates to ($\textit{Separate info release}_{TECH,i,t}$). This allows us to explicitly separate the measurement of information releases from the number of patents released at once. Specifications using $\textit{Separate info release}_{TECH,i,t}$ also include fixed effects for the number of patents a firm receives on a given Patent Tuesday. We thus exploit only the residual variation in the degree of patent complementary while abstracting from the number of patents and, hence, the potential effect of measurement error.[7]

Table 1 presents basic descriptive statistics. Please refer to Appendix A for a full description of all variables. The patents in our sample receive on average 1.13 self-citations within 10 years after the patent has been granted. The mean (median) of *Separate info* $release_{PATENT}$ is 0.24 (0.083), which implies that each patent release is accompanied by the contemporaneous release of 4 (12) other patents on the same day for the same firm. However, there is considerable variation in the number of patent grants published for a given firm on a given grant day, ranging from patents that are released by themselves (Max(*Separate info* $release_{PATENT}$) = 1) to the simultaneous release of 436 patents (Min(*Separate info* $release_{PATENT}$) = 0.002).

[INSERT TABLE 1]

Table 2 presents the regression estimates for equation [1]. We find that the market's response to a patent grant positively predicts references to that patent in the firms' future patent applications ($p \leq 0.01$). Consistent with prior literature that documents a general "learning from market feedback" effect (e.g., Bakke and Whited, 2010; Chen et al., 2007; Luo, 2005), firms seem to incorporate the market's response to successful investments when making decisions about future investments in innovation.[8] However, whether firms can extract useful feedback from the market's response to a patent grant also seems to depend on whether the information is released separately or together with other pieces of information all at once. The coefficient on *Separate info* $release_{PATENT}$ (column [1]) and on the interaction of

[7] One may argue that a remaining concern for identification is that as a result of the variation in firm innovation cycles over time, high-value patents are more likely to be released separately compared to follow-up innovations of potentially lower economic value. However, the mean patent valuation on grant day shows no clear relationship with the number of patents granted simultaneously. See Online Appendix Figure OA.3. Our results are also robust to including the number of patent applications filed simultaneously with the application of the patent granted as additional control variables (see Online Appendix Table OA.2).

[8] The positive coefficient for *log(Patent valuation)* also somewhat alleviates concerns of systematic measurement error in patent valuation as this argument does not apply to results involving only the base effect of *Separate info* $release_{PATENT}$ or *Separate info* $release_{TECH}$.

log(Patent valuation) and *Separate info release*$_{PATENT}$ (column [2]) is significantly positive ($p \leq 0.05$). This suggests that firms put more weight on patent valuations when fewer patents are released on the same day, i.e., when the market's aggregate response can be more clearly attributed to a specific piece of information. The coefficient estimates suggest that if a patent is released itself (*Separate info release*$_{PATENT} = 1$) instead of together with another patent (*Separate info release*$_{PATENT} = 0.5$), it will receive 1.73% more self-citations within the next 10 years. Similarly, the coefficient on the interaction term in column [2] indicates that patent with an economic value of $2.7 million released separately instead of simultaneously with another patent, are associated with 0.62% more self-citations within the next 10 years. While this effect seems economically small, it nevertheless indicates a change in firm behavior, especially considering that the average patent receives only 1.13 self-citations in total over a period of 10 years. Additionally, due to the idiosyncratic nature of feedback effects, it is inherently difficult to identify the channels by which these feedback effects occur. While self-citations allow us to link past signals to future decisions, they are not the only dimension along which feedback materializes. Similar to firms that adjust various features of their strategies to cater to the financial market, firms can also adjust their patents to incorporate feedback (e.g., citations, technological focus, wording). As such, the identified effect likely captures only a fraction of the true feedback effect. We find similar results for specifications including *Separate info release*$_{TECH}$ alleviating concerns that results are due to systematic measurement error in patent valuations that increases with the number of patents released at the same time (columns [3] and [4]). Taken together, these patent-specific estimates suggest that firms not only utilize market feedback for subsequent decision making but that the ability to extract critical feedback also depends on whether the market's response can be tied to a specific piece of information.[9]

[INSERT TABLE 2]

[9] To ensure the robustness of our results our regressions exclude singletons (see deHaan and Breuer (2021) for a discussion).

4.2 Alternative measures of patent value

While the previous tests including *Separate info release*$_{TECH,i,t}$ already explicitly address concerns related to potential systematic measurement error in patent valuations, we nevertheless perform a number of additional tests that use alternative measures to capture signals of patent value observed by management to further alleviate any remaining concerns. First, we re-estimate equation [1] including the aggregate Kogan et al. (2017) estimate as our measure of patent value. This specification abstracts from any specific assumptions regarding true patent value or managements' allocation of aggregate patent valuations to individual patents. Instead, it focuses on the aggregate signal observable by management. According to our hypothesis, management should find it more difficult to allocate this aggregate signal to individual patents the more patents are released at the same time. The same holds for the number of unique technology classes theses patents relate to. Table 3 columns [1] and [2] present the results. The aggregate patent valuations do not show any significant association with patent-specific future self-citations. However, we again find a significantly positive coefficient for the interaction of *log(Patent valuation)* and *Separate info release*$_{PATENT}$/*Separate info release*$_{TECH}$.

We next test whether our results continue to hold if we abstract from the assumption that management would equally attribute aggregate market reactions to individual patents. To do so, we construct an alternative allocation of total value that takes into account the characteristics of patents released and their association with patent value. For each firm-year, we first estimate the relation of patent value and various patent characteristics for all single patent release observations in the previous year. We then use these coefficient estimates to compute expected patent values for all individual patents released on simultaneous release days based on observable characteristics. These expected patent values are then used to compute alternative weights for allocating aggregate market reactions to individual patents released on simultaneous release days.[10] Conceptually, the resulting individual patent values capture a hypothetical allocation of aggregate market reactions to individual patents based on information also observable by management. Results are similar to the main specification (see Table 3 columns [3] and [4]). Patent valuations are significantly positively associated with future self-citations. We again find significantly positive effects for *Separate info release*$_{PATENT}$ as well as the interaction on *log(Patent valuation)* and *Separate info release*$_{PATENT}$ (column [3]). Similarly, the coefficient on the interaction of *log(Patent valuation)* and *Separate info release*$_{TECH}$ remains positive and statistically significant (column [4]).

[INSERT TABLE 3]

Third, we construct a test that fully abstracts from multiple patent release days and instead relies on alternative simultaneous events for identification. Specifically, we limit the sample to single patent release days only and study the effect of simultaneous major events (e.g., earnings announcements, guidance, product-related announcements, M&A-related announcements, etc.) that are likely to affect the stock price and, hence, impair the informativeness of market prices to learn about patent value. We find that patent valuations are less predictive of future self-citations, if a patent is released on days with alternative major news announcements (see Online Appendix Table OA.3). The result of this test is again consis-

[10]More specifically, we use the sample of single patent releases and estimate the following regression model on a yearly basis: $Patent\ valuation = \beta_1 Innovative\ specificity + \beta_2 Explorativeness + \beta_3 log(Backward\ citations) + \beta_4 log(Grant\ lag) + \beta_5 log(1 + Scientific\ backward\ citations) + \beta_6 log(Independent\ claims) + \sum Tech\ class_j + \epsilon$. The choice of explanatory variables follows prior literature that identifies patent characteristics likely associated with patent valuations (e.g., Higham et al., 2021). We then use the coefficient estimates to calculate the expected value of individual patents for all simultaneous patent release days based on their characteristics. To avoid hindsight bias and stale information, we use the coefficients estimates in year t-1 to measure the expected patent valuations in year t. To ensure positive fitted values, we add the minimum fitted patent valuation for firm i at date t plus $1 to all patent valuations for firm i at date t. This ensure strictly positive valuations while not affecting the relative rank within each release day. We then use these adjusted fitted values to calculate the share of the aggregate market reaction that is attributable to the individual patent. Overall, this approach yields unique patent valuations for simultaneous release days. The resulting valuations correspond to a plausible alternative allocation of aggregate market reactions based on patents' observable characteristics.

tent with the notion that simultaneous events impair managers' ability to extract specific information from market prices.

Finally, to test for potential bias emerging from markets' under- or overreaction to patent information, we also repeat this analysis using adjusted patent valuation measures. Specifically, we reduce (increase) the Kogan et al. (2017) patent-specific valuation measures by 0.1%, 0.5%, or 1% for each patent released on date t for firm i. Adjusting the measurement of patent valuations does not affect our inferences (see Online Appendix Table OA.4). Taken together, these additional robustness tests all suggest that our results are unlikely to simply reflect measurement error in patent valuations associated with the number of patents released at once.

4.3 Patent characteristics and capital market feedback

Corporate innovation strategies include both uncovering new possibilities through the generation of previously unknown knowledge (i.e., exploration) and exploiting existing possibilities through the use of already existing knowledge (i.e., exploitation) (e.g., Almeida et al., 2018; Benner and Tushman, 2003; Manso, 2011; March, 1991). As a result, not all patents represent a fundamental search for new technologies that have the potential to transform businesses and markets. In fact, firms often file patents to utilize, refine, and protect existing technologies against potential workarounds from competitors, e.g., to prevent more firms from entering the market or to ensure continuing licensing revenue (e.g., Cohen et al., 2000). While such exploitative patents still have economic value, e.g., because they protect the continuance of future cash flows, market feedback may be more important for patents that relate to more risky investments in exploratory innovative activities. For such activities, management has to critically assess whether future investments to further develop and exploit the newly developed and patented technology are worthwhile. Since investments in new technologies are typically riskier than investments that refine existing technologies, managers are more likely to incorporate a broader set of information into their decision-making process (e.g., Bai et al., 2016; Ferracuti and Stubben, 2019; Fleming, 2001). Thus, to the extent that managers incorporate market feedback into their decision making, they should also rely more on the market's response if it concerns patents that relate to relatively more risky and exploratory investments. As a result, if the concurrent release of information affects managers' ability to extract useful information from market prices, the effect of separate information releases should be more pronounced for patents that relate to more exploratory technologies.

We test this idea by estimating equation [1] separately for patents that are more/less exploratory. Similar to several innovation-related studies (e.g., Benner and Tushman, 2003; Custódio et al., 2019; Fitzgerald et al., 2021; Gao et al., 2018), we measure patent explorativeness as the total number of citations made that represent new knowledge for the firm divided by the total number of citations in the patent, where the firm's existing knowledge includes all patents that were either filed by the firm itself or cited in one of its existing patents between year t-5 and year t-1. The more new knowledge cited in a patent, the more exploratory the corresponding innovation.

Table 4 Panel A reports descriptive statistics for patents with above-median and below-median explorativeness. On average, more and less exploratory patents are relatively similar with respect to their likelihood of a separate release and their economic value. In fact, the average value appears to be slightly higher for less exploratory patents, alleviating concerns that exploratory patents are, on average, both of higher value and originating from specific innovation cycles that also makes them more likely to be released separately from other patents. Panel B reports the regression results separately for information releases based on the number of patents (columns [1] and [2]) and the number of unique technology classes (columns [3] and [4]). As expected, it appears that the firm's ability to extract clearer signals from the market seems to be particularly important for patents that relate to more exploratory innovative activities. The coefficient estimates for β_3 are significantly positive and significantly larger for patents with above-median explorativeness compared to those with below-median explorativeness ($p \leq 0.1$). These results further confirm the notion that firms' ability to extract clear feedback from market prices depends on the amount of concurrent information released at the same time and that the clarity of such feedback may be more important for managerial decision making if it concerns relatively riskier innovative strategies.[11]

[INSERT TABLE 4]

4.4 Additional robustness tests

We run several robustness tests to ensure that our results are not driven by the definition of the treatment variable, by other simultaneous information releases, or by structural differences in patenting behavior. First, we repeat the analysis using the number of patents and technology classes issued on the same date as an alternative treatment variable (Table 5 Panel A and B column [1]). Second, to control for the potential effect of other simultaneous information releases, we limit the sample to observations without concurrent events (Table 5 Panel A and B column [2]). Finally, we exclude the bottom 5% (column [3]) and top 5% (column [4]) of observations in terms of the total number of patents granted per year. Overall, the results remain similar across all alternative specifications.[12]

[INSERT TABLE 5]

[11] Besides that, the results also alleviate remaining concerns that the observed relation between market responses and future investments is merely due to market responses being correlated with managers' private information. Since managers have by definition less information about more exploratory endeavors, observing relatively stronger effects for exploratory patents suggests that it is not managers' private information, but the market's feedback they are reacting to.

[12] Our results are also robust to clustering standard errors by firm or firm and grant date (see Online Appendix Table OA.5) as well as using shorter and longer horizons to measure future self-citations (see Online Appendix Table OA.6).

5 Capital Market Feedback and Corporate Innovation

5.1 Main specification

We next investigate whether firms that receive more market feedback also exhibit different levels of corporate innovation. Even if the interaction between disclosures and market feedback affects firm investment choices, this does not necessarily imply that firms also become more innovative or invest in activities with economic benefits. To test this conjecture, we abstract away from market reactions to specific patents and examine the relation between firm exposure to simultaneous vs. separate information releases and the value of their future investment portfolios at the firm level. If the simultaneous release of information about past investments in innovation impairs firms' ability to learn information critical to future investment decisions from the market's response, firms that are exposed to more (fewer) simultaneous information releases should exhibit relatively less (more) valuable investment portfolios in the future. We explore this idea by aggregating the firm-specific measure of weekly "Patent Tuesday" information releases by year and testing for its predictive ability regarding the valuation of future patent portfolios:

$$log(Patent\ portfolio\ valuations_{i,t+x}) = \beta_1 Separate\ info\ release\ exposure_{PATENT,i,t} + \beta_2 log(\#Patents_{i,t}) + \sum Controls_{i,t} + \sum Firm_i + \sum Industry_s\ x\ Year_t + \epsilon \quad (2)$$

The dependent variable, $Patent\ portfolio\ valuations_{i,t+x}$, is the average patent valuation across all applications that were filed by firm i in year t+x that are eventually granted. We construct a measure of firm-specific exposure to simultaneous vs. separate information releases, $Separate\ info\ release\ exposure_{PATENT,i,t}$, as the sum of the patent-specific *Separate info release* measure for firm i aggregated over year t and scaled by the firm-specific number of Patent Tuesdays with patent grants in year t:

$$Separate\ info\ release\ exposure_{PATENT,i,t} = \frac{\sum Separate\ info\ release_{PATENT,i,t}}{\#Patent\ release\ days_{i,t}}$$

Higher values indicate that the firm is exposed to relatively more separate information releases. Since $\textit{Separate info release exposure}_{PATENT,i,t}$ and $\textit{Patent portfolio valuation}_{i,t+x}$ are naturally affected by the number of patents a firm receives during the year, we also include the number of patents granted to firm i in year t ($\#Patents_{i,t}$). Conceptually, this variable captures the total number of individual pieces of information released during the year. As such, the coefficient on $\textit{Separate info release exposure}_{PATENT,i,t}$ should reflect the effect of the relation between the distribution of these pieces of information (i.e., more simultaneous or more separate releases) and the average valuation of future patent portfolios. We again include standard controls from the prior literature as well as firm fixed effects and industry-specific time trends. The fixed effects control for the possibility that specific firms generate more or less valuable patents as well as potential trends across industries over time. (See Appendix A for a full description of all variables.)

The final sample includes 32,119 firm-year observations from 1962 to 2017. Table 6 presents the descriptive statistics. Sample firms receive an average of 54.6 patents per year and generate future patents with an average value of $9.99 m ($9.57 m) [$9.29 m] in year t+1 (t+2) [t+3]. The average value of the firm-specific exposure to separate information releases is 0.835, with considerable variation across firms and years (min = 0.006; max = 1).

[INSERT TABLE 6]

Table 7 presents the regression results for equation [2]. We estimate a regression for the valuation of the patents applied for in years t+1, t+2, and t+3. $\textit{Separate info release exposure}_{PATENT}$ exhibits a significant positive association with *Patent portfolio valuations* across all specifications ($p \leq 0.01$). These results are consistent with the notion that those firms that can obtain more specific market feedback also invest in innovative activities that lead to more valuable patents, on average.

[INSERT TABLE 7]

5.2 Separate information releases and innovative quality

While the previous analyses focus on the economic value of future patent portfolios, we also examine whether market feedback is associated with the scientific quality of subsequent innovation investments. We use two measures of scientific quality. First, we follow a considerable prior literature in management and economics and use the number of citations that patents receive (e.g., Trajtenberg, 1990). In addition, we use the measure of patent importance developed by Kelly et al. (2021), which is based on the textual similarity of a patent to previous and subsequent work. We again construct a firm–year specific measure by taking the average number of citations received by all patents applied for in years t+1, t+2, and t+3. Table 8 presents the estimates for equation [2] using the average number of citations and patent importance as outcome variables. Again, we find a positive association between *Separate info release exposure*$_{PATENT}$ and both *Patent portfolio citations* and *Patent portfolio importance* across all specifications. These findings suggest that the increase in available market feedback due to the separate release of information not only leads to more valuable patent portfolios in the future but also positively affects the (scientific) quality of firm investments in innovation.[13]

[INSERT TABLE 8]

[13] The sample for this test ends in 2009 due to data availability constrains.

5.3 Robustness analyses

To ensure that our results are not driven by the construction of *Separate info release exposure*$_{PATENT}$, we re-estimate equation [2] with two alternative definitions of firm exposure to separate vs. simultaneous releases of value-relevant patent information. First, we construct a binary variable, *Separate info release exposure*$_{PATENT,BIN}$, that differentiates only between separate and simultaneous information releases but ignores the number of concurrent pieces of information disclosed at the same time. This variable is based on an indicator variable that takes on a value of one if only one patent is granted to firm i on day t and zero otherwise. We then aggregate this measure to the firm-year level as before. As indicated in Table 9, column (1), the coefficient estimate for *Separate info release exposure*$_{PATENT,BIN}$ remains statistically significant ($p \leq 0.01$). Second, we construct *Patent Tuesday HHI* as a concentration measure based on the Herfindahl-Hirschman index for firm i's patent grants over the number of Patent Tuesdays in year t (Table 9, column (2)). We find that the more concentrated patent grants are over fewer release days, the lower the valuation of the future patent portfolios. Third, column (3) presents the results using an alternative definition of a separate information release that - similar to the patent-level tests - aggregates the patent release information on a given day to the level of unique technology classes. *Separate info release exposure*$_{TECH}$ is constructed analogously to *Separate info release exposure*$_{PATENT}$ but substitutes the number of patents with the number of unique technology classes. The more patents from different technology classes that are granted on the same day, the less clear is the information that firms receive from the market since they cannot attribute the market response to a specific type of technology class. Again, we find that firms with a greater number of separate information releases show higher average patent valuations in the future. All three alternative measures thus confirm the association between separate vs. simultaneous information releases and the value of the firm's future innovative activities.

The descriptive statistics in Table 6 further suggest that the total number of patents a firm receives per year varies considerably across firm–years. To ensure that the results are not driven by observations with a very low or high number of patents, we re-estimate the specification excluding the bottom 5% (Table 9, column (4)) and top 5% (Table 9, column (5)) of firms in terms of the number of patents. The coefficient estimate for *Separate info release exposure*$_{PATENT}$ remains statistically significant and similar in size, alleviating concerns regarding the total number of patents received.[14]

[INSERT TABLE 9]

6 Capital Market Feedback and Competitor Learning

If managers can extract useful information from the market's response to their firm's actions or disclosures, this response may also convey timely information to other firms and competitors (e.g., Arya and Ramanan, 2021; Foucault and Fresard, 2014; Giuri et al., 2007; Xiong and Yang, 2021). In our final set of tests, we examine whether the separate vs. simultaneous release of information is associated with competitor learning and decision-making. First, we reestimate equation [1] but use nonself-citations (i.e., citations from other firms) as the dependent variable. If the number of unique pieces of information released at a time affects competitors' ability to learn from stock market reactions to other firms' disclosures, other firms should be more likely to cite a firm's patent if a favorable market response on the release day can be more clearly attributed to that particular patent. Table 10, column (1) presents the results. Consistent with the notion of competitor learning from other firms' stock prices, the market response to a particular patent predicts future citations by other firms, and more importantly, this effect becomes stronger when fewer pieces of information (i.e., other patent grants for the same firm) are released simultaneously. Second, we construct a firm-level test based on equation [2] that examines whether the

[14] In unreported tests, we further repeat the analysis by dropping one year at a time, one industry at a time, and one firm at a time to ensure that the results are not driven by any specific year, industry or firm. The coefficient estimate for *Separate info release exposure*$_{PATENT}$ remains statistically significant at the $p \leq 0.05$ level across all estimations.

average value of a firm's future patent portfolio is associated with the number of separate information releases at the industry level ($Separate\ info\ release\ exposure_{INDUSTRY}$). When more information within an industry is disclosed on its own, firms should be more likely to benefit by extracting competitive and market information from stock price reactions to those disclosures. We find that an industry's exposure to separate information releases is significantly positively associated with the average valuation of firms' future patent portfolios. Taken together, these findings suggest that the structure of information releases not only affects firms' ability to extract information from stock price reactions to their own actions and disclosures but also extends to their ability to extract such information from reactions to other firms' and competitors' actions and disclosures.

[INSERT TABLE 10]

7 Conclusion

We investigate whether the simultaneous release of value-relevant information affects managers' ability to gather decision-relevant information from market prices. Theory predicts that when multiple pieces of information are released at once, management may find it more difficult to infer useful feedback since the observed market response aggregates all individual pieces of information into a single signal. Instead, if pieces of information are released separately, management can obtain a clearer signal of the market's assessment of a particular piece of information.

We take advantage of the USPTO's disclosure mechanism for firm-specific patent information and use the timing of patent grant disclosures as a source of plausibly exogenous variation in the simultaneous release of value-relevant information. We find that the market valuation of individual patents is more predictive of future firm behavior when less information on other patents is released simultaneously on the grant date. The firm's ability to extract clearer signals from the market's response also seems to be more relevant for patents that relate to relatively riskier innovative strategies. Firms' ability to extract clear feedback signals around information releases positively predicts the value and quality of future investments in innovation. The effect of separate information releases on firm ability to extract information from market prices also extends to peer firm disclosures. Taken together, our results are consistent with the notion that the structure and timing of information releases affect managerial learning from market prices.

These findings are important in light of efforts to better understand the effect of informational efficiency on real efficiency. While the effect of market prices on real decision making has been well documented, there is still considerable debate about whether and how corporate disclosures facilitate or impede managers' ability to gather decision-relevant information from secondary markets. Our results suggest that the interplay of disclosures, capital market feedback, and managerial decision making may be more nuanced.

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Appendix A

Variable Definitions

Outcome variables	
Patent portfolio valuation$_{t+1/2/3}$	The average patent valuations of firm i's patents filed in year t + 1/2/3 and eventually granted. Source: Kogan et al. (2017) updated data as of 2020.
Patent portfolio citations$_{t+1/2/3}$	The average number of forward citations that are no self-citations of firm i's patents filed in year t + 1/2/3 and eventually granted. Source: Patentsview citation data.
Patent portfolio importance$_{t+1/2/3}$	The average of Kelly et al. (2021) patent importance measure calculated on a 1-year forward window of firm i's patents filed in year t + 1/2/3 and eventually granted. Source: Kelly et al. (2021) data.
Self-citations$_{PATENT,3y/5y/10y}$	The number of forward self-citations that firm i makes to patent p within 3/5/10 years after patent grant. Source: Patentsview citation data.
Citations$_{PATENT,10y}$	The number of forward citations that are no self-citations of firm i's patent p within 10 years after patent grant. Source: Patentsview citation data.
Self-citations$_{TECH,10y}$	The average number of forward self-citations of firm i's patents in technology class j at Patent Tuesday t within 10 years after patent grant. Source: Patentsview citation data.
Treatment variables	
Separate info release$_{PATENT}$	A continuous separateness measure defined as: $Separate\ info\ release_{PATENT,i,t} = \frac{1}{\#Patents_{i,t}}$ where $\#Patents_{i,t}$ is the number of firm i's patents granted at Patent Tuesday t. Source: Kogan et al. (2017) updated data as of 2020.
Separate info release$_{PATENT,COUNT}$	A continuous separatedness measure defined as the number of firm i's patents granted at Patent Tuesday t. Source: Kogan et al. (2017) updated data as of 2020.
Separate info release exposure$_{PATENT}$	The *Separate info release* measure aggregated to the firm-year level and divided by the number of firm i's Patent Tuesdays in year t. Source: Kogan et al. (2017) updated data as of 2020.
Separate info release$_{PATENT,BIN}$	A binary separatedness measure that is based on an indicator variable that takes the value of one if only one patent is granted for firm i at day t, and zero otherwise. Source: Kogan et al. (2017) updated data as of 2020.
Separate info release exposure$_{PATENT,BIN}$	The *Binary separate info release* measure aggregated to the firm-year level and divided by the number of firm i's Patent Tuesdays in year t. Source: Kogan et al. (2017) updated data as of 2020.

Appendix A

Variable Definitions (continued)

Separate info release$_{TECH}$	A continuous separatedness measure defined as: $$Separate\ tech\ info\ release_{i,t} = \frac{1}{\#Unique\ tech\ classes_{i,t}}$$ where $\#Unique\ tech\ classes_{i,t}$ is the number of unique technology classes of firm i's patents granted at Patent Tuesday t. Source: Patentsview application data.
Separate info release exposure$_{TECH}$	The *Separate tech info release* measure aggregated to the firm-year level and divided by the number of firm i's Patent Tuesdays in year t. Source: Patentsview application data.
Separate info release exposure$_{INDUSTRY}$	The *Separate info release* measure aggregated to the SIC4-year level and divided by the number of Patent Tuesdays of firms in the SIC4 industry in year t. Source: Kogan et al. (2017) updated data as of 2020.
Patent Tuesday HHI	The Herfindahl-Hirschman index of firm i's patent grants over the Patent Tuesdays in year t. Source: Kogan et al. (2017) updated data as of 2020.
Patent valuation	The Kogan et al. (2017) patent valuation measure based on capital market reactions to patent grants. Source: Kogan et al. (2017) updated data as of 2020.
Tech valuation	The *Patent valuation* measure aggregated to the firm-date level and divided by the the number of unique technology classes of firm i's patents granted at Patent Tuesday t. Source: Kogan et al. (2017) updated data as of 2020.
Control variables	
#Patents	Firm i's number of patents granted in year t. Source: Kogan et al. (2017) updated data as of 2020.
Total assets	Firm i's book value of total assets in year t. Source: CRSP Compustat Merged data.
R&D assets	Firm i's research and development (R&D) expenditure divided by book value of total assets in year t, set to zero if missing. Source: CRSP Compustat Merged data.
Age	Firm i's age approximated by the number of years listed on Compustat. Source: CRSP Compustat Merged data.
ROA	Firm i's operating income before depreciation divided by book value of total assets in year t. Source: CRSP Compustat Merged data.
Leverage	Firm i's book value of debt divided by book value of total assets in year t. Source: CRSP Compustat Merged data.
CAPEX assets	Firm i's capital expenditure scaled by book value of total assets in year t. Source: CRSP Compustat Merged data.

Appendix A

Variable Definitions (continued)

TobinsQ	Firm i's market-to-book in year t, calculated as market value of equity plus book value of assets minus book value of equity minus balance sheet deferred taxes, set to zero if missing, divided by book value of assets. Source: CRSP Compustat Merged data.
Innovative specificity	The measure is calculated as: $Innovative\ specificity_p = \sum_j^n m_{p,j}^2$ where $m_{p,j}$ denotes the percentage of citations made by patent p that belong to patent class j, out of n technology classes assigned by the USPTO. The measure is the inverse of the Trajtenberg et al. (1997) patent originality measure. Source: Patentsview citation data.
Explorativeness	An explorativeness measure that is calculated as the total number of citations made to new knowledge divided by the total number of citations made by the patent. We define firm i's existing knowledge in year t as all patents either produced by firm i or that were cited by firm i's patents within 5 years up to year t-1. Source: Patentsview citation data and Kogan et al. (2017) updated data as of 2020.
PPE assets	Firm i's property, plant & equipment divided by book value of total assets measured at the end of fiscal year t. Source: CRSP Compustat Merged data.
Turnover	Firm i's average turnover in year t. Source: CRSP Daily Stock data.
Backward citations	Number of citations of firm i's patent p to other patents. Source: Patentsview citation data.
Grant lag	Number of years between patent filing date and patent grant date of firm i's patent p. Source: Kogan et al. (2017) updated data as of 2020.
Scientific backward citations	Number of citations of firm i's patent p to scientific publications as documented in the reference section on the front-page of the patent. Source: Marx and Fuegi (2020) front-page patent citations to scientific articles data.
Independent claims	Number of independent claims of firm i's patent p. Source: Patentsview claim data.

Figure 1
Simultaneous vs. Separate Release of Patent Information on "Patent Tuesdays"

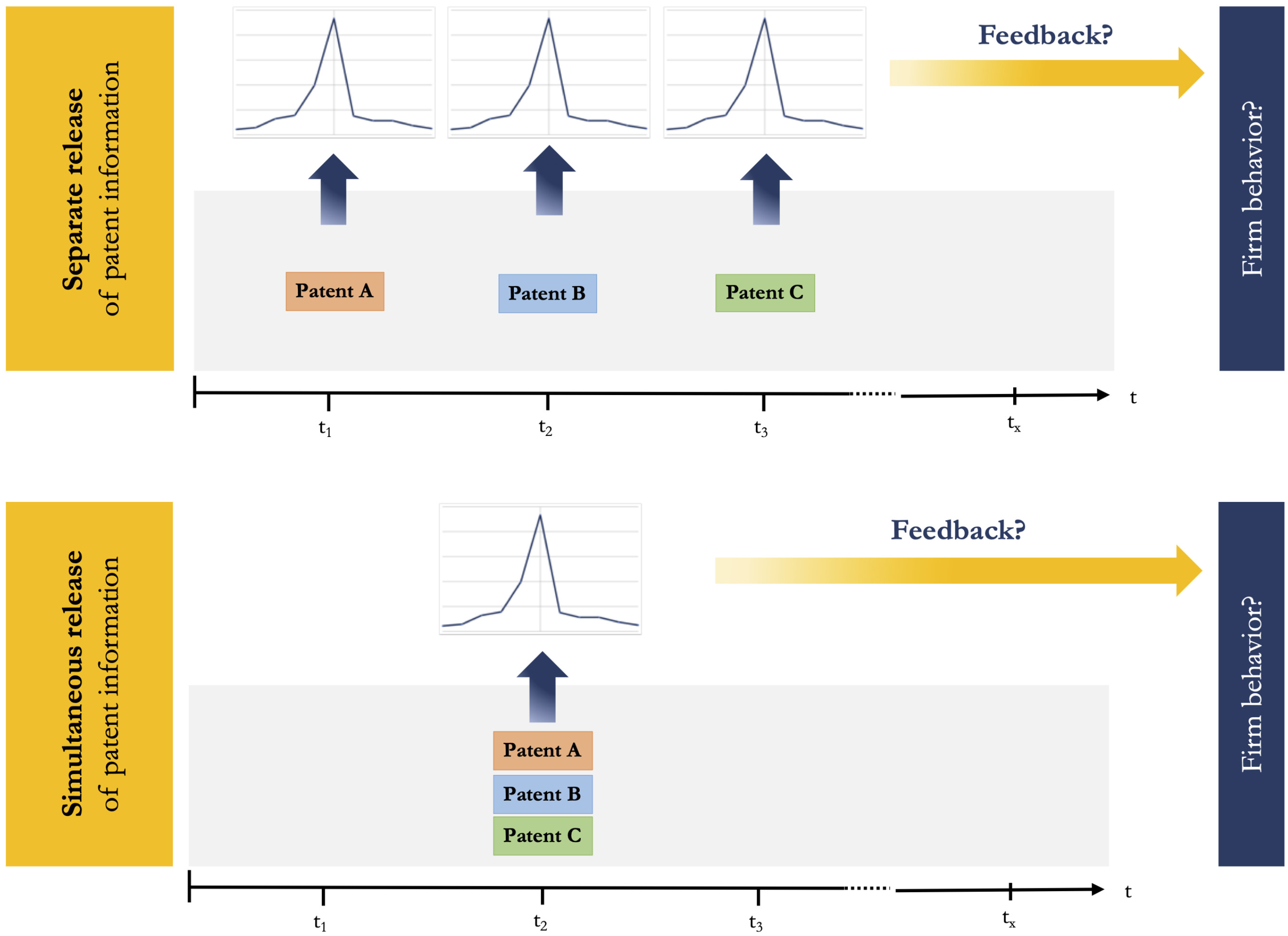


Figure 2

Simultaneous vs. Separate Release of Technology Class Information on "Patent Tuesdays"

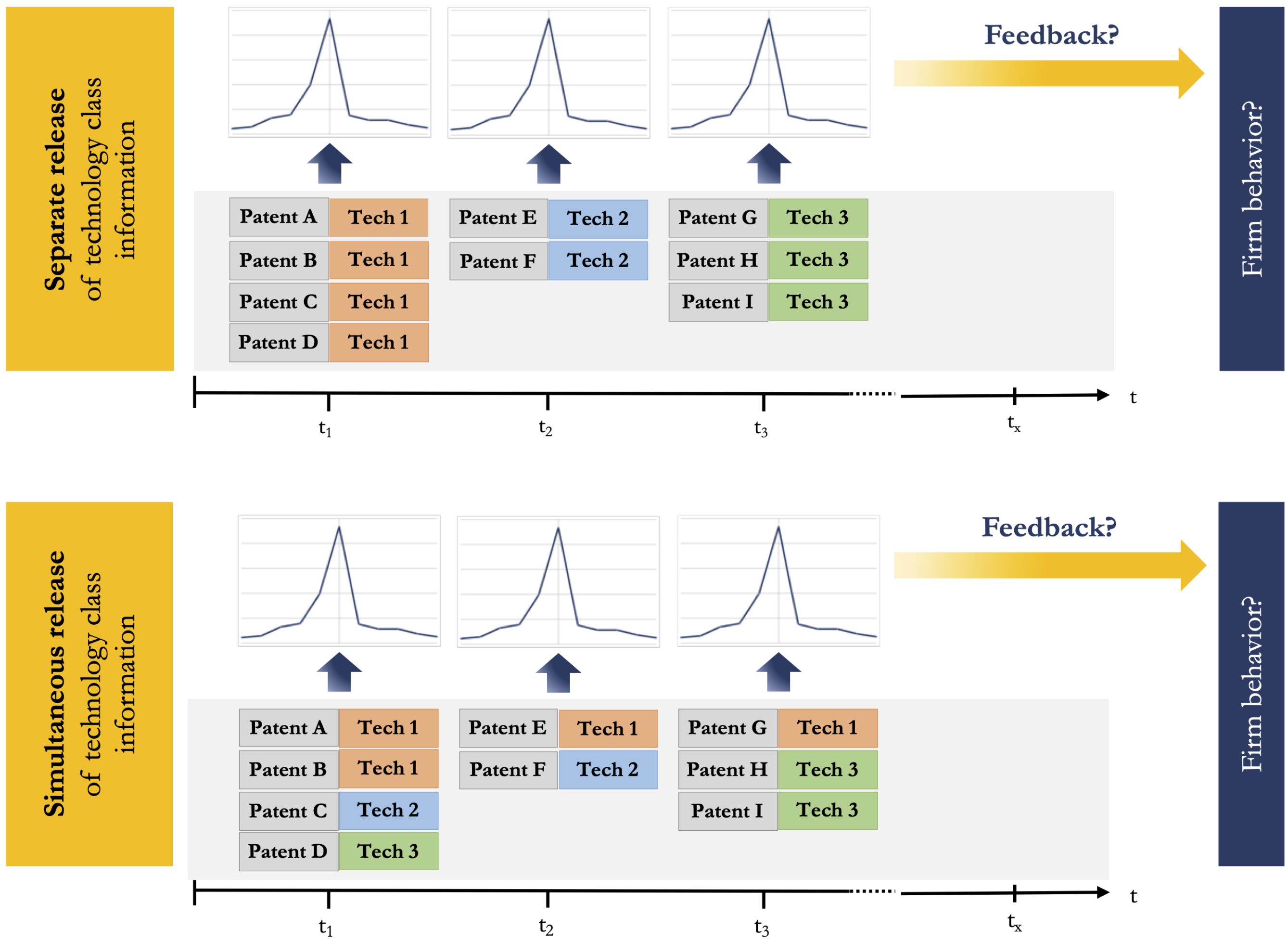


Table 1

Descriptive Statistics: Patent-Level Analyses

	N	Mean	SD	Min	P25	P50	P75	Max
Outcome variables								
Self-citations$_{PATENT,10y}$	1,964,350	1.130	3.098	0	0	0	1	19
Citations$_{PATENT,10y}$	1,964,350	3.063	6.956	0	0	0	3	41
Treatment variables								
Separate info release$_{PATENT}$	1,964,350	0.235	0.315	0.002	0.031	0.083	0.333	1.000
#Patents	1,964,350	25.263	38.424	1	3	12	32	436
Separate info release$_{TECH}$	1,964,350	0.282	0.326	0.015	0.056	0.125	0.333	1.000
#Technology classes	1,964,350	11.884	11.573	1	3	8	18	67
Patent valuation	1,964,350	10.524	19.088	0.009	0.734	3.887	10.878	116.495
Control variables								
Total assets	1,964,350	65,057	92,892	28	7,555	28,744	89,409	495,023
Age	1,964,350	31.129	18.065	0.000	17.000	30.000	44.000	69.000
ROA	1,964,350	0.132	0.089	-0.238	0.086	0.129	0.181	0.357
TobinsQ	1,964,350	1.965	1.171	0.746	1.167	1.585	2.358	7.137
Turnover	1,964,350	0.009	0.008	0.000	0.004	0.006	0.011	0.046
PPE assets	1,964,350	0.227	0.156	0.021	0.100	0.199	0.309	0.775
CAPEX assets	1,964,350	0.054	0.042	0.004	0.024	0.043	0.073	0.226
R&D assets	1,964,350	0.065	0.055	0.000	0.030	0.051	0.084	0.302
Leverage	1,964,350	0.224	0.149	0.000	0.111	0.213	0.315	0.632
Innovative specificity	1,964,350	0.560	0.286	0.123	0.333	0.500	0.802	1.000
Explorativeness	1,964,350	0.575	0.380	0.000	0.200	0.667	1.000	1.000

Notes: Please refer to Appendix A for a full description of all variables.

Table 2

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making

	log(1+Self-citations$_{PATENT,10y}$)			
	PATENT		*TECH*	
	(1)	(2)	(3)	(4)
Separate info release$_{PATENT}$	0.0344**	0.0021		
	(0.0169)	(0.0180)		
log(Patent valuation) × Separate info release$_{PATENT}$		0.0124**		
		(0.0060)		
Separate info release$_{TECH}$			0.0291**	0.0027
			(0.0127)	(0.0194)
log(Patent valuation) × Separate info release$_{TECH}$				0.0156**
				(0.0060)
log(Patent valuation)	0.0241***	0.0224***	0.0142***	0.0100
	(0.0063)	(0.0066)	(0.0043)	(0.0087)
Control variables				
log(Total assets)	-0.1078***	-0.1092***	-0.0935***	-0.0943***
	(0.0190)	(0.0190)	(0.0089)	(0.0188)
log(1+Age)	-0.0873***	-0.0881***	-0.0832***	-0.0844***
	(0.0263)	(0.0262)	(0.0150)	(0.0261)
ROA	-0.0698	-0.0706	-0.0613	-0.0608
	(0.0841)	(0.0841)	(0.0476)	(0.0849)
TobinsQ	0.0202***	0.0197***	0.0222***	0.0218***
	(0.0063)	(0.0062)	(0.0036)	(0.0059)
log(Turnover)	0.0074	0.0065	0.0024	0.0009
	(0.0090)	(0.0090)	(0.0047)	(0.0084)
PPE assets	-0.1541*	-0.1553*	-0.1443***	-0.1451*
	(0.0787)	(0.0787)	(0.0447)	(0.0762)
CAPEX assets	0.1651	0.1639	0.2118*	0.2147
	(0.2263)	(0.2258)	(0.1257)	(0.2309)
R&D assets	-0.4204**	-0.4206**	-0.3693***	-0.3654**
	(0.1936)	(0.1934)	(0.1057)	(0.1801)
Leverage	-0.1623***	-0.1595***	-0.1636***	-0.1609***
	(0.0586)	(0.0583)	(0.0296)	(0.0565)
Innovative specificity	-0.0503***	-0.0504***	-0.0504***	-0.0505***
	(0.0072)	(0.0072)	(0.0044)	(0.0073)
Explorativeness	-0.0676***	-0.0677***	-0.0677***	-0.0678***
	(0.0121)	(0.0121)	(0.0047)	(0.0121)
Firm × Tech class FE	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes
Number of patents FE	No	No	Yes	Yes
Observations	1,964,350	1,964,350	1,964,350	1,964,350
Adjusted R^2	0.28524	0.28527	0.28548	0.28552

Notes: Two-way clustered standard errors by firm and year in parentheses. ∗, ∗∗, and ∗ ∗ ∗ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 3

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making: Alternative Measures of Patent Valuations

	log(1+Self-citations$_{PATENT,10y}$)			
	Aggregate daily patent valuation		Patent-characteristics-based re-weighted patent valuation	
	$PATENT$	$TECH$	$PATENT$	$TECH$
	(1)	(2)	(3)	(4)
Separate info release$_{PATENT}$	0.0255		0.0231	
	(0.0165)		(0.0162)	
log(Patent valuation) × Separate info release$_{PATENT}$	0.0232***		0.0095*	
	(0.0062)		(0.0056)	
Separate info release$_{TECH}$		-0.0127		0.0012
		(0.0222)		(0.0187)
log(Patent valuation) × Separate info release$_{TECH}$		0.0147**		0.0137**
		(0.0060)		(0.0053)
log(Patent valuation)	0.0089	0.0111	0.0147***	0.0048
	(0.0091)	(0.0090)	(0.0044)	(0.0044)
Control variables				
log(Total assets)	-0.1034***	-0.0949***	-0.0973***	-0.0841***
	(0.0187)	(0.0187)	(0.0171)	(0.0165)
log(1+Age)	-0.0858***	-0.0842***	-0.0986***	-0.0973***
	(0.0258)	(0.0261)	(0.0249)	(0.0250)
ROA	-0.0534	-0.0621	-0.0595	-0.0555
	(0.0845)	(0.0850)	(0.0779)	(0.0780)
TobinsQ	0.0228***	0.0214***	0.0229***	0.0236***
	(0.0062)	(0.0058)	(0.0062)	(0.0060)
log(Turnover)	0.0040	0.0010	0.0047	-0.0010
	(0.0086)	(0.0084)	(0.0092)	(0.0088)
PPE assets	-0.1727**	-0.1447*	-0.1646**	-0.1473*
	(0.0797)	(0.0763)	(0.0796)	(0.0773)
CAPEX assets	0.2068	0.2127	0.1980	0.2269
	(0.2326)	(0.2313)	(0.2168)	(0.2161)
R&D assets	-0.4261**	-0.3675**	-0.3908**	-0.3283*
	(0.1950)	(0.1803)	(0.1930)	(0.1768)
Leverage	-0.1580***	-0.1598***	-0.1558***	-0.1576***
	(0.0586)	(0.0564)	(0.0570)	(0.0553)
Innovative specificity	-0.0506***	-0.0505***	-0.0554***	-0.0553***
	(0.0072)	(0.0073)	(0.0075)	(0.0075)
Explorativeness	-0.0676***	-0.0678***	-0.0642***	-0.0655***
	(0.0121)	(0.0121)	(0.0110)	(0.0112)
Firm × Tech class FE	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes
Number of patents FE	No	Yes	No	Yes
Observations	1,964,350	1,964,350	1,730,797	1,730,797
Adjusted R^2	0.28513	0.28552	0.28428	0.28461

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 4

Patent Explorativeness, Simultaneous Information Releases, and Capital Market Feedback

Panel A: Descriptive statistics

	N	Mean	Std
Separate info release$_{PATENT}$			
High explorativeness	912,219	0.270	0.335
Low explorativeness	1,052,131	0.204	0.292
Separate info release$_{TECH}$			
High explorativeness	912,219	0.309	0.339
Low explorativeness	1,052,131	0.258	0.311
Patent valuation			
High explorativeness	912,219	9.988	18.766
Low explorativeness	1,052,131	10.989	19.350

Panel B: Regression analyses

	log(1+Self-citations$_{PATENT,10y}$)			
	PATENT		*TECH*	
	Explorativeness			
	High	Low	High	Low
	(1)	(2)	(3)	(4)
Separate info release$_{PATENT}$	-0.0192	0.0486*		
	(0.0151)	(0.0252)		
log(Patent valuation) × Separate info release$_{PATENT}$	0.0209***	0.0038		
	(0.0053)	(0.0082)		
Test for difference in coefficients [p-value]	*[0.0806]**			
Separate info release$_{TECH}$			-0.0203	0.0329
			(0.0174)	(0.0258)
log(Patent valuation) × Separate info release$_{TECH}$			0.0274***	0.0034
			(0.0057)	(0.0078)
Test for difference in coefficients [p-value]			*[0.0131]***	
log(Patent valuation)	0.0190***	0.0267***	0.0019	0.0181
	(0.0047)	(0.0085)	(0.0065)	(0.0108)
Control variables				
log(Total assets)	-0.1016***	-0.1235***	-0.0828***	-0.1096***
	(0.0139)	(0.0246)	(0.0135)	(0.0238)
log(1+Age)	-0.0698***	-0.1627***	-0.0674***	-0.1545***
	(0.0171)	(0.0508)	(0.0170)	(0.0499)
ROA	-0.0168	-0.1036	-0.0078	-0.0914
	(0.0704)	(0.0993)	(0.0693)	(0.1009)
TobinsQ	0.0146***	0.0181**	0.0174***	0.0195**
	(0.0052)	(0.0076)	(0.0050)	(0.0074)

(Continued on next page)

Table 4

(continued)

	log(1+Self-citations$_{PATENT,10y}$)			
	PATENT		*TECH*	
	Explorativeness			
	High	Low	High	Low
	(1)	(2)	(3)	(4)
log(Turnover)	0.0109	0.0034	0.0033	-0.0011
	(0.0068)	(0.0127)	(0.0064)	(0.0117)
PPE assets	-0.1528**	-0.0932	-0.1359**	-0.0887
	(0.0583)	(0.1220)	(0.0543)	(0.1172)
CAPEX assets	0.1083	0.2111	0.1823	0.2534
	(0.1697)	(0.2791)	(0.1665)	(0.2851)
R&D assets	-0.4843***	-0.4310	-0.4150***	-0.3782
	(0.1509)	(0.2712)	(0.1390)	(0.2516)
Leverage	-0.1402***	-0.2017**	-0.1451***	-0.1962***
	(0.0459)	(0.0751)	(0.0440)	(0.0724)
Innovative specificity	-0.0161***	-0.0679***	-0.0159***	-0.0681***
	(0.0048)	(0.0113)	(0.0048)	(0.0114)
Explorativeness	-0.2529***	-0.0287**	-0.2539***	-0.0288**
	(0.0231)	(0.0128)	(0.0232)	(0.0129)
Firm × Tech class FE	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes
Number of patents FE	No	No	Yes	Yes
Observations	912,219	1,052,131	912,219	1,052,131
Adjusted R^2	0.23631	0.31685	0.23693	0.31708

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 5

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making: Robustness Tests

Panel A: Simultaneous information release $PATENT$

	log(1+Self-citations$_{PATENT,10y}$)			
	Count	No Other Event	#Patents > 5%	#Patents < 95%
	(1)	(2)	(3)	(4)
Separate info release$_{PATENT,COUNT}$	-0.0002			
	(0.0002)			
log(Patent valuation) × Separate info release$_{PATENT,COUNT}$	-0.0005***			
	(0.0001)			
Separate info release$_{PATENT}$		-0.0047	0.0029	-0.0010
		(0.0188)	(0.0203)	(0.0180)
log(Patent valuation) × Separate info release$_{PATENT}$		0.0133**	0.0109*	0.0106*
		(0.0063)	(0.0060)	(0.0061)
log(Patent valuation)	0.0329***	0.0222***	0.0228***	0.0254***
	(0.0050)	(0.0071)	(0.0066)	(0.0068)
Control variables				
log(Total assets)	-0.1048***	-0.0960***	-0.1188***	-0.1081***
	(0.0186)	(0.0185)	(0.0206)	(0.0188)
log(1+Age)	-0.0913***	-0.0982***	-0.0597**	-0.0757***
	(0.0258)	(0.0256)	(0.0280)	(0.0261)
ROA	-0.0526	-0.0741	-0.0425	-0.0867
	(0.0837)	(0.0760)	(0.0975)	(0.0848)
TobinsQ	0.0192***	0.0219***	0.0195***	0.0191***
	(0.0064)	(0.0059)	(0.0071)	(0.0057)
log(Turnover)	0.0037	0.0037	0.0082	0.0056
	(0.0089)	(0.0084)	(0.0101)	(0.0090)
PPE assets	-0.1691**	-0.1423*	-0.1462	-0.1324*
	(0.0772)	(0.0729)	(0.0870)	(0.0782)
CAPEX assets	0.1813	0.0761	0.1553	0.1544
	(0.2291)	(0.2033)	(0.2430)	(0.2254)
R&D assets	-0.4013**	-0.3398**	-0.5085**	-0.4457**
	(0.1837)	(0.1665)	(0.2312)	(0.1965)
Leverage	-0.1390**	-0.1698***	-0.1555**	-0.1529***
	(0.0563)	(0.0551)	(0.0655)	(0.0563)
Innovative specificity	-0.0512***	-0.0583***	-0.0501***	-0.0528***
	(0.0073)	(0.0073)	(0.0073)	(0.0069)
Explorativeness	-0.0679***	-0.0777***	-0.0743***	-0.0695***
	(0.0122)	(0.0142)	(0.0127)	(0.0130)
Firm × Tech class FE	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes
Observations	1,964,350	1,396,918	1,861,457	1,864,044
Adjusted R^2	0.28562	0.28143	0.29200	0.28861

(Continued on next page)

Table 5
(continued)

Panel B: Simultaneous information release $TECH$

	log(1+Self-citations$_{PATENT,10y}$)			
	Count	No Other Event	#Patents > 5%	#Patents < 95%
	(1)	(2)	(3)	(4)
Separate info release$_{TECH,COUNT}$	-0.0010			
	(0.0012)			
log(Patent valuation) × Separate info release$_{TECH,COUNT}$	-0.0009***			
	(0.0003)			
Separate info release$_{TECH}$		-0.0074	0.0149	-0.0014
		(0.0188)	(0.0198)	(0.0186)
log(Patent valuation) × Separate info release$_{TECH}$		0.0149**	0.0130**	0.0155**
		(0.0060)	(0.0060)	(0.0060)
log(Patent valuation)	0.0221***	0.0140	0.0106	0.0111
	(0.0076)	(0.0088)	(0.0088)	(0.0086)
Control variables				
log(Total assets)	-0.0917***	-0.0856***	-0.1025***	-0.0945***
	(0.0189)	(0.0186)	(0.0206)	(0.0186)
log(1+Age)	-0.0860***	-0.0934***	-0.0539*	-0.0759***
	(0.0262)	(0.0257)	(0.0277)	(0.0261)
ROA	-0.0558	-0.0601	-0.0314	-0.0706
	(0.0846)	(0.0761)	(0.0988)	(0.0843)
TobinsQ	0.0217***	0.0227***	0.0217***	0.0214***
	(0.0059)	(0.0057)	(0.0067)	(0.0056)
log(Turnover)	0.0012	-0.0002	0.0021	0.0005
	(0.0083)	(0.0078)	(0.0095)	(0.0083)
PPE assets	-0.1528**	-0.1448**	-0.1342	-0.1321*
	(0.0755)	(0.0713)	(0.0841)	(0.0774)
CAPEX assets	0.2144	0.1119	0.2057	0.2076
	(0.2356)	(0.2091)	(0.2490)	(0.2321)
R&D assets	-0.3585*	-0.3066*	-0.4415**	-0.3883**
	(0.1794)	(0.1578)	(0.2167)	(0.1816)
Leverage	-0.1529***	-0.1673***	-0.1556**	-0.1581***
	(0.0559)	(0.0536)	(0.0634)	(0.0551)
Innovative specificity	-0.0508***	-0.0585***	-0.0502***	-0.0529***
	(0.0073)	(0.0073)	(0.0074)	(0.0069)
Explorativeness	-0.0679***	-0.0779***	-0.0744***	-0.0697***
	(0.0121)	(0.0143)	(0.0127)	(0.0130)
Firm × Tech class FE	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes
Number of patents FE	Yes	Yes	Yes	Yes
Observations	1,964,350	1,396,918	1,861,457	1,864,044
Adjusted R^2	0.28565	0.28166	0.29227	0.28883

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 6

Descriptive Statistics: Firm-Level Analyses

	N	Mean	SD	Min	P25	P50	P75	Max
Outcome variables								
Patent portfolio valuation$_{t+3}$	32,119	9.998	19.799	0.043	1.184	3.425	8.986	128.869
Patent portfolio valuation$_{t+2}$	32,119	9.569	18.760	0.044	1.175	3.365	8.689	122.192
Patent portfolio valuation$_{t+1}$	32,119	9.285	18.240	0.045	1.172	3.308	8.451	119.944
Patent portfolio citations$_{t+3}$	32,119	15.963	20.786	0.000	3.592	10.333	19.338	130.292
Patent portfolio citations$_{t+2}$	32,119	16.778	22.026	0.000	4.250	10.750	19.943	140.400
Patent portfolio citations$_{t+1}$	32,119	17.583	23.376	0.000	4.750	11.000	20.444	148.655
Patent portfolio importance$_{t+3}$	26,127	-1.547	0.149	-1.965	-1.645	-1.555	-1.453	-1.113
Patent portfolio importance$_{t+2}$	26,127	-1.541	0.150	-1.957	-1.639	-1.550	-1.448	-1.100
Patent portfolio importance$_{t+1}$	26,127	-1.537	0.150	-1.954	-1.635	-1.545	-1.445	-1.087
Treatment variables								
Separate info release exposure$_{PATENT}$	32,119	0.835	0.230	0.006	0.769	0.921	1.000	1.000
Separate info release exposure$_{PATENT,BIN}$	32,119	0.746	0.303	0.000	0.590	0.857	1.000	1.000
Separate info release exposure$_{TECH}$	32,119	0.813	0.281	0.011	0.757	0.944	1.000	1.000
Separate info release exposure$_{INDUSTRY}$	32,119	0.734	0.200	0.015	0.596	0.771	0.895	1.000
Patent Tuesday HHI	32,119	0.249	0.293	0.020	0.051	0.125	0.333	1.000
Control variables								
#Patents	32,119	54.581	134.737	1	3	10	37	883
Total assets	32,119	7,620	23,778	7	154	674	3,203	166,374
Age	32,119	17.535	13.563	0	7	15	25	58
ROA	32,119	0.106	0.165	-0.673	0.082	0.137	0.187	0.383
TobinsQ	32,119	2.051	1.645	0.656	1.085	1.481	2.323	10.338
Turnover	32,119	0.006	0.007	0.000	0.001	0.004	0.008	0.039
PPE assets	32,119	0.269	0.174	0.009	0.135	0.244	0.370	0.756
CAPEX assets	32,119	0.060	0.044	0.002	0.028	0.050	0.080	0.236
R&D assets	32,119	0.067	0.099	0.000	0.008	0.032	0.084	0.567
Leverage	32,119	0.201	0.157	0.000	0.066	0.192	0.300	0.681

Notes: Please refer to Appendix A for a full description of all variables.

Table 7

Simultaneous Information Releases and Corporate Innovation: Value of Future Patent Portfolios

	log(Patent portfolio valuation$_{t+x}$)		
	t+1	t+2	t+3
	(1)	(2)	(3)
Separate info release exposure$_{PATENT}$	0.8703***	0.7710***	0.6214***
	(0.1019)	(0.1042)	(0.1059)
Control variables			
log(#Patents)	-0.0362***	-0.0331***	-0.0330***
	(0.0105)	(0.0114)	(0.0116)
log(Total assets)	0.3198***	0.2494***	0.1944***
	(0.0273)	(0.0280)	(0.0281)
log(1+Age)	0.0190	0.0099	0.0084
	(0.0255)	(0.0274)	(0.0283)
ROA	0.6547***	0.6174***	0.5228***
	(0.0952)	(0.1044)	(0.0990)
TobinsQ	0.1208***	0.0956***	0.0752***
	(0.0109)	(0.0114)	(0.0116)
log(Turnover)	-0.0656***	-0.0773***	-0.0812***
	(0.0213)	(0.0203)	(0.0203)
PPE assets	-0.1494	-0.0949	-0.0066
	(0.1509)	(0.1507)	(0.1550)
CAPEX assets	0.6025***	0.4288**	0.2496
	(0.2180)	(0.2123)	(0.2381)
R&D assets	1.014***	0.9181***	0.7646***
	(0.1876)	(0.1975)	(0.2097)
Leverage	-0.3305***	-0.2349***	-0.1549*
	(0.0843)	(0.0821)	(0.0848)
Firm FE	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes
Observations	32,119	32,119	32,119
Adjusted R^2	0.88436	0.88273	0.88009

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 8

Simultaneous Information Releases and Corporate Innovation: Quality of Future Patent Portfolios

	log(1+Patent portfolio citations$_{t+x}$)			Patent portfolio importance$_{t+x}$		
	t+1	t+2	t+3	t+1	t+2	t+3
	(1)	(2)	(3)	(4)	(5)	(6)
Separate info release exposure$_{PATENT}$	0.0893*	0.1430***	0.1228**	0.0113*	0.0165**	0.0117**
	(0.0524)	(0.0466)	(0.0527)	(0.0064)	(0.0062)	(0.0054)
Control variables						
log(#Patents)	0.0013	0.0058	0.0006	-0.0017*	-0.0018*	-0.0043***
	(0.0079)	(0.0068)	(0.0071)	(0.0009)	(0.0010)	(0.0011)
log(Total assets)	0.0028	-0.0048	-0.0050	0.0010	-0.0015	-0.0009
	(0.0129)	(0.0129)	(0.0132)	(0.0016)	(0.0016)	(0.0016)
log(1+Age)	-0.0328**	-0.0279*	-0.0214	-0.0065**	-0.0036*	-0.0027
	(0.0161)	(0.0150)	(0.0149)	(0.0026)	(0.0021)	(0.0020)
ROA	-0.0701	-0.0965*	-0.0255	0.0115	0.0110	0.0092
	(0.0589)	(0.0499)	(0.0602)	(0.0092)	(0.0090)	(0.0096)
TobinsQ	0.0078	0.0091*	0.0064	0.0017*	0.0000	-0.0012
	(0.0047)	(0.0052)	(0.0042)	(0.0008)	(0.0010)	(0.0009)
log(Turnover)	-0.0047	-0.0032	0.0069	0.0030**	0.0018	0.0016
	(0.0089)	(0.0081)	(0.0086)	(0.0014)	(0.0013)	(0.0011)
PPE assets	-0.2532***	-0.3077***	-0.3228***	-0.0186*	-0.0167	-0.0185*
	(0.0875)	(0.0870)	(0.0966)	(0.0106)	(0.0104)	(0.0099)
CAPEX assets	0.2966*	0.4677***	0.3856**	0.0322	0.0108	0.0163
	(0.1719)	(0.1571)	(0.1591)	(0.0219)	(0.0178)	(0.0180)
R&D assets	0.1254	0.0684	0.0105	0.0523***	0.0488***	0.0420**
	(0.1276)	(0.1148)	(0.1391)	(0.0169)	(0.0170)	(0.0189)
Leverage	0.0065	0.0275	-0.0298	-0.0138**	-0.0129**	-0.0130*
	(0.0490)	(0.0467)	(0.0473)	(0.0060)	(0.0056)	(0.0066)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	32,119	32,119	32,119	26,127	26,127	26,127
Adjusted R^2	0.77712	0.79361	0.79968	0.85571	0.86242	0.87276

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 9

Simultaneous Information Releases and Corporate Innovation: Robustness Tests

	log(Patent portfolio valuation$_{t+3}$)				
	Binary	HHI	TECH	#Patents > 5%	#Patents < 95%
	(1)	(2)	(3)	(4)	(5)
Separate info release exposure$_{PATENT,BIN}$	0.1636***				
	(0.0479)				
Patent Tuesday HHI		-0.3547***			
		(0.0525)			
Separate info release exposure$_{TECH}$			0.6560***		
			(0.1033)		
Separate info release exposure$_{PATENT}$				0.2622***	0.5646***
				(0.0840)	(0.1065)
Control variables					
log(#Patents)	-0.0672***	-0.1609***	-0.0363***	-0.0467***	-0.0503***
	(0.0111)	(0.0189)	(0.0126)	(0.0114)	(0.0140)
log(Total assets)	0.1858***	0.1971***	0.1347***	0.1919***	0.2011***
	(0.0255)	(0.0286)	(0.0288)	(0.0274)	(0.0293)
log(1+Age)	0.0246	0.0200	-0.0013	-0.0284	0.0209
	(0.0282)	(0.0284)	(0.0312)	(0.0276)	(0.0306)
ROA	0.5294***	0.5267***	0.4487***	0.4688***	0.5198***
	(0.0914)	(0.0993)	(0.0993)	(0.0942)	(0.1124)
TobinsQ	0.0752***	0.0754***	0.0548***	0.0687***	0.0814***
	(0.0068)	(0.0116)	(0.0099)	(0.0105)	(0.0127)
log(Turnover)	-0.0784***	-0.0809***	-0.0573***	-0.0704***	-0.0893***
	(0.0192)	(0.0205)	(0.0207)	(0.0186)	(0.0219)
PPE assets	0.0009	0.0015	-0.1589	-0.0731	0.0001
	(0.1534)	(0.1556)	(0.1557)	(0.1466)	(0.1623)
CAPEX assets	0.2568	0.2333	0.0259	0.1432	0.2177
	(0.2151)	(0.2392)	(0.2571)	(0.2304)	(0.2436)
R&D assets	0.7528***	0.7799***	0.6432***	0.7148***	0.7635***
	(0.2069)	(0.2091)	(0.2150)	(0.2093)	(0.2418)
Leverage	-0.1548*	-0.1545*	-0.0363	-0.1587*	-0.1498*
	(0.0838)	(0.0849)	(0.0783)	(0.0814)	(0.0895)
Firm	Yes	Yes	Yes	Yes	Yes
Industry SIC2 × Year	Yes	Yes	Yes	Yes	Yes
Observations	32,119	32,119	26,101	30,513	28,835
Adjusted R^2	0.87916	0.87991	0.88252	0.88228	0.88034

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table 10

Capital Market Feedback and Competitor Learning

	$\log(1+\text{Citations}_{PATENT,10y})$		$\log(\text{Patent portfolio valuation}_{t+3})$
	(1)	(2)	(3)
Separate info release$_{PATENT}$	-0.0172		
	(0.0153)		
log(Patent valuation)	0.0158***		
× Separate info release$_{PATENT}$	(0.0052)		
Separate info release$_{TECH}$		-0.0108	
		(0.0129)	
log(Patent valuation)		0.0116**	
× Separate info release$_{TECH}$		(0.0049)	
log(Patent valuation)	0.0118*	0.0120	
	(0.0070)	(0.0077)	
Separate info release exposure$_{INDUSTRY}$			0.2155*
			(0.1189)
Control variables			
log(#Patents)			-0.0829***
			(0.0112)
log(Total assets)	-0.0485***	-0.0431***	0.1853***
	(0.0106)	(0.0115)	(0.0284)
log(1+Age)	-0.0493**	-0.0409*	0.0281
	(0.0239)	(0.0229)	(0.0290)
ROA	-0.1479**	-0.1480**	0.5284***
	(0.0695)	(0.0677)	(0.0998)
TobinsQ	-0.0080	-0.0069	0.0753***
	(0.0059)	(0.0054)	(0.0117)
log(Turnover)	0.0481***	0.0450***	-0.0786***
	(0.0083)	(0.0081)	(0.0206)
PPE assets	-0.1069	-0.1046	-0.0040
	(0.0740)	(0.0698)	(0.1575)
CAPEX assets	0.2878**	0.3115**	0.2593
	(0.1207)	(0.1176)	(0.2405)
R&D assets	-0.0237	-0.0128	0.7455***
	(0.2039)	(0.1952)	(0.2088)
Leverage	-0.1032**	-0.0964**	-0.1565*
	(0.0429)	(0.0403)	(0.0854)
Innovative specificity	-0.1019***	-0.1022***	
	(0.0149)	(0.0149)	
Explorativeness	0.0291***	0.0291***	
	(0.0081)	(0.0080)	
Firm × Tech class FE	Yes	Yes	No
Tech class × Date FE	Yes	Yes	No
Industry SIC2 × Year FE	Yes	Yes	Yes
Number of patents FE	No	Yes	No
Firm FE	No	No	Yes
Observations	1,964,350	1,964,350	32,119
Adjusted R^2	0.39397	0.39413	0.87909

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

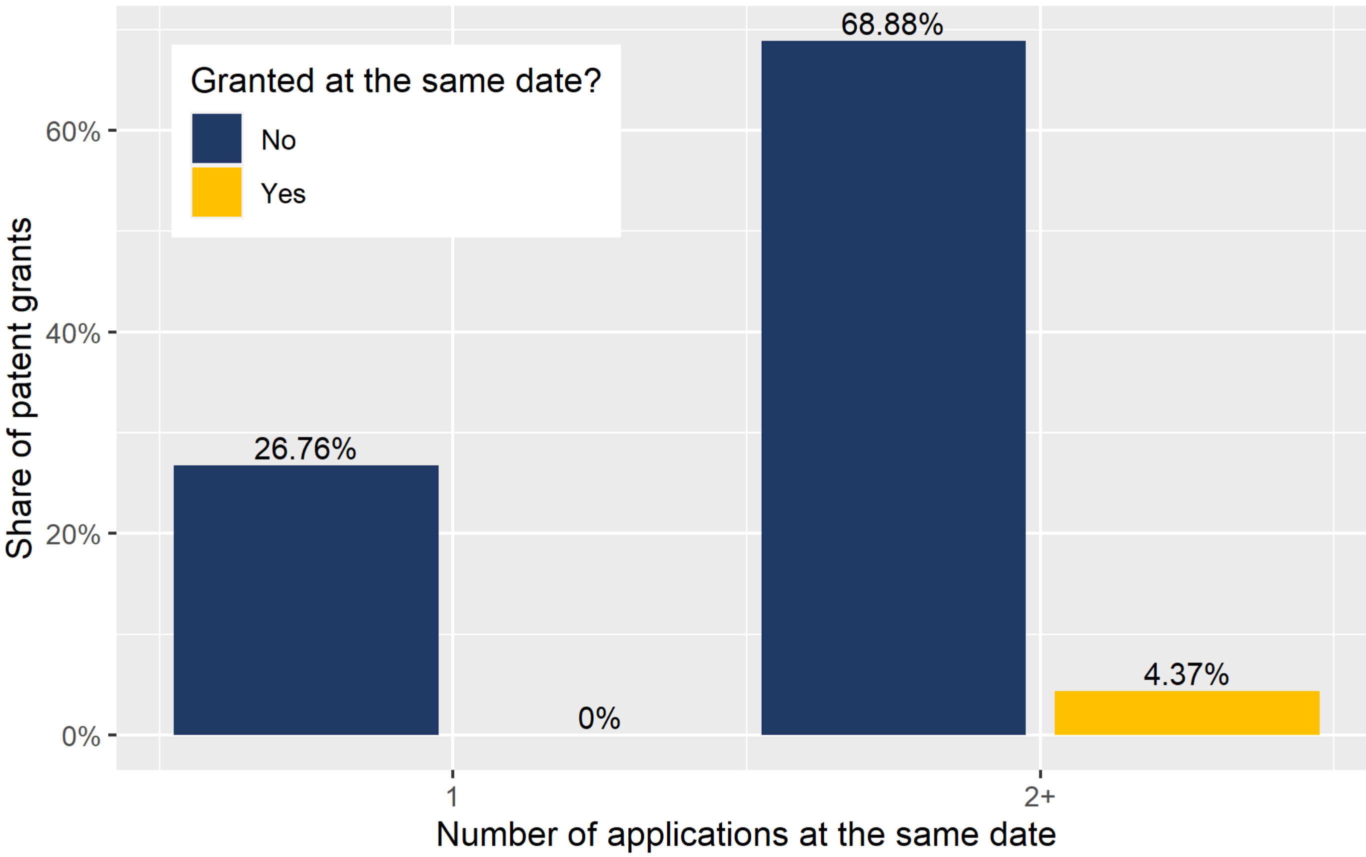
Simultaneous Information Releases and Capital Market Feedback

ONLINE APPENDIX

August 2022

Figure OA.1

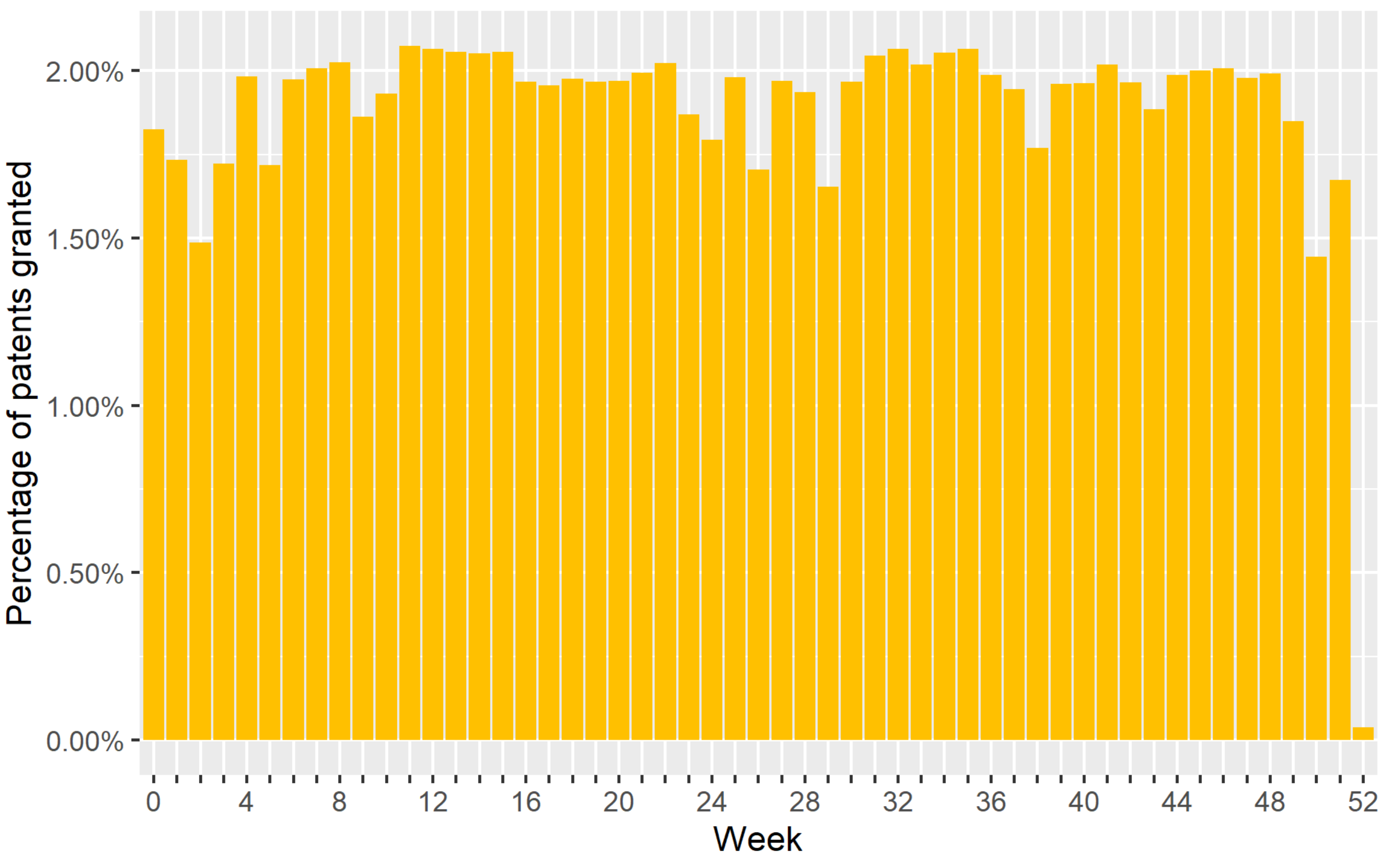
Clustering of Patents Filed and Granted on the Same Day



Notes: Figure OA.1 presents the percentage of concurrent patent applications that are also granted at the same time. By definition, the grant of a separately filed patent application never overlaps with the grant of a concurrently filed application. For those applications filed at the same day, the majority is granted on different days. Please see the paper for details regarding the sample selection.

Figure OA.2

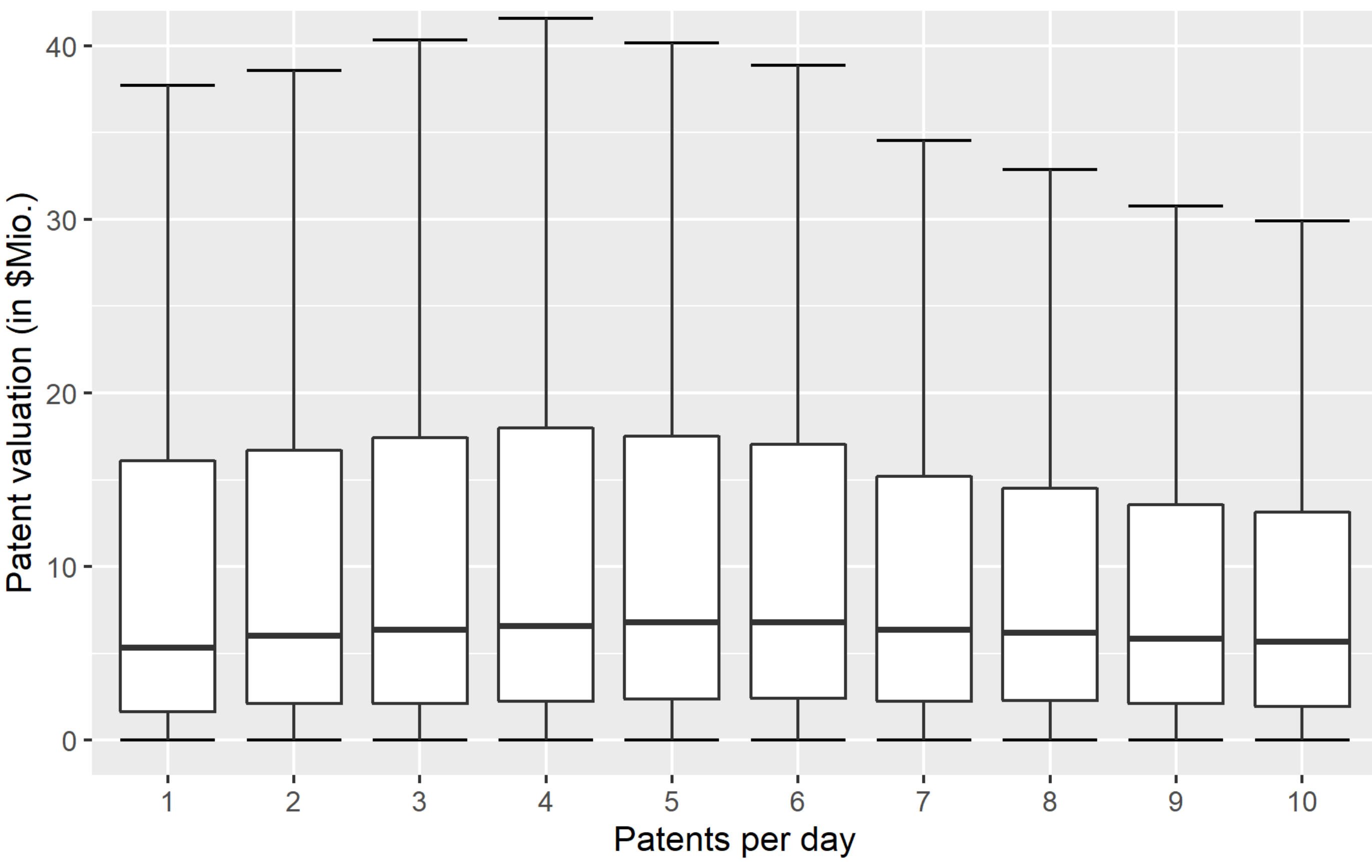
Distribution of Patent Grants across "Patent Tuesdays"



Notes: Figure OA.2 presents the average distribution of patent grants within our sample across weeks. Please see the paper for details regarding the sample selection.

Figure OA.3

Valuation by Number of Patent Grants



Notes: Figure OA.3 presents the distribution of patent valuations across firms and “Patent Tuesdays” grouped by the firm-specific number of patents issued on a given day. We limit the analysis to a maximum of 10 patent issued per day. Please see the paper for details regarding the sample selection and variable definitions.

Table OA.1

Notification of Allowance, Fee Payments, and the Timing of Patent Grants

Panel A: Additional sample restrictions

	#	#
Patent sample		1,964,350
less: Missing data in PatEx database	-978	1,963,372
less: Patent applications with duplicate events	-124,243	1,839,129
less: Missing event information	-564,036	1,275,093
less: Different patent issue date	-13	1,275,080
less: Extreme date differences (top/bottom 1%)	-59,362	1,215,718

Panel B: Descriptive statistics for timing differences

	N	Mean	SD	Min	P25	P50	P75	Max
Days between NOA and issue date	1,215,718	122.9	33.3	47	109	125	133	321
Days between NOA and fee payment	1,215,718	72.6	23.6	5	62	84	90	104
Days between fee payment and issue date	1,215,718	50.7	27.02	28	36	42	50	237
Patents issued on the same day for which also the fee was paid on the same day:								
Days with 2 patents issued	73,246	1.18	0.38	1	1	1	1	2
Days with 4 patents issued	45,475	1.47	0.76	1	1	1	2	4
Days with 6 patents issued	35,644	1.69	1.02	1	1	1	2	6
Days with 8 patents issued	29,972	1.97	1.33	1	1	1	2	8
Days with 10 patents issued	27,165	2.23	1.64	1	1	2	3	10
Difference in days between fee payments for patents issued on the same day:								
Days with 2 patents issued	73,246	13.87	27.71	0	0	3	12	199
Days with 4 patents issued	45,475	26.63	37.19	0	4	9	34	201
Days with 6 patents issued	35,644	34.56	41.73	0	7	15	48	204
Days with 8 patents issued	29,972	41.47	46.07	0	8	19	63	205
Days with 10 patents issued	27,165	46.56	48.44	0	9	24	74	208
Patents paid on the same day which are also issued on the same day:								
Days with 2 patent fees paid	158,076	1.48	0.50	1	1	1	2	2
Days with 4 patent fees paid	91,048	2.48	1.16	1	1	3	4	4
Days with 6 patent fees paid	63,360	3.46	1.80	1	2	4	5	6
Days with 8 patent fees paid	49,072	4.40	2.42	1	2	5	7	8
Days with 10 patent fees paid	37,270	5.31	3.00	1	2	6	8	10

Notes: Table OA.1 present additional sample restrictions (Panel A) as well as descriptive statistics for timing differences in patents' Notification of Allowance (NOA), applicants' fee payment, and the final issuance of the patent by the USPTO (Panel B). The initial sample includes all 1,964,350 patents from the regression sample. Information on events during the examination process is from the USPTO's Patent Examination Research Dataset (PatEx). The database includes all information that can be obtained from the "*Transaction History*" tab on USPTO's Public PAIR website.

Table OA.2

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making: Controlling for the Number of Simultaneous Applications

	log(1+Self-citations$_{PATENT,10y}$)					
	PATENT			*TECH*		
	(1)	(2)	(3)	(4)	(5)	(6)
Separate info release$_{PATENT}$	0.0032	-0.0082	-0.0157			
	(0.0179)	(0.0179)	(0.0179)			
log(Patent valuation)	0.0122**	0.0132**	0.0140**			
× Separate info release$_{PATENT}$	(0.0060)	(0.0061)	(0.0061)			
Separate info release$_{TECH}$				0.0020	0.0024	0.0010
				(0.0194)	(0.0193)	(0.0193)
log(Patent valuation)				0.0159**	0.0151**	0.0150**
× Separate info release$_{TECH}$				(0.0060)	(0.0059)	(0.0059)
log(Patent valuation)	0.0233***	0.0191***	0.0172***	0.0099	0.0104	0.0105
	(0.0065)	(0.0064)	(0.0063)	(0.0086)	(0.0086)	(0.0087)
Control variables						
log(Total assets)	-0.1115***	-0.0976***	-0.0898***	-0.0961***	-0.0868***	-0.0810***
	(0.0189)	(0.0188)	(0.0189)	(0.0189)	(0.0190)	(0.0192)
log(1+Age)	-0.0883***	-0.0845***	-0.0809***	-0.0849***	-0.0808***	-0.0770***
	(0.0262)	(0.0261)	(0.0259)	(0.0260)	(0.0260)	(0.0259)
ROA	-0.0703	-0.0712	-0.0705	-0.0595	-0.0643	-0.0654
	(0.0842)	(0.0834)	(0.0832)	(0.0849)	(0.0846)	(0.0846)
TobinsQ	0.0197***	0.0200***	0.0202***	0.0219***	0.0215***	0.0213***
	(0.0062)	(0.0062)	(0.0061)	(0.0059)	(0.0059)	(0.0059)
log(Turnover)	0.0071	0.0043	0.0030	0.0012	-2.1×10^{-5}	-0.0005
	(0.0089)	(0.0089)	(0.0090)	(0.0084)	(0.0084)	(0.0084)
PPE assets	-0.1580*	-0.1435*	-0.1356*	-0.1481*	-0.1354*	-0.1280*
	(0.0788)	(0.0775)	(0.0769)	(0.0764)	(0.0753)	(0.0746)
CAPEX assets	0.1624	0.1572	0.1513	0.2171	0.1977	0.1852
	(0.2259)	(0.2260)	(0.2264)	(0.2305)	(0.2305)	(0.2308)
R&D assets	-0.4337**	-0.3530*	-0.3077*	-0.3771**	-0.3179*	-0.2812
	(0.1930)	(0.1812)	(0.1765)	(0.1809)	(0.1732)	(0.1700)
Leverage	-0.1581***	-0.1659***	-0.1701***	-0.1599***	-0.1648***	-0.1677***
	(0.0584)	(0.0576)	(0.0573)	(0.0566)	(0.0559)	(0.0556)
Innovative specificity	-0.0504***	-0.0500***	-0.0496***	-0.0505***	-0.0501***	-0.0498***
	(0.0072)	(0.0072)	(0.0072)	(0.0073)	(0.0073)	(0.0072)
Explorativeness	-0.0677***	-0.0681***	-0.0686***	-0.0678***	-0.0682***	-0.0687***
	(0.0121)	(0.0122)	(0.0122)	(0.0121)	(0.0122)	(0.0122)
log(Weekly number of filed patents)	0.0070**			0.0089***		
	(0.0034)			(0.0029)		
log(Quarterly number of filed patents)		-0.0268***			-0.0242***	
		(0.0060)			(0.0052)	
log(Yearly number of filed patents)			-0.0434***			-0.0408***
			(0.0076)			(0.0066)
Firm × Tech class FE	Yes	Yes	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of patents FE	No	No	No	Yes	Yes	Yes
Observations	1,964,350	1,964,350	1,964,350	1,964,350	1,964,350	1,964,350
Adjusted R^2	0.28531	0.28555	0.28582	0.28558	0.28575	0.28599

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table OA.3

Single Patent Releases and Simultaneous Major Events

	$\log(1+\text{Self-citations}_{PATENT,10y})$
	(1)
log(Patent valuation)	0.0377***
	(0.0087)
Selected major event	0.0245
	(0.0165)
log(Patent valuation)× Selected major event	-0.0120**
	(0.0056)
Control variables	
log(Total assets)	-0.0550***
	(0.0144)
log(1+Age)	-0.2074***
	(0.0163)
ROA	-0.0272
	(0.0650)
TobinsQ	0.0186***
	(0.0055)
log(Turnover)	-0.0028
	(0.0077)
PPE assets	-0.2354***
	(0.0774)
CAPEX assets	0.3312**
	(0.1575)
R&D assets	0.0631
	(0.1300)
Leverage	-0.1263***
	(0.0400)
Innovative specificity	-0.0510***
	(0.0092)
Explorativeness	-0.0620***
	(0.0103)
Firm FE	Yes
Tech class × Date FE	Yes
Industry SIC2 × Year FE	Yes
Observations	236,575
Adjusted R^2	0.23580

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Table OA.3

(Continued)

Notes: Table OA.3 presents the results for estimating the main specification using the sample of single patent release days and simultaneous major events. We use the Capital IQ Key Developments database and include the following events to construct our alternative treatment variable *Selected major event*: Announcements of Earnings (28), Earnings Calls (48), Delayed Earnings Announcements (61), Corporate Guidance - Lowered (26), Corporate Guidance - Raised (27), Guidance/Update Calls (49), Corporate Guidance - New/Confirmed (29), Product-Related Announcements (41), Labor-related Announcements (44), M&A Calls (52), M&A Transaction Announcements (80), M&A Transaction Closings (81), M&A Transaction Cancellations (82), Regulatory Authority - Regulations (205), Regulatory Authority - Compliance (206), Regulatory Authority - Enforcement Actions (207), Executive Changes - CEO (101), Executive Changes - CFO (102), Special Dividend Announced (94), Dividend Affirmations (45), Dividend Increases (46), Dividend Decreases (47), Dividend Cancellation (213), Dividend Initiation (214), Preferred Dividend (215), Operating Results Release Date (219), Operating Results Calls (221), Announcement of Operating Results (226), Seeking to Sell/Divest (1), Seeking Acquisitions/Investments (3), Seeking Financing/Partners (5), Strategic Alliances (22). The variable *Selected major event* takes the value of one if at least one of these events occurred on the grant date, and zero otherwise. We use a sample of patents that are granted alone to rule out that our results are driven by simultaneous patent grants. In addition, we cut the sample at 2019-12-07 due to data availability. The table presents two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table OA.4

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making: Adjusted Patent Valuations

	log(1+Self-citations$_{PATENT,10y}$)					
	Lower valuation			Higher valuation		
	-1%	-0.5%	-0.1%	+1%	+0.5%	+0.1%
	(1)	(2)	(3)	(4)	(5)	(6)
log(Patent valuation$_{-1\%}$)	0.0184***					
	(0.0055)					
log(Patent valuation$_{-1\%}$) × Separate info release$_{PATENT}$	0.0141**					
	(0.0059)					
log(Patent valuation$_{-0.5\%}$)		0.0093*				
		(0.0053)				
log(Patent valuation$_{-0.5\%}$) × Separate info release$_{PATENT}$		0.0178***				
		(0.0058)				
log(Patent valuation$_{-0.1\%}$)			0.0219***			
			(0.0064)			
log(Patent valuation$_{-0.1\%}$) × Separate info release$_{PATENT}$			0.0127**			
			(0.0060)			
log(Patent valuation$_{+1\%}$)				0.0234***		
				(0.0072)		
log(Patent valuation$_{+1\%}$) × Separate info release$_{PATENT}$				0.0115*		
				(0.0061)		
log(Patent valuation$_{+0.5\%}$)					0.0233***	
					(0.0069)	
log(Patent valuation$_{+0.5\%}$) × Separate info release$_{PATENT}$					0.0118*	
					(0.0061)	
log(Patent valuation$_{+0.1\%}$)						0.0227***
						(0.0067)
log(Patent valuation$_{+0.1\%}$) × Separate info release$_{PATENT}$						0.0122**
						(0.0061)
Separate info release$_{PATENT}$	0.0034	0.0146	0.0022	0.0039	0.0027	0.0020
	(0.0181)	(0.0181)	(0.0180)	(0.0182)	(0.0181)	(0.0180)
Control variables						
log(Total assets)	-0.1044***	-0.1026***	-0.1089***	-0.1100***	-0.1098***	-0.1094***
	(0.0187)	(0.0188)	(0.0190)	(0.0190)	(0.0190)	(0.0190)
log(1+Age)	-0.0811***	-0.0880***	-0.0882***	-0.0871***	-0.0875***	-0.0879***
	(0.0263)	(0.0260)	(0.0262)	(0.0261)	(0.0261)	(0.0262)
ROA	-0.0763	-0.0525	-0.0699	-0.0714	-0.0716	-0.0710
	(0.0851)	(0.0826)	(0.0839)	(0.0846)	(0.0844)	(0.0842)
TobinsQ	0.0215***	0.0228***	0.0198***	0.0196***	0.0196***	0.0197***
	(0.0061)	(0.0062)	(0.0062)	(0.0062)	(0.0062)	(0.0062)
log(Turnover)	0.0055	0.0047	0.0064	0.0068	0.0067	0.0066
	(0.0091)	(0.0089)	(0.0090)	(0.0090)	(0.0090)	(0.0090)

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Table OA.4

(Continued)

	log(1+Self-citations$_{PATENT,10y}$)					
	Lower valuation			Higher valuation		
	-1%	-0.5%	-0.1%	+1%	+0.5%	+0.1%
	(1)	(2)	(3)	(4)	(5)	(6)
PPE assets	-0.1327*	-0.1707**	-0.1556*	-0.1573*	-0.1560*	-0.1553*
	(0.0776)	(0.0802)	(0.0787)	(0.0787)	(0.0786)	(0.0786)
CAPEX assets	0.1655	0.2049	0.1653	0.1620	0.1619	0.1631
	(0.2190)	(0.2275)	(0.2257)	(0.2270)	(0.2264)	(0.2259)
R&D assets	-0.4360**	-0.4142**	-0.4196**	-0.4272**	-0.4244**	-0.4215**
	(0.1963)	(0.1954)	(0.1933)	(0.1946)	(0.1941)	(0.1936)
Leverage	-0.1573***	-0.1633***	-0.1598***	-0.1579***	-0.1584***	-0.1592***
	(0.0573)	(0.0587)	(0.0583)	(0.0583)	(0.0583)	(0.0583)
Innovative specificity	-0.0521***	-0.0505***	-0.0504***	-0.0504***	-0.0504***	-0.0504***
	(0.0069)	(0.0072)	(0.0072)	(0.0072)	(0.0072)	(0.0072)
Explorativeness	-0.0698***	-0.0676***	-0.0677***	-0.0676***	-0.0676***	-0.0677***
	(0.0129)	(0.0121)	(0.0121)	(0.0121)	(0.0121)	(0.0121)
Firm × Tech class FE	Yes	Yes	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,887,259	1,964,350	1,964,350	1,964,350	1,964,350	1,964,350
Adjusted R^2	0.28709	0.28513	0.28526	0.28525	0.28526	0.28527

Notes: Table OA.4 presents the results for adjusted measures of patent valuations. Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table OA.5

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making: Alternative Clustering

	log(1+Self-citations$_{PATENT,10y}$)			
	$PATENT$		$TECH$	
	Firm (1)	Firm & Date (2)	Firm (3)	Firm & Date (4)
Separate info release$_{PATENT}$	0.0021	0.0021		
	(0.0174)	(0.0192)		
log(Patent valuation) × Separate info release$_{PATENT}$	0.0124**	0.0124**		
	(0.0057)	(0.0062)		
Separate info release$_{TECH}$			0.0027	0.0027
			(0.0159)	(0.0169)
log(Patent valuation) × Separate info release$_{TECH}$			0.0156***	0.0156**
			(0.0059)	(0.0065)
log(Patent valuation)	0.0224***	0.0224***	0.0100	0.0100
	(0.0053)	(0.0059)	(0.0076)	(0.0083)
Control variables				
log(Total assets)	-0.1092***	-0.1092***	-0.0943***	-0.0943***
	(0.0166)	(0.0183)	(0.0166)	(0.0183)
log(1+Age)	-0.0881***	-0.0881***	-0.0844***	-0.0844***
	(0.0264)	(0.0292)	(0.0263)	(0.0291)
ROA	-0.0706	-0.0706	-0.0608	-0.0608
	(0.0795)	(0.0878)	(0.0797)	(0.0880)
TobinsQ	0.0197***	0.0197***	0.0218***	0.0218***
	(0.0058)	(0.0064)	(0.0056)	(0.0062)
log(Turnover)	0.0065	0.0065	0.0009	0.0009
	(0.0091)	(0.0101)	(0.0086)	(0.0095)
PPE assets	-0.1553**	-0.1553*	-0.1451**	-0.1451*
	(0.0749)	(0.0825)	(0.0729)	(0.0803)
CAPEX assets	0.1639	0.1639	0.2147	0.2147
	(0.2309)	(0.2555)	(0.2362)	(0.2615)
R&D assets	-0.4206**	-0.4206**	-0.3654**	-0.3654*
	(0.1882)	(0.2080)	(0.1740)	(0.1922)
Leverage	-0.1595***	-0.1595***	-0.1609***	-0.1609***
	(0.0532)	(0.0587)	(0.0519)	(0.0573)
Innovative specificity	-0.0504***	-0.0504***	-0.0505***	-0.0505***
	(0.0066)	(0.0072)	(0.0066)	(0.0073)
Explorativeness	-0.0677***	-0.0677***	-0.0678***	-0.0678***
	(0.0093)	(0.0102)	(0.0093)	(0.0102)
Firm × Tech class FE	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes
Number of patents FE	No	No	Yes	Yes
Observations	1,964,350	1,964,350	1,964,350	1,964,350
Adjusted R^2	0.28527	0.28527	0.28552	0.28552

Notes: Standard errors in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.

Table OA.6

Simultaneous Information Releases and the Informativeness of Market Prices for Corporate Decision Making: Alternative Citation Horizons

	log(1+Self-citations$_{PATENT,Y}$)					
	PATENT			*TECH*		
	3y	5y	all	3y	5y	all
	(1)	(2)	(3)	(4)	(5)	(6)
Separate info release$_{PATENT}$	-0.0227	-0.0160	-0.0176			
	(0.0136)	(0.0160)	(0.0190)			
log(Patent valuation)	0.0090**	0.0112**	0.0168**			
× Separate info release$_{PATENT}$	(0.0043)	(0.0052)	(0.0064)			
Separate info release$_{TECH}$				-0.0068	-0.0044	0.0022
				(0.0127)	(0.0156)	(0.0208)
log(Patent valuation)				0.0106**	0.0137***	0.0193***
× Separate info release$_{TECH}$				(0.0041)	(0.0050)	(0.0063)
log(Patent valuation)	0.0189***	0.0219***	0.0267***	0.0128**	0.0125*	0.0155
	(0.0050)	(0.0059)	(0.0067)	(0.0062)	(0.0074)	(0.0093)
Control variables						
log(Total assets)	-0.0439***	-0.0698***	-0.1199***	-0.0352***	-0.0575***	-0.1061***
	(0.0115)	(0.0144)	(0.0205)	(0.0122)	(0.0151)	(0.0199)
log(1+Age)	-0.0799***	-0.0927***	-0.1053***	-0.0763***	-0.0887***	-0.1009***
	(0.0172)	(0.0216)	(0.0279)	(0.0171)	(0.0214)	(0.0278)
ROA	-0.0374	-0.0465	-0.0984	-0.0355	-0.0416	-0.0902
	(0.0574)	(0.0728)	(0.0801)	(0.0585)	(0.0739)	(0.0805)
TobinsQ	0.0140***	0.0185***	0.0166**	0.0151***	0.0201***	0.0188***
	(0.0047)	(0.0057)	(0.0065)	(0.0043)	(0.0053)	(0.0063)
log(Turnover)	0.0006	0.0020	0.0016	-0.0031	-0.0029	-0.0038
	(0.0063)	(0.0077)	(0.0092)	(0.0060)	(0.0073)	(0.0087)
PPE assets	-0.0479	-0.0948	-0.1050	-0.0365	-0.0818	-0.0899
	(0.0625)	(0.0715)	(0.0847)	(0.0614)	(0.0696)	(0.0838)
CAPEX assets	0.0798	0.1130	0.1690	0.1090	0.1545	0.2136
	(0.1551)	(0.1832)	(0.2303)	(0.1594)	(0.1881)	(0.2354)
R&D assets	-0.2728**	-0.3656**	-0.4374**	-0.2441**	-0.3231**	-0.3887**
	(0.1253)	(0.1605)	(0.2067)	(0.1200)	(0.1509)	(0.1923)
Leverage	-0.1299***	-0.1541***	-0.2129***	-0.1292***	-0.1540***	-0.2138***
	(0.0411)	(0.0512)	(0.0624)	(0.0395)	(0.0493)	(0.0617)
Innovative specificity	-0.0425***	-0.0475***	-0.0798***	-0.0426***	-0.0476***	-0.0798***
	(0.0054)	(0.0064)	(0.0093)	(0.0055)	(0.0064)	(0.0093)
Explorativeness	-0.0510***	-0.0597***	-0.0918***	-0.0511***	-0.0598***	-0.0919***
	(0.0079)	(0.0099)	(0.0132)	(0.0080)	(0.0099)	(0.0132)
Firm × Tech class FE	Yes	Yes	Yes	Yes	Yes	Yes
Tech class × Date FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry SIC2 × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Number of patents FE	No	No	No	Yes	Yes	Yes
Observations	1,964,350	1,964,350	1,964,350	1,964,350	1,964,350	1,964,350
Adjusted R^2	0.18406	0.22732	0.30876	0.18433	0.22764	0.30894

Notes: Two-way clustered standard errors by firm and year in parentheses. $*$, $**$, and $***$ represent significance at the 10 percent, 5 percent, and 1 percent level, respectively. Please refer to Appendix A for a full description of all variables.