

# **Whistleblowers in the Board: The Role of Independent Directors in Prosecuting Cartels**

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Stock market reactions to news of cartel prosecutions are muted when indicted firms have a high proportion of independent directors serving on their boards. This finding is robust to checks concerning self-selection and survives several falsification tests. The relation between market reactions to cartel prosecution and board independence are particularly pronounced when independent directors hold more outside directorships and fewer stock options in the indicted firms — when they have lower incentives to collaborate with price-fixing schemes. We corroborate our inferences about directors' incentives showing that, after prosecution, independent directors serving on cartel firms are penalized by losing board seats and vote support across their directorships in other firms. Consistent with those directors taking actions that mitigate personal costs from prosecution, we also find that firms with a higher proportion of independent directors are more likely to cooperate with antitrust authorities, to experience director turnover prior to news of prosecution, and to replace the CEO after such news. Our results show that cartel prosecution imposes significant personal costs onto independent directors and that they take measurable actions to reduce those costs. Understanding these incentives is key for antitrust authorities in designing strategies for cartel prosecution.

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## 1. Introduction

Price-fixing cartel schemes are detrimental to a well-functioning economy as they enable colluding firms to secretly extract extraordinary, noncompetitive rents from the public. The magnitude of this problem is substantial and has been growing in an ever more globalized economy. The estimated volume of sales attributable to price-fixing cartels prosecuted between 1990 and 2013 surpasses \$1.5 trillion, with “overcharges” reaching, on average, over 20% of observed prices (Connor and Bolotova, 2006). The widespread and pervasive nature of cartel activity around the world is evidenced by the more than 7,000 companies named in 717 international cartel convictions in 70 different countries between 1990 and 2013 (Connor, 2014).

Antitrust enforcement actions have increased after the wave of price-fixing scandals of the late-1990s.<sup>1</sup> They have gained renewed attention in recent years following the public outrage over price manipulation cases involving the auto parts industry and the setting of the LIBOR rate.<sup>2</sup> The data on cartel prosecution compiled in Figure 1 depicts this trend: While less than 80 cartels were prosecuted per year before 2005, more than 120 were indicted annually between 2005 and 2011. The total fines per year increased from less than \$2 billion to more than \$7 billion over the same period. Notably, an increasing number of cartels have been uncovered through applications to leniency programs.<sup>3</sup>

[Figure 1 About Here]

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<sup>1</sup> High-profile cases include the lysine pricing scandal involving ADM and the auction price conspiracy involving Sotheby's and Christie's.

<sup>2</sup> As of 2014, the US Department of Justice investigation into price fixing in the auto parts industry has resulted in charges against 26 companies and more than \$2 billion in criminal fines. The LIBOR investigation included 16 global banks: including J.P. Morgan, Citigroup, HSBC, and UBS. Banks indicted in the LIBOR scandal have received fines in excess of \$6 billion dollars.

<sup>3</sup> A leniency program defines rules for granting reductions in penalties to firms or individuals that self-report participation in cartel activities and cooperate in the investigation of the enforcement authorities.

Despite the recent emphasis on antitrust enforcement, regulators disagree on how to implement policies aimed at the detection and successful prosecution of cartels. The policy debate has focused on the use of more significant individual penalties — penalties imposed on executives and directors as opposed to firms — and on the deterrent effect of civil, criminal, and even market-based sanctions. The lack of consensus around cartel prosecution policies is evidenced by significant cross-country differences in the regulatory framework.<sup>4</sup> This is an area where research is much needed and academic work can help guide more effective and uniform antitrust policies around a more integrated world economy.

Our paper contributes to the design of optimal cartel discovery policies. It does so by putting a spotlight on the role played by independent directors on cartel prosecutions, before and after investigations come to light. We show how the success of cartel detection and prosecution is affected by the degree of corporate *board independence*; that is, the extent to which board members have limited (economic) ties to the firm. Our hypotheses are grounded on theoretical work on antitrust regulation suggesting that corporate governance affects optimal law enforcement against cartels (see, e.g., Buccirosi and Spagnolo, 2008). Firms can be seen as the nexus of contracts among several individuals with potentially different objectives. Although agency problems stemming from individuals' self-interest can lead to undesirable behaviors, they can also be used by regulatory authorities. We posit that the misalignment of objectives of managers and directors — officials in the same organization — is a powerful friction for antitrust regulators to exploit in prosecutions.<sup>5</sup> As regulation is used as a tool to shape the board

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<sup>4</sup> A key difference between European and US antitrust laws is that the US legislation contemplates criminal sanctions not only for corporations but also for individuals. This discrepancy has created difficulties for the joint prosecution of cartels operating across those two jurisdictions.

<sup>5</sup> Prior papers have only looked at frictions amongst managers of the different firms involved in cartel (see Motta and Polo, 2003; Aubert, Rey, and Kovacic, 2006).

directorship of public corporations, we show additional positive externalities to the principle of requiring firms to have independent directors.

Managers and directors' preferences towards engaging in cartel activity differ significantly. Unlike managers, directors derive limited gains (at best) from price-fixing schemes as their equity holdings and other monetary interests in the firm are generally far less convex than those of managers. Involvement in cartel scandals, however, can bring significant costs for directors. First, because boards are legally responsible for overseeing managerial misconduct, directors may share in the legal liability stemming from cartel prosecution.<sup>6</sup> But the reputational and personal wealth costs associated with cartel involvement are likely to weigh even higher on directors' objective function. This is especially true for those directors that serve on multiple corporate boards, as the reputational damage from cartel involvement may extend onto their other directorships. As such, professional independent directors may have stronger incentives than managers to distance themselves from a cartel or to cooperate with antitrust authorities.

It is also possible, however, that directors are not significantly affected by cartel prosecution. Arguably, the involvement of directors in the price-fixing schemes can be more difficult to verify in court than the involvement of managers. Managers have explicit decision-making powers and prosecutors have an easier time investigating those company officials with active wrongdoing. Additionally, unlike financial reporting or the design of executive compensation contracts, the detection of price-fixing activities is not a specific task of any board committee, so monitoring responsibilities are diluted across many actors in the firm. Notably,

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<sup>6</sup> In a number of jurisdictions, cartel-related individual sanctions include both monetary fines and imprisonment. In the US, while cartel-related individual monetary fines have remained relatively constant overtime, the number of imprisoned individuals and the magnitude of the prison terms have increased. On average, 31 individuals per year have been sent to jail for cartel participation US between 2009 and 2013 (up 50% from just a few years before). The average prison term imposed to managers and directors involved in cartel investigations jumped to 2 years between 2009 and 2013 (up from 8 months in the 1990's).

shareholders, too, could be tolerant towards price-fixing — after all, if undetected, price fixing generates large profits for shareholders. Whether the incentives generated by cartel collusion are significant enough to induce directors to take action — either in helping perpetrating cartels or denouncing them — and whether their induced behavior ultimately benefits or hurts shareholders is an open question.

We conduct a series of tests on the link between the presence of independent directors in boards and outcomes associated with cartel prosecutions using a comprehensive set of companies indicted by antitrust authorities in the US between 2002 and 2012. We first analyze the market reaction to cartel prosecutions. In particular, we model abnormal returns to cartel indictments and other antitrust rulings as a function of the proportion of independent directors at the firms cited. We find that the presence of independent directors reduces the cost of cartel prosecution to shareholders. Firms with larger proportions of independent directors on their boards observe significantly smaller value losses in cartel-busting episodes. The magnitude of the variation in equity returns is substantial. In multivariate tests, we find that a one-standard deviation change in director independence is associated with an increase of nearly 100 basis points in average daily returns around announcements involving cartel investigations and indictments.

The finding that losses to shareholders around cartel prosecution news are modulated by the fraction of independent directors on company boards is robust to a number of checks. Results become even stronger when we, for example, use a Heckman test to shore up our tests against potential selection bias in our sample of prosecuted firms. To test whether omitted factors related to board independence could be confounding our results, we simulate “placebo prosecution dates” with which we estimate models that emulate our base specification. These tests show that the positive effect of board independence on equity returns are only observed

when antitrust authorities make announcements concerning cartel prosecutions. Indeed, the very make up of board independence of prosecuted firms is indistinguishable from that of the underlying industry-year population from which those firms are drawn. Beyond tests performed on *de facto* persecuted firms, we also explore the effect of prosecution on unprosecuted peer firms (for example, firms operating in the same industry of the indicted firm). Similar to our tests on prosecuted firms, we find that when the *expected probability* of prosecution increases, unprosecuted firms also experience abnormal returns that are positively correlated with the percentage of independent directors on the board. The evidence suggests that our inferences are not specific to our sample of prosecuted firms.

We further our interpretation of the role played by independent directors in cartel prosecutions by examining whether the association between stock returns and the presence of independent directors is motivated by the potential personal costs associated with public persecutions. We find that losses from cartel indictments are lower when directors have a higher number of directorship appointments outside of the indicted firms. Those losses are also lower when outside directors have fewer stock options (lower economic incentives to take on risk).

We corroborate our inferences by examining the consequences of cartel indictments for individual directors. Our analysis shows that, after prosecution announcements, directors of firms involved in cartels depart from a significant number of directorships *in other firms*. Even when they do not lose their positions, they lose voting support across their portfolio of outside directorships. We go a step further and find that directors involved in cartels suffer large personal wealth losses associated with their portfolios of outside directorships.

To better understand the patterns documented, we examine three additional dynamics that take place around cartel prosecutions. The first concerns leniency application, a unique provision

of antitrust regulation often exploited by board members to avoid the costs of prosecution.<sup>7</sup> In particular, we examine the association between the probability of applying for leniency and the presence of independent directors on the board. We find that firms with a higher proportion of independent directors are more likely to apply for leniency in cartel prosecutions. Second, consistent with the notion that directors act preemptively on the threat of cartel formation and prosecution, we show evidence that a significant number of independent directors depart from prosecuted firms in the months anteceding the announcement of the prosecution. Finally, we find that firms with a higher proportion of independent directors are more likely to replace the CEO following prosecution announcements.

In all, our results are consistent with the idea that cartel prosecution bears significant costs for independent directors and that those directors take ex-ante and ex-post actions to mitigate their personal losses. Our analysis details the various market-based sanctions imposed onto independent directors involved in price-fixing scandals. Our study suggests that these sanctions can be used to inform and rationalize regulatory choices around antitrust enforcement.

Our paper contributes to several strands of literature. First, it extends prior work on the effect of fraudulent activities on directors' reputation (e.g., Agrawal, Jaffe, and Karpoff, 1999; and Ertimur, Ferri and Maber, 2012). The analysis of price-fixing differs from that on securities fraud in several dimensions, nonetheless. As suggested by Figure 2, cartel prosecution is associated with much larger market losses and thus provides a potentially more powerful setting

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<sup>7</sup> Board members can single-handedly initiate investigations that eventually result in leniency applications. For example, in 2009 Tecumseh Products — a large producer of refrigerant compressors — applied for leniency in a number of jurisdictions (US, EU, and Brazil) after an internal investigation directed by its board of directors uncovered the participation of managers in price-fixing dealings. The firm's audit committee was comprised entirely of independent directors, each with multiple assignments in other firms. Half of those directors resigned as news about the firm's involvement became public.

to observe the effect of director's incentives. This is particularly important considering that prior literature is inconclusive on whether reputational incentives are strong enough to prevent fraud.

[Figure 2 About Here]

Our work has also clear links with the literature on board composition and independence (see, e.g., Hermalin and Weisbach, 2003). Prior research has uncovered factors that adversely affect directors' ability to provide monitoring services, such as the number of directors on the board (Yermack, 1996), their other directorships (Fich and Shivdasani, 2006), and their connections to the CEO (Hwang and Kim, 2009). Our results deepen the understanding of the role of reputation in enhancing a director's monitoring incentives. To our knowledge, no other study examines incentives arising from cartel prosecution and how these incentives affect director's actions.

Finally, our findings are also related to the nascent literature on the efficacy of whistle-blowing programs. Dyck, Morse and Zingales (2010) and Bowen, Call, and Rajgopal (2010) document that whistle blowing by employees plays a significant role on fraud detection and is mainly driven by monetary rather than reputational incentives. We contribute to this literature by providing evidence on the effect of director's reputational incentives to participate in leniency programs.

The remainder of the paper proceeds as follows. Section 2 provides background on cartel enforcement. Section 3 describes the sample and the key variables used in this study. We analyze stock market reactions to cartel discovery in Section 4. The consequences of cartel prosecution for individual directors are presented in Section 5. Section 6 presents our analysis of director behavior around cartel prosecution. Section 7 concludes.

## 2. Background on Cartel Prosecution

The first formal cartel investigations in the US took place after the introduction of the Sherman Act of 1890. Subsequent legislation has shaped the role and scope of action of antitrust authorities.<sup>8</sup> In Europe, antitrust regulatory efforts started in 1958 with the Treaty of Rome, which set the basis for the competition policy of the EU. Antitrust actions have increased dramatically in recent years both in the US and in the EU. A recent surge in cartel prosecution activity has been preceded by an increase in the penalties associated with price-fixing and the introduction of leniency programs.

Regarding penalties, the US introduced the Antitrust Criminal Penalty Enhancement and Reform Act (ACPERA) in 2004. ACPERA increased the maximum corporate fine to \$100 million, the maximum individual fine to \$1 million, and the maximum prison term to 10 years. In the EU, antitrust fines were substantially revised in 2006.

Leniency programs define rules for granting reductions in penalties to firms or individuals that step forward to self-report participation in cartel activities and provide active cooperation in investigations conducted by enforcement authorities. In the US, the Corporate Leniency Program was introduced in 1978 and revised in 1993 to grant full amnesty to the first informant firm. The program was amended in 1994 to grant amnesty to individuals, and in 1999 to decrease penalties in exchange for information about other cartels in which investigated firms were involved. In Europe, leniency programs were introduced in 1996 and revised in 2002 and 2006.

The theoretical literature on antitrust highlights the trade-offs faced by the regulation of cartel prosecution. Some authors suggest that leniency programs can be an effective cartel deterrence tool as the possibility of applying for leniency exacerbates conflicts of interests

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<sup>8</sup> The Sherman Act was followed by the Clayton Act (1914), the Robinson-Patman Act (1936), and the Celler-Kefauver (1950).

amongst managers of colluding firms, making their coalition less sustainable (see, e.g., Aubert, Rey, and Kovacic, 2006; Harrington, 2008). Motta and Polo (2003), on the other hand, argue that because firms can obtain lower fines from cooperation with antitrust prosecutors, the existence of a leniency program reduces the expected costs of cartel involvement. Moreover, Spagnolo (2004) argues that the existence of a leniency program may stabilize collusive arrangements if used strategically by cartel members to punish deviations from their agreement.

The economics literature also proposes that corporate governance is likely to play a role in cartel activity since joining a cartel is typically decided at the very top of a firm's hierarchy. Prior studies posit that certain corporate governance structures and managerial compensation schemes may facilitate collusive agreements (see, e.g., Harrington, 2006; Buccirosi and Spagnolo, 2008). From an empirical perspective, however, the role of governance on cartel activity is understudied.<sup>9</sup> To our knowledge, no prior study empirically examines how the incentives of different firm officials shape the prosecution of cartel schemes.

### **3. Data and Variable Construction**

An international cartel is defined as a conspiracy in restraint of trade that has one or more corporate or individual participants with headquarters, residency, or nationality outside the jurisdiction of the investigating antitrust authority (see DOJ, 2013; Connor, 2014). Our analysis is based on data from the Private International Cartel (PIC) database.<sup>10</sup> The PIC database contains information on all cartels discovered anywhere in the world from January 1990 to 2012.

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<sup>9</sup> Artiga González, Schmid and Yermack (2013) document a number of empirical regularities suggesting that cartel firms use financial reporting and corporate governance strategies to hide their fraudulent behavior. Goncharov and Peter (2014) study the effect of financial reporting transparency on industry coordination.

<sup>10</sup> The term "private cartels" is often used in the antitrust literature to differentiate illegal price-fixing schemes from ("public") price agreements protected by government sovereignty or by international treaties such as the Organization of Oil Exporting Countries.

The dataset includes a total of 717 convicted cartels, with 7,238 named firms. The data include each firm's name, country of incorporation, the markets and locations where collusion took place, the duration of the collusive agreement, the imposed fines, and whether the firm was granted amnesty under a plea deal. PIC also contains information on the "key dates" of the prosecution process: 1) the date when a cartel investigation is first publicly revealed, and 2) the date on which penalties are publicly announced. Information on these prosecutor dates are collected from press releases of antitrust authorities, such as the US Department of Justice, the Canadian Competition Bureau, the European Commission, and other national authorities with active anti-cartel programs. They are supplemented with data from business newspapers, trade magazines, and news services.

We select firms headquartered in the US with non-missing Compustat and CRSP data. Because our tests require detailed data on board characteristics, we also impose that the firms are covered by Equilar.<sup>11</sup> These requirements result in a sample of 191 American public firms involved in 199 cartels prosecuted by 41 antitrust authorities from 2002 to 2012. Some sample firms are prosecuted for more than one cartel and/or in different jurisdictions. Moreover, for a given firm-cartel-jurisdiction observation we consider both the first announcement of the prosecution and the announcement of the penalties imposed. Thus, the number of observations in our tests differ according to the level of analysis. Specifically, our sample includes 373 firm-cartel observations, 519 firm-year observations, 585 firm-cartel-jurisdiction observations, and a total of 1,028 announcements.

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<sup>11</sup> The Equilar database provides board composition data collected from annual proxy filings (DEF 14A) with the SEC. The database covers a large number of firms starting from fiscal year 2001.

Table 1 presents descriptive statistics for the firms and cartels included in the sample. Panel A shows that the sample firms cover a wide range of industries with a relatively high representation of producers of chemicals and allied products, consumer durables, manufacturing, and financial firms.

[Table 1 About Here]

Panel B presents statistics of the following characteristics of the sample firms: *Size* is the natural logarithm of the firm's market value, *BM* is the firm's book-to-market ratio, *Past\_Return* is the firm's market-adjusted return (measured over one year prior to the cartel announcement date), *ROA* is the firm's return on assets, computed as operating income before depreciation scaled by total assets, *Leverage* is the leverage ratio of the firm, computed as total debt scaled by total assets, and *Volatility* is the market-adjusted stock return volatility of the firm measured in the one year prior to the announcement of cartel prosecution.

Not surprisingly, cartel firms tend to be large. The mean (median) market capitalization of cartel firms is 43,574 (10,774) million dollars, while the mean (median) market capitalization of the firms in the CRSP-Compustat universe is 2,794 (275) million dollars. Panel B also shows that the cartel firms have relatively low book-to-market ratios and are comparatively more profitable, but not riskier than the typical firm in the CRSP-Compustat universe. These characteristics are consistent with the notion that, prior to cartel prosecution, the sample firms had been extracting rents from price-fixing.

Panel B also presents statistics for several governance characteristics of the cartel firms. *Independent\_Directors* is the number of independent directors scaled by the total number of directors. *Chair\_Insider* equals one if the chair of the board also holds an executive position, and zero otherwise. *Staggered* equals one if the corporate directors have staggered terms, zero

otherwise. *Busy\_Directors* is the number of outside directors who serve simultaneously on at least two boards scaled by the total number of directors. *Age\_69* is the number of outside directors who are at least 69 years old scaled by the total number of directors.

*Indep\_Director\_Holdings* is the number of shares held by outside directors scaled by the total number of shares outstanding. *Institutional\_Holdings* is the number of shares owned by institutions scaled by the total number of shares.<sup>12</sup>

Summary statistics suggest that the sample firms have a high proportion of independent directors (more on this below). Panel B also suggests that sample firms are widely held; the mean (median) value of *Institutional\_Holdings* is 72% (73%). Although the CEO is the chairman of the board in 85% of the cases, the percentage of staggered boards (34%) is lower than the typical firm in Equilar (51%).

Panel C presents statistics on the characteristics of the 199 cartels in which the sample firms were involved. *Number\_Participants* is the number of firms involved in the cartel. *Duration* is the number of years from the beginning to the end of the cartel. *Cartel\_Sales* is the total revenues of the cartel firms during the collusive period (expressed in million dollars). *Fines\_Cartel* is the total amount of monetary fines imposed on all of the firms that participate in a given cartel (expressed in million dollars). *Leniency\_Cartel* equals one if the cartel prosecution was prompted by a leniency application, and zero otherwise. For each cartel firm, *Fines\_Firm* is the total fines imposed on the firm (expressed in million dollars). *Recidivism* is the number of times the firm has been prosecuted for involvement in prior cartels. We note three characteristics that warrant attention. First, the total volume of sales affected by these cartels is substantial (\$49.3 billion). On average, firms receive relevant fines (\$67 million) for cartel involvement.

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<sup>12</sup> Data on institutional ownership are collected from the Thomson-Reuters database of 13-F filings (CDA/Spectrum).

Finally, about one third of the cartels we analyze (32%) were uncovered through leniency applications. This last statistic reflects the importance of those programs in cartel prosecutions.

## 4. Independent Directors and the Market Reaction to Cartel Prosecution

### 4.1. Cross-sectional Variation in Stock Returns

Our first set of empirical tests focuses on the market reaction to news on cartel prosecutions. Analyzing the market's perception of cartel prosecutions provides an opportunity to explore whether cartel prosecution places differential costs on firms with a higher percentage of independent directors. If the stock market anticipates that independent directors will pursue actions that reduce the cost of on the prosecution of wrong-doing activities, we expect to find a positive (or less negative) association between announcement returns and the percentage of independent directors at the time of the announcement.

We study the stock market reaction to cartel prosecution announcements by collecting from the PIC database all prosecution announcements involving our sample firms. We collect dates regarding antitrust authorities' announcements of investigations as well as convictions and other similar rulings. We gather these dates for each cartel in which the firm is involved and for each jurisdiction in which the cartel is prosecuted. This results in a total of 547 first-announcement dates, and a total of 1,028 announcements (including announcements of prosecution of the same cartel in several jurisdictions as well as announcements of sanctions and other rulings).

We first explore graphically whether the market reaction to cartel prosecution announcements depends on the pre-existing proportion of independent directors in the firm. Figure 4 plots (market-adjusted) buy-and-hold returns around investigation announcements partitioning the sample into firms with above-median (blue line) and below-median values of *Independent\_Directors* (red line). As shown in Figure 4, both groups of firms experience negative returns around those announcements. However, firms with higher values of

*Independent\_Directors* exhibit notably smaller negative returns than firms with a lower proportion of independent directors.

[Figure 4 About Here]

Next, we test the robustness of the empirical pattern in Figure 4. Panel A of Table 2 includes statistics on the following measures of stock return (expressed in %): Buy-and-hold raw (unadjusted) returns, market-adjusted buy-and-hold returns, and average abnormal returns computed using a 3-factor (Fama-French plus momentum) model. These measures are computed on the announcement day and over a  $(-5, +5)$  day window around the announcement day.<sup>13</sup> As in the analysis in Figure 4, we partition the sample into two groups of firms. *High (Low)* refers to observations with above (below) the median values of *Independent\_Directors*. The first set of columns in Panel A, presents average stock returns on the first announcement date of each cartel prosecution (*First Notice*). The second set of columns presents average stock returns on all prosecution announcements (*All Announcements*). That is, we include dates corresponding not only to breaking news on the cartel prosecution, but also announcements of sanctions.

The tabulated results show that the difference in stock returns on the announcement day between the two groups of firms (*High vs. Low*) is close to 1%. When returns are compounded over a  $(-5, +5)$  day window this difference increases to more than 2%.<sup>14</sup> When we include in the analysis all prosecution announcement dates, both groups of firms experience a decrease in the magnitude of the stock market reaction, and the difference in stock returns between the two groups of firms narrows to 1%. This dilution of the return pattern is driven by the lack of stock

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<sup>13</sup> We obtain similar results using windows of intermediate length (i.e., 1, 2, 3, and 4 days around the announcement date).

<sup>14</sup> The average daily alpha over the  $(-5, +5)$  day window around prosecution announcements is 0.23% (Table 2, Panel A). Multiplying this average alpha by 11 days yields a total return of 2.53%, which is close in magnitude to the market-adjusted buy-and-hold return (2.32%) over the same window.

market reaction to the announcement of sanctions and subsequent prosecutions in other jurisdictions (i.e., the inclusion of these dates introduces noise in the analysis). We interpret the lack of reaction on later dates as suggestive that the market anticipates the final outcome of the prosecutions and subsequent prosecutions in other jurisdictions in which the cartel operates.

[Table 2 About Here]

One potential issue with interpreting the results in Panel A is that the percentage of independent directors in our sample of firms could be correlated with risk factors that are, in turn, correlated with the cross-section of returns. Although the three-factor adjustment of average daily alphas helps mitigate this concern, we further test the robustness of the association between announcement returns and the percentage of independent directors by estimating the following multivariate model of announcement returns:

$$\begin{aligned}
 \text{Abnormal\_Return} = & \delta_0 + \delta_1 \text{Independent\_Directors} + \delta_2 \text{Size} + \\
 & \delta_3 \text{BM} + \delta_4 \text{Past\_Return} + \varepsilon
 \end{aligned}
 \tag{1}$$

The dependent variable *Abnormal\_Return* is constructed as the market-adjusted return on the announcement date (expressed as a percentage). *Independent\_Directors* is the percentage of independent directors on the board. Finally, Eq. (1) includes controls for variables found by prior literature to be associated with the cross-section of stock returns, i.e., *Size*, *BM*, and *Past\_Return*. Panel B of Table 2 (see columns (1) and (4)) presents the results of estimating Eq. (1) including, respectively, the first announcement of each cartel prosecution, and all announcement dates. Table 2, Panel B, again shows that the proportion of independent board members is positively associated with the announcement returns (the coefficient on *Independent\_Directors* is positive and significant across all specifications). The magnitude of the coefficient on

*Independent\_Directors* on the sample of first announcement dates (column (1)) is 5.38, which implies that one-standard deviation change in *Independent\_Directors* (i.e., 15%) is associated with an average difference of 80 basis points in daily returns on days containing news about cartel prosecution announcements.

Because *Independent\_Directors* could also be correlated with unobserved omitted risk factors, we simulate the empirical distribution of the coefficients in Eq. (1) when there are announcements of cartel prosecutions. Specifically, for each firm-specific announcement in Eq. (1), we generate a random date selected from a window of (-6, +6) months around the announcement of the prosecution (excluding the actual prosecution announcement date) and re-estimate Eq. (1) on these random dates within that window. We repeat this procedure one thousand times and retain the coefficients from each of the iterations.<sup>15</sup> The resulting empirical distribution of coefficients from these random dates is then used to test the null hypothesis that the coefficients estimated on the announcement dates (columns (1) and (4)) are equal to the average coefficients estimated on the random dates (columns (2) and (5)). The t-statistics corresponding to testing the equality of coefficients estimated on prosecution announcement dates and random dates are presented in columns (3) and (6) of Panel B.<sup>16</sup> These results reveal that estimating Eq. (1) on random days yields coefficients that are, on average, undistinguishable from zero. The statistically significant difference between the coefficients in Eq. (1) estimated on prosecution announcement dates and random dates provides evidence that the cross sectional pattern of abnormal returns around prosecutions is unique to our cartel distribution dates.

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<sup>15</sup> The randomization procedure preserves the number of critical dates of each cartel prosecution as well as the distance between those dates.

<sup>16</sup> These *t*-statistics assume that the coefficients of Eq. (1) are normally distributed. We relax this assumption by testing the hypothesis of equality of coefficients using non-parametric tests. The inference does not change.

## 4.2. Sample Selection

### 4.2.1. Heckman Correction

One concern about our statistical tests is that our sample of prosecuted firms has not been randomly selected. Summary statistics show, for example, that the sample firms have a high proportion of independent directors, suggesting that observations in our sample are not representative of the universe of firms.

We deal with this concern in two different ways. First, we benchmark the percentage of independent directors among our sample firms to that among comparable industry peers. For each sample firm, the corresponding industry peer is defined as the firm with the same SIC code that is closest in size to the sample firm. As shown in Figure 3, our sample firms do not differ significantly from comparable industry peers in terms of the empirical distribution of *Independent\_Directors*.

[Figure 3 About Here]

We further check whether sample-selection is likely to confound our results by estimating an alternative specification of Eq. (1) including a Heckman-correction term (Heckman, 1979). To do so, in the first stage of the Heckman model we include the determinants of the inclusion of a firm in the sample (i.e., the probability of cartel prosecution) as follows:

$$\begin{aligned} \textit{Prosecution}_{it} = & \delta_0 + \delta_1 \textit{Independent\_Directors} + \delta_2 \textit{Firm\_Characteristics} \\ & + \delta_2 \textit{Governance\_Characteristics} + \delta_3 \textit{Prosecution\_Effort} \\ & + \delta_4 \textit{Collusion\_Incentives} + \varepsilon. \end{aligned} \quad (2)$$

*Prosecution* equals 1 if the firm is prosecuted for cartel involvement in year  $t$ , and 0 otherwise. For each prosecuted firm, we include only the year in which the prosecution related to a given cartel is announced for the first time. For each year of the sample period (2002-2012),

the control group of non-prosecuted firms is formed by all the firms in the CRSP-Compustat universe that are not included in the PIC database. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Characteristics* includes *Size*, *BM*, *Leverage*, *ROA*, *Past\_Return*, and *Volatility*. *Governance\_Characteristics* includes *Staggered*, *Chair\_Insider*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. All the variables in *Firm\_Characteristics* and *Governance\_Characteristics* are measured at the start of the year in which prosecution takes place. *Prosecution\_Effort* includes two measures of regulatory effort to prosecute price-fixing cartels. *Budget\_Increase* is the inflation-adjusted increase in the budget of the Antitrust Division of the DOJ. *Punishment\_Severity* is the logarithm of the average fine imposed by the DOJ in that year.

Based on prior research in Economics (e.g., Stigler, 1964; Hay and Kelley, 1974; Shapiro, 1989; Levenstein and Suslow, 2006; Harrington, 1989), we include in Eq. (2) measures of conditions that generate incentives to engage and sustain price fixing behavior (*Collusion\_Incentives*). *Herfindahl* is the Herfindahl index of the industry. *Innovation* is the industry average of the R&D expenses scaled by total assets. *Barriers\_to\_Entry* is the industry average of the PP&E expenses scaled by total assets. *Number\_Competitors* is the number of firms in the industry. *Cost\_Assymmetry* is the industry standard deviation of cost of goods sold (COGS) scaled by total assets. *Market\_Power* is the industry average of the selling margin, computed as  $(\text{sales revenues} - \text{COGS}) / \text{sales revenues}$ . *Heterogeneity* is the industry standard deviation of the selling margin, computed as  $(\text{sales revenues} - \text{COGS}) / \text{sales revenues}$ . Because prior literature suggests that multi-market contacts among firms could favor collusion (e.g., Bernheim and Whinston, 1990), we also include a measure of the degree of business diversification of the company. Specifically, *Diversification* is defined as the number of business

segments in which the company operates. Finally, also following prior work (e.g., Green and Porter 1984; Rotenberg and Saloner, 1986; Haltiwanger and Harrington, 1991), we include controls for demand conditions that determine collusion. *Demand\_Growth* is the percentage increase of industry sales. *Demand\_Elasticity* is the correlation between percentage changes in industry sales and percentage changes in the sum of sales across all Compustat firms. *Demand\_Volatility* is the standard deviation of industry sales as percentage of total assets.

In the second stage of the Heckman model, the dependent variable *Abnormal\_Return* is computed for each firm-cartel observation as the average market-adjusted return to prosecution announcements related to the prosecution of the firm for a given cartel (expressed as a %), including all jurisdictions in which the firm was prosecuted. In the first set of columns (*First Notice*) *Abnormal\_Return* is computed including only first prosecution announcements related to a given cartel. In the second set of columns (*All announcements*) *Abnormal\_Return* is computed including all prosecution announcements. As in previous tests, this second stage of the model includes the following controls: *Size*, *BM*, and *Past\_Return*. These controls are measured in the year prior to the first prosecution announcement related to each firm-cartel observation.

Table 3 presents the results of estimating the association between prosecution announcement returns and the percentage of independent directors in the firm including the Heckman correction for sample selection. The results of the first stage of the estimation reveal that there is no significant association between *Independent\_Directors* and the probability of undergoing cartel prosecution. This result is consistent with the descriptive analysis in Figure 3, in which there is no observable difference in the percentage of independent directors between sample firms and industry-peers.

Table 3 also reveals that cartel involvement is associated with corporate governance characteristics. Specifically, firms in which the CEO is also the chairman of the board, firms with "busy" directors, and firms in which directors have a lower equity stake are more likely to be involved in cartel prosecutions. The positive and significant coefficient on *Budget\_Increase* suggests that increases in prosecution efforts lead to a higher probability of prosecution. Regarding the determinants of collusive behavior, we find that the probability of cartel involvement is higher among firms producing products with a higher degree of innovation, less elastic demand, firms operating in markets with a smaller number of competitors, and firms with presence in a higher number of markets. The results of the second stage of the Heckman model show that the inverse Mills ratio is highly significant, confirming the existence of sample selectivity. The sample-selection correction, however, does not subsume the statistical significance of the coefficient on *Independent\_Directors*.

[Table 3 About Here]

#### 4.2.2. *Effect of Prosecutions on Peer Firms*

To provide further insight into whether the pattern of returns we document is unique to our sample firms, we analyze the effect of cartel prosecutions on peer firms. Cartel investigations in industry peers are often followed by further investigations and subsequent discovery of other collusion agreements in the industry. In fact, evidence shows that a cartel investigation in a peer firm can be interpreted as a shock that increases the probability of prosecution of other firms in the industry (see Hammond, 2009). We exploit this pattern to explore whether the market reaction to an increase in the *probability of prosecution* varies with the percentage of independent directors in the unprosecuted firms.

Specifically, for each firm prosecuted for involvement in a given cartel, we obtain a sample of unprosecuted peers using Hoberg and Phillip's (2010) text-based identification of peer firms. For robustness, we repeat the analysis adding all firms in the same SIC code. For the sample of unprosecuted peers we estimate the following model:

$$\begin{aligned}
 \text{Abnormal\_Return} = & \delta_0 + \delta_1 E[\text{Prosecution}] + \delta_2 E[\text{Prosecution}] * \text{Independent\_Directors} \\
 & \delta_3 \text{Independent\_Directors} + \delta_4 \text{Size} + \delta_5 \text{BM} + \delta_6 \text{Past\_Return} + \varepsilon \quad (3)
 \end{aligned}$$

For each unprosecuted peer, the dependent variable *Abnormal\_Return* is constructed as the market-adjusted return on the announcement date of a cartel prosecution in a peer firm (expressed as a percentage). *Independent\_Directors* is the percentage of independent directors on the board. For each unprosecuted firm, we use two measures of the probability of potential prosecution, *E[Prosecution]*. Our first measure of *E[Prosecution]* equals one if the firm is prosecuted in the future (i.e., if the firm appears in the PIC dataset because of later prosecutions). Our second measure of *E[Prosecution]* is computed as the fitted value of the logit model in Eq. (2), that is, the model we use in the Heckman-correction test to explain the probability of cartel prosecution.

Table 4 presents the results of estimating Eq. (3). The mean stock returns on peer firms are positive, suggesting that, on average, cartel prosecution provides unprosecuted peer firms with a competitive advantage with respect to their prosecuted peers. However, the negative and significant coefficient on *E[Prosecution]* suggests that this benefit is smaller if the firms itself is more likely to be the target of future cartel investigations. More importantly, the positive and significant coefficient on the interaction between *E[Prosecution]* and *Independent\_Directors* suggests that, among unprosecuted firms, the expected costs of prosecution are lower for firms with a higher percentage of independent directors. That is, our conclusion from prior tests using

the sample of prosecuted firms can also be extended to unprosecuted firms that are likely to be prosecuted.

[Table 4 About Here]

#### 4.3. The Effect of Directors' Incentives

To provide more direct evidence of whether the documented returns pattern is ultimately driven by director's behavior, we re-estimate Eq. (1) and interact *Independent\_Directors* with measures of directors' incentives. We construct two variables to gauge those incentives. Our first measure is based on the effect of directorship portfolio considerations on director's behavior (e.g., Masulis and Mobbs, 2014). We define *Other\_Boards* as the logarithm of one plus the number of outside boards in which the director serves (i.e., the directors' unprosecuted directorships in other firms). If cartel prosecution has spillover effects on other boards on which directors serve, directors with a higher number of outside directorships are exposed to a larger downside from cartel prosecution. As such, we expect the interaction between *Other\_Boards* and *Independent\_Directors* to be positive.

Our second measure is based on directors' economic incentives in the prosecuted firm. Specifically, *Stock\_Options* measures the percentage of stock options in the director's equity holdings in the prosecuted firm. As explained by prior literature (Guay, 1999), stock options provide incentives to take risks by introducing convexity in compensation schemes. Indeed, prior literature finds that fraud is one of the risky strategies that firms follow to maximize the value of stock options (e.g., Armstrong, Larcker, Ormazabal, Taylor, 2013). Because directors with a higher proportion of options have a lower economic downside than directors with small or no option holdings, we predict that the interaction between *Stock\_Options* and *Independent\_Directors* to be negative.

Table 5 presents the results from estimating Eq. (1) including the interaction between *Independent\_Directors* and our two measures of asymmetry in directors' incentives. In Panel A, the positive and significant interaction between *Other\_Boards* and *Independent\_Directors* suggests that, as hypothesized, the positive association between announcement returns and *Independent\_Directors* is concentrated among firms in which directors hold a larger number of outside directorships and thus a potentially larger downside from cartel prosecution. Similarly, the negative and significant interaction between *Stock\_Options* and *Independent\_Directors* in Panel B indicates that firms in which independent directors hold a larger fraction of options exhibit more negative returns.

[Table 5 About Here]

Taken together, the results in Table 5 suggest that the valuation losses from cartel prosecution are less pronounced when the downside of directors' objective function is larger. The return patterns documented in Figure 4 and Table 2 appear to be associated with directors' incentives.

## **5. Independent Directors' Losses from Cartel Prosecution**

Our interpretation of the results of the previous section is that directors have personal concerns in face of cartel prosecution. In this section we explore whether these concerns are justified by observable consequences of cartel prosecution for individual directors. Finding that directors bear significant personal costs from cartel involvement would suggest that the threat of cartel prosecution provides strong incentives for directors to take actions to avoid or mitigate these costs.

### *5.1. Loss of directorships*

Following previous literature (e.g., Srinivasan, 2005; Fich and Shivdasani, 2007), we study whether directors lose board seats after news about the cartel scandal break out. Although board directors are rarely dismissed, they could receive significant pressure to leave their seats after firm misconduct. Indeed, previous literature documents that directors are more likely to leave their seats after news of financial irregularities or option backdating (e.g., Srinivasan, 2005; Fich and Shivdasani, 2007; Ertimur Ferri, and Maber, 2012).

To test whether directors lose board seats after news of cartel prosecution, we construct a panel including all independent directors serving on American public firms covered by BoardEx from 2002 to 2012.<sup>17</sup> Using this panel, we estimate the following OLS model:

$$NDepartures = \delta_0 + \delta_1 Cartel\_Involvement + \delta_2 Director\_Controls + \varepsilon \quad (4)$$

For each director in year  $t$ ,  $NDepartures$  is the number of board departure announcements in year  $t+1$ .<sup>18</sup>  $Cartel\_Involvement$  is an indicator variable that equals one if the director is involved in a prosecuted cartel in year  $t$ , and zero otherwise.  $Director\_Controls$  is a vector of controls for director characteristics, including  $Age$ ,  $NBoards$ , and  $Wealth$ .  $Age$  is the natural logarithm of one plus the age of the director. We include this variable because older directors are more likely to retire and thus reduce the number of their directorships.  $NBoards$  is the natural logarithm of the number of boards in which the director serves. This variable controls for the relative importance of the loss of directorships for the director and proxies for the director's current reputation (see Masulis and Mobbs, 2014).  $Wealth$  is the natural logarithm of one plus the director's wealth in

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<sup>17</sup> We exclude from our analysis directors that also hold managerial positions in any of the companies covered by BoardEx. That is, we focus on individuals whose full-time careers are serving on boards of directors.

<sup>18</sup> Given that  $NDepartures$  is censored at 0, we also estimate equation (4) using a tobit model. We further check the robustness of our results to using a zero-inflated regression model because, in addition to being censored,  $NDepartures$  is a discrete variable. We obtain similar results using these alternative specifications.

public firms (i.e., the added value of the director's equity portfolio across her directorships). This variable captures economic incentives in the supply for director talent (e.g., wealthier directors could have weaker incentives to retain directorships).

The results on the association between *NDepartures* on *Cartel\_Involvement* are presented in Panel A of Table 6. Consistent with cartel prosecution leading to board departures, the univariate regression results of column (1) show that the mean value of *NDepartures* for the director-years without cartel involvement (i.e., *Cartel\_Involvement* = 0) is 0.02, but 0.07 (i.e.,  $0.02 + 0.05$ ) for observations with *Cartel\_Involvement* = 1. This difference is statistically significant (*t*-statistic of 6.39). To further illustrate this result, we analyze the percentage of directors that depart from at least one directorship (i.e., *NDepartures* is greater than zero). We conduct this analysis for each of the two groups defined by *Cartel\_Involvement*. Consistent with a higher frequency of departures among directors of cartel firms, we find that *NDepartures* is greater than zero for 7.4% of the directors serving in cartel firms. In contrast, *NDepartures* is greater than zero for only 1.6% of directors that do not serve on cartel firms. The results from the multivariate Tobit model in column (2) of Panel A confirm the significant association between *NDepartures* and *Cartel\_Involvement*. The coefficient returned for *Cartel\_Involvement* is positive and significant, suggesting that directors of prosecuted firms are more likely to depart from their directorships than directors not involved in cartel firms.

One possible difficulty in interpreting the results in Table 6, Panel A, is that directors departing from cartel firms could receive offers from other firms, thus undermining the notion that cartel prosecution reduces directors' job opportunities. To explore this concern, we modify the dependent variable in Eq. (4) so as to measure director-level appointments at other firms. In this test the unit of observation is now director-years. Accordingly, we define  $\Delta NBoards$  as the

change in the total number of directorships (in both public and private companies) between year  $t-1$  and year  $t+1$ . The results are presented in Panel B of Table 6. The univariate regression model shows that  $\Delta NBoards$  is 0.02 for the director-years without cartel involvement (i.e.,  $Cartel\_Involvement = 0$ ), and  $-0.04$  (i.e.,  $0.02 - 0.06$ ) for the director-years with cartel involvement (i.e.,  $Cartel\_Involvement = 1$ ). This difference is statistically significant ( $t$ -statistic of  $-3.91$ ). Further analysis shows that while 17.9% of the directors of cartel firms experience a reduction in the number of directorships, only 6.6% of the directors not serving in cartel firms experience such reduction. The negative and significant coefficient on  $Cartel\_Involvement$  in the multivariate analysis confirms the negative association between  $\Delta NBoards$  and  $Cartel\_Involvement$  and thus cast doubt on the notion that there is a substitution of directorships after cartel prosecution.

[Table 6 About Here]

Taken together, the results in Table 6 imply that directors involved in cartel investigations experience a reduction in the number of their directorships after the announcement of the cartel prosecution. This evidence supports the hypothesis that directors suffer significant personal costs from cartel prosecution, and extends prior findings on the reputational consequences of other types of firm misbehavior such as securities fraud (e.g., Srinivasan, 2005; Fich and Shivdasani, 2007).

## 5.2. *Wealth losses*

We further explore directors' losses from antitrust enforcement by examining changes in their personal wealth after news of cartel prosecution. We focus on the component of directors'

wealth that is publicly observable; that is, the value of directors' equity portfolio in the public firms they serve. In this examination we re-estimate Eq. (4) using wealth changes ( $\Delta Wealth$ ) as alternative dependent variable. Specifically, we define  $\Delta Wealth$  as the change in director's wealth from year  $t-1$  to year  $t+1$ . For each director-year, director's wealth is computed as the sum of the value of the equity portfolio (i.e., company stock and stock options) held by the director at the end of the year.<sup>19</sup>

Table 7 presents the results. The univariate analysis shows that, while  $\Delta Wealth$  is not statistically different from zero for directors that do not serve on prosecuted firms, directors of prosecuted firms experience losses of more than half a million dollars in less than two years ( $\Delta Wealth$  for directors of cartel firms is  $-0.16 - 0.46 = -0.62$  million dollars). The difference between the two groups of directors is statistically significant. In the multivariate analysis, the coefficient on *Cartel\_Involvement* is also negative and statistically significant ( $t$ -statistic of  $-2.29$ ), confirming that directors involved in prosecuted firms suffer abnormal wealth losses after prosecution news.

[Table 7 About Here]

### 5.3. Loss of voting support in director elections

To further understand the ex-post reputational losses borne by directors after cartel prosecution, we analyze whether prosecution events are followed by a drop in voting support at director elections. This analysis is informative because, even if in some cases reputational penalties from cartel prosecution are not strong enough to force a director to resign or to cause her not be re-elected, directors could also face reputational penalties by losing voting support in

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<sup>19</sup> Stock option values are computed using the Black-Scholes formula. Inputs for the formula are measured at the end of the year.

director elections across their portfolio of directorships (e.g., Ertimur, Ferri, and Maber, 2012). Given the key role of reputation in the market for director talent, a significant loss in voting support could have important consequences for a director’s future job opportunities.

We analyze the association between cartel detection and voting support after cartel prosecution news. We collect information on shareholder voting on director elections from the ISS Voting Analytics database.<sup>20</sup> To test differences in voting support across directors as a function of their involvement in cartel investigations we construct a panel with all the voting items of individual director elections in the ISS database. That is, we conduct our analysis at director-firm-year level. Specifically, we estimate the following model:

$$\begin{aligned} \Delta Support\_OtherFirms = & \delta_0 + \delta_1 Cartel\_Involvement + \delta_2 Firm\_Controls \\ & + \delta_3 Governance\_Controls + \varepsilon \end{aligned} \quad (5)$$

For each voting item (which corresponds to a director-firm-year observation), the dependent variable  $\Delta Support\_OtherFirms$  is defined as the percentage of “for” votes for director  $i$  at firm  $j$  at the annual meeting of year  $t$  minus the percentage of “for” votes for director  $i$  at firm  $j$  at the annual meeting of year  $t-1$ .  $Cartel\_Involvement$  equals one if the director is involved in a cartel firm for which the news on cartel prosecution occur within the 365-day window prior to the date of the annual meeting of year  $t$ , and zero otherwise. Eq. (5) includes two sets of control variables as defined in prior tests; i.e.,  $Firm\_Controls$ , and  $Governance\_Controls$ .<sup>21</sup>

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<sup>20</sup> The ISS Voting Analytics database compiles shareholder votes for all agenda items at a firm’s shareholder meetings, including director elections. The database provides the identity of the companies holding elections, the shareholder meeting date, the agenda item descriptions, the number of “For”, “Against”, “Abstain”, “Withhold” and “Do Not Vote” votes of institutional owners. The database includes voting data since 2003 and covers companies included in the Russell 3000.

<sup>21</sup> We do not include  $Cartel\_Controls$  because equation (5) includes only unprosecuted directorships.

The univariate analysis in Table 8 reveals that the mean value of  $\Delta Support\_OtherFirms$  is 1% lower among the observations in which the director is a board member of a firm prosecuted for cartel ( $t$ -statistics of  $-3.39$ ). The standard deviation of  $\Delta Support\_OtherFirms$  is 8%, implying that a non-trivial percentage of cartel directors experience a considerable increase in withheld votes.<sup>22</sup> The negative and significant coefficient on *Cartel\_Involvement* in the multivariate analysis of Table 6 confirms that, after cartel prosecution news, directors of cartel firms lose voting support across their portfolio of directorships.

[Table 8 About Here]

In all, the evidence in Tables 6 through 8 suggests that directors are disciplined by the market because of cartel involvement, regardless of whether they are held personally accountable for collusive behavior by antitrust authorities. The findings of this section suggest that, in addition to corporate fines and individual criminal and civil sanctions, there exists an individual market-based penalty for cartel participation.

## **6. Directors' Reaction to Cartel Prosecution: Ex-Ante and Ex-Post Behaviors**

### *6.1. Leniency Applications*

One important action directors can take to mitigate the costs of cartel prosecution is to encourage the firm to cooperate with antitrust authorities by applying for leniency. Arguably, leniency programs grant amnesty regarding both civil and criminal penalties. Moreover, leniency

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<sup>22</sup> To interpret the magnitude of  $\Delta Support\_OtherFirms$  it is critical to consider that the mean (median) voting support at director elections in the ISS Voting Analytics database is 94.8% (97.6%). The 25<sup>th</sup> percentile is 94.5%, suggesting that an 8% decrease in support would place the director in the left tail of the distribution of voting support. These results are similar to those in previous literature (e.g., Ertimur, Ferri, and Maber, 2012), with the additional interest with respect to prior work that the voting effect we document occurs in *unprosecuted* directorships. That is, the loss in voting support expands beyond the firm in which fraud is perpetrated.

applications could reduce reputational damage as the market may interpret cooperation with authorities as directors fulfilling their monitoring role.<sup>23</sup>

To test the empirical association between the proportion of independent directors and the probability of applying for leniency, we collect data on corporate leniency applications from the PIC database.<sup>24</sup> Because leniency applications are jurisdiction-specific, we include all the jurisdictions in which each sample firm is prosecuted for a given cartel and estimate the following probit model:

$$\begin{aligned} \text{Leniency} = & \delta_0 + \delta_1 \text{Independent\_Directors} + \delta_2 \text{Firm\_Controls} \\ & + \delta_3 \text{Governance\_Controls} + \delta_4 \text{Cartel\_Controls} + \varepsilon \end{aligned} \quad (6)$$

For each cartel and jurisdiction in which the firm is prosecuted, the dependent variable *Leniency* equals one if the company applies for leniency, and zero otherwise. *Leniency* equals one in 53 cases of the 579 jurisdiction-specific prosecutions. Eq. (6) also includes the three sets of control variables used in our prior tests; i.e., *Firm\_Controls*, *Governance\_Controls*, and *Cartel\_Controls*.

Table 9 presents multivariate results of estimating Eq. (6). The estimated coefficient for *Independent\_Directors* is positive and significant across the different model specifications. The marginal effect of *Independent\_Directors* in model (1) is 0.22, implying that an increase of one standard deviation in *Independent\_Directors* (i.e., 0.15) is associated with a 3.3% increase in the probability of applying for leniency. The results for some control variables are worth discussing.

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<sup>23</sup> Leniency programs have been described by legal scholars as “the cornerstone of the Antitrust Division’s cartel enforcement regime because they create powerful incentives for self-reporting by wrongdoers that can have a significant destabilizing effect on a conspiracy” (Varnev, 2013)

<sup>24</sup> Although the DOJ does not publicly disclose the identity of leniency applicants, this information is publicly available because its disclosure is required by courts in connection with litigation (Connor, 2009).

The positive and significant coefficient on *Fines\_Cartel*, for example, suggests that firms are more likely to apply for leniency if the potential penalties are larger. Moreover, the positive and significant coefficient on *Recidivism* indicates that having been subject to past prosecution increases the probability of surrendering to the antitrust authorities.

[Table 9 About Here]

The results in Table 9 suggest that independent directors favor cooperation with antitrust prosecutors as an attempt to mitigate personal costs associated with cartel prosecution. This is an important finding considering the key role of leniency programs on antitrust enforcement.

## 6.2. Independent Director Turnover prior to Cartel Prosecutions

Another action directors can take to avoid personal costs from cartel prosecution is to depart from their firms before prosecution by antitrust authorities come to light. To examine whether there is abnormal turnover of independent directors before news of cartel prosecution, we collect data on departure announcements from BoardEx in the calendar year in which there is news of cartel prosecution. We measure director turnover activity in each of the twelve months of the year in which there is a prosecution announcement. We use the resulting panel of firm-month observations to estimate the following hazard model:

$$\begin{aligned}
 \textit{Departure} = & \delta_0 + \delta_1 \textit{Independent\_Directors} + \delta_2 \textit{Independent\_Directors*Pre\_Prosecution} \\
 & + \delta_3 \textit{Pre\_Prosecution} + \delta_4 \textit{Firm\_Controls} + \delta_5 \textit{Governance\_Controls} \\
 & + \delta_6 \textit{Cartel\_Controls} + \varepsilon
 \end{aligned}
 \tag{7}$$

For each firm-month, we define *Departure* as one if there is at least one director departure announcement in that month, and zero otherwise. For the months in which there are prosecution

announcements, *Pre\_Prosecution* equals one if there is a departure announcement before the prosecution announcement, and zero otherwise. We interact this variable with *Independent\_Directors*. Similar to previous tests, we include *Firm\_Controls*, *Governance\_Controls*, and *Cartel\_Controls* into the set of controls.<sup>25</sup>

Table 10 presents the results. The coefficient on the interaction between *Independent\_Directors* and *Pre\_Prosecution* is positive and statistically significant in all models, indicating that a significant number of independent directors leave the board in anticipation of cartel prosecution announcements. Our evidence is consistent with Fahlenbrach, Low, and Stulz's (2010) findings that directors leave in anticipation of poor performance, but we push the literature further in suggesting that directors are not only informed about their firms' future prospects, but also about the existence of (still uncovered) fraud. The results support the notion that authorities in charge of antitrust enforcement may exploit internal tensions between independent directors and management, and are consistent with prior evidence that a number of director resignations are driven by conflicts with management or other directors (see Agrawal and Chen, 2011).

[Table 10 About Here]

The results in Tables 9 and 10 suggest that the threat of incurring personal costs from cartel prosecution provides strong enough incentives for independent directors to take actions prior to prosecution announcements.

### 6.3. CEO Turnover Following Cartel Prosecutions

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<sup>25</sup> Note that the usual controls in the director turnover literature are included in these right-hand side variables. Specifically, *Age\_69* controls for the possibility that the turnover is due to retirement, and *Past\_Return* and *ROA* is included because prior literature documents a negative relation between past performance and the probability of director turnover (e.g., Yermack, 2004).

The threat of incurring personal costs from cartel prosecution could also induce independent directors to take actions after news of cartel prosecution to enhance their reputation as monitors by signaling their commitment to punish fraudulent behavior. An especially important disciplinary action the board can take is to replace the CEO of the prosecuted firm. Accordingly, we next test whether firms with a higher proportion of independent directors are more likely to replace their CEO after prosecution events. Specifically, we collect data on CEO departures in the years in which there is news of cartel prosecution for our sample firms and estimate the following probit model:

$$\begin{aligned}
 CEO\_Turnover = & \delta_0 + \delta_1 Independent\_Directors + \delta_2 Firm\_Controls + \\
 & \delta_3 Governance\_Controls + \delta_4 Cartel\_Controls + \varepsilon
 \end{aligned}
 \tag{8}$$

For each firm being prosecuted in year  $t$ ,  $CEO\_Turnover$  equals one if the CEO leaves the firm within the 12 months after the first news of cartel prosecution in year  $t$ , and zero otherwise. The rest of the variables are as previously defined. The results from the multivariate models support the positive association between *Independent\_Directors* and *CEO\_Turnover*. The coefficient on *Independent\_Directors* is positive and statistically different from zero in the multivariate specifications tabulated in Table 11. These findings are consistent with the idea that independent directors replace the CEO after cartel detection in an effort to enhance their reputations as monitors.

[Table 11 About Here]

One possible difficulty in interpreting the results in Table 11 is that cartel firms could be losing talented CEOs. If so, the consequences of the documented turnover pattern for shareholder wealth would be unclear. To shed further light on the economic consequences of the results in

Table 9, we compute abnormal returns at the announcement of CEO resignations. We find that these resignations are associated with an average positive abnormal return of 1.3%. This positive market reaction suggests that, on average, the documented CEO turnover pattern is not detrimental to shareholder wealth. Accordingly, our evidence is consistent with the notion that directors take disciplinary actions around cartel prosecution that are beneficial to shareholders.

## **7. Conclusions**

This paper studies the role played by independent directors in cartel prosecutions. We analyze the stock market reaction around cartel prosecution announcements and find that firms with a higher proportion of independent directors exhibit less negative abnormal returns. We also find that this association is stronger among firms in which directors hold more outside directorships and receive less option-based compensation. That is, our results are stronger in cases in which directors' downside from cartel prosecution is likely to be larger.

We explore whether potential reputational losses at outside directorships provide strong incentives for directors to deviate from price-fixing schemes by examining the ex-post effect of cartel prosecution on unprosecuted directorships. We find evidence that directors of prosecuted firms lose board positions, suffer significant wealth losses, and lose voting support across their portfolio of directorships.

To better understand the association between cartel-busting news announcement returns and the proportion of independent directors, we look at directors' actions around cartel prosecution. First, we find that, ex-ante, firms with a higher proportion of independent directors are more likely to apply for leniency. Second, we find an abnormal level of independent director departures in the period prior to prosecution announcements. Third, we find that, after news of cartel prosecution,

there is a higher frequency of CEO turnover among firms with a higher proportion of independent directors.

Overall, our results are consistent with the notion that outside directors' incentives can play a central role in cartel prosecution efforts. Our analysis contributes to the regulatory debate on antitrust policies by providing evidence on the effect of market sanctions to individuals involved in price-fixing schemes. We believe the results of our study are relevant to regulators designing and enforcing antitrust policies and to market participants seeking to understand the role of corporate governance and antitrust regulation on firm value and behavior.

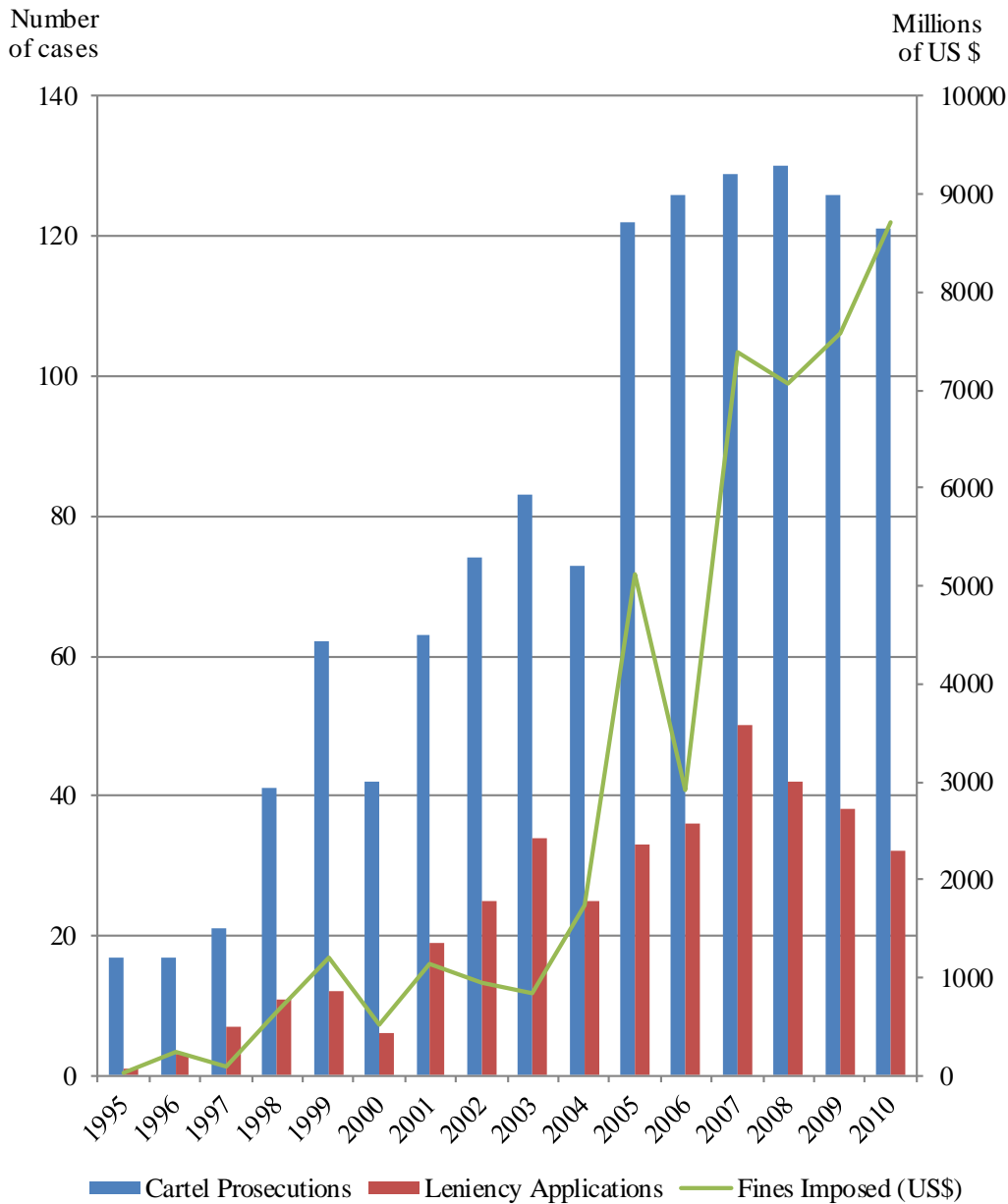
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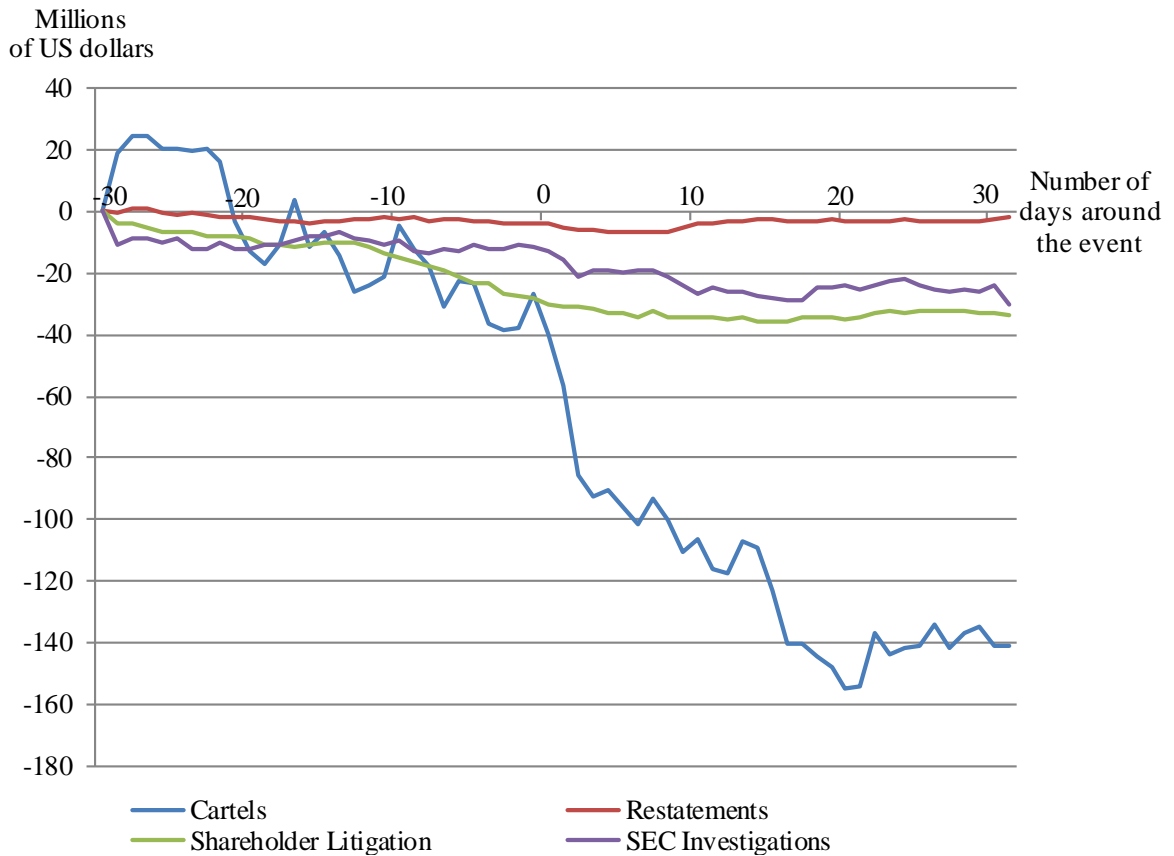
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**Figure 1. Cartel Prosecution Activity around the World**



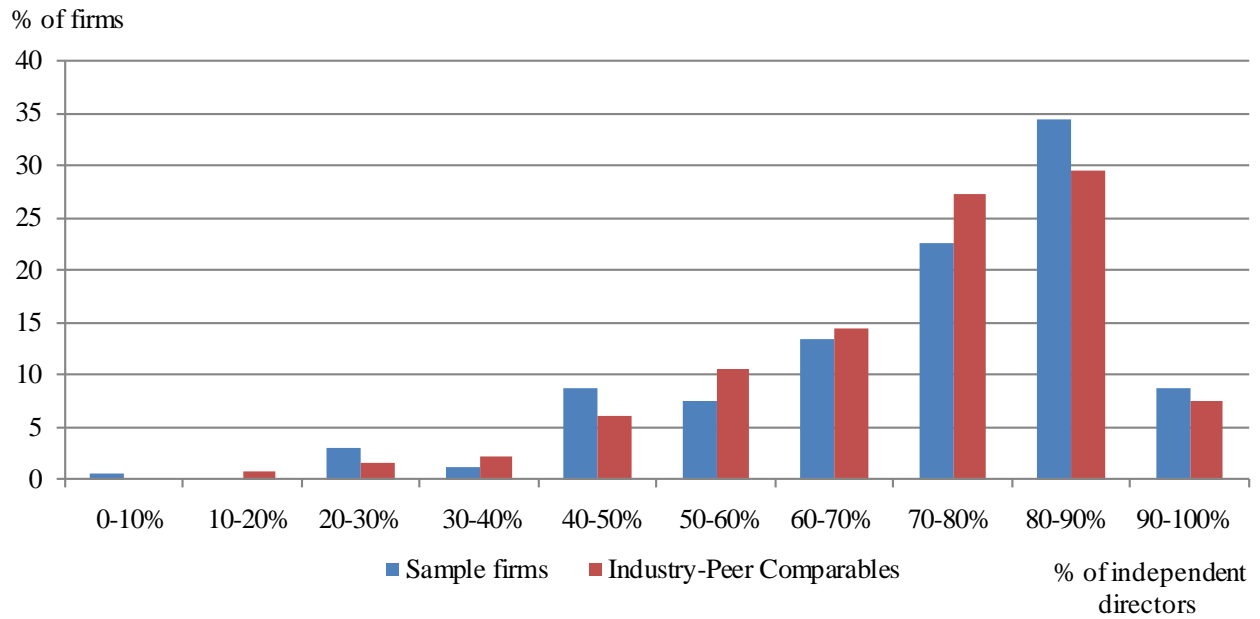
This figure plots data on the number of cartel prosecutions, leniency applications, and amount of fines between 1995 and 2011. The left vertical axis indicates number of cases and refers to cartel prosecutions and leniency applications. The right vertical axis indicates million dollars and refers to the total annual amount of imposed fines. Each indictment in a given jurisdiction is counted as one prosecution regardless of whether the cartel is prosecuted in another jurisdiction. Fines are aggregated in the year in which they are levied by each antitrust authority. Data on cartel prosecutions around the world are obtained from the PIC database (see Connor, 2014).

**Figure 2. Price-Fixing vs Securities Fraud**



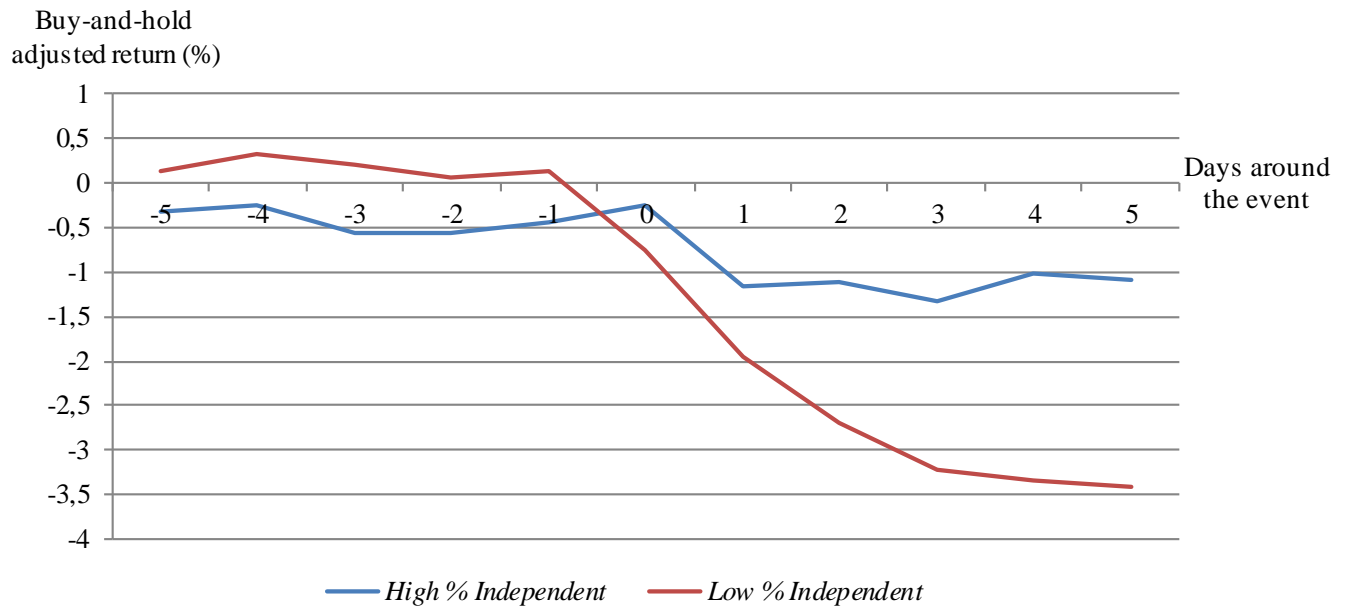
This figure plots average cumulated changes in the market capitalization over a window of  $(-30,+30)$  days around the first announcement of the following events: Cartel prosecution, restatements, shareholder litigation, and SEC investigations. The left vertical axis indicates average accumulated changes in market capitalization (in million dollars) for each one of the groups of firms. The horizontal axis indicates the number of days before or after the day with news announcing each one of the events. For example "-10" means 10 days before the announcement of the cartel prosecution, restatement, shareholder litigation, or SEC investigation. Information on cartel prosecution dates for US public firms are obtained from the PIC database (see Connor, 2004). Information on dates related to restatements, shareholder litigation, and SEC investigations are obtained from the CapitalIQ Key Developments database.

**Figure 3. Board Independence**



This figure plots data on the percentage of independent directors in sample and benchmark firms between 2002 and 2012. The vertical axis indicates percentage of firms. The horizontal axis indicates percentage of independent directors. Data on director independence comes from Equilar.

**Figure 4. Cartel prosecution and Board Independence**



This figure plots average market-adjusted cumulated (buy-and-hold) returns over a window (-5, +5) days around the announcement of cartel prosecution. *Low % Independent* refers to the firms with below-median percentage of independent directors. *High % Independent* refers to the firms with above-median percentage of independent directors. The left vertical axis indicates average market-adjusted buy-and-hold returns (in %) for each one of the groups of firms. The horizontal axis indicates the number of days before or after the first announcement of cartel prosecution. For example "-5" means 5 days before the announcement of the cartel prosecution event.

**Table 1. Descriptive statistics for the sample firms**

This table reports descriptive statistics for our sample of firms prosecuted for cartel participation between 2002 and 2012. Panel A presents the industry distribution of the sample firms. Panel B reports descriptive statistics about selected characteristics of the sample firms. In Panel B, *Market Cap* is the firm's equity market value (in million dollars). *BM* is the Book-to-market ratio. *Leverage* is total liabilities divided by total assets. *Past\_Return* is the compounded stock return over the fiscal year. *ROA* is return on assets (operating income scaled by total assets). *Volatility* is stock return volatility, computed as the standard deviation of daily returns over 365 days prior to fiscal year end. *Independent\_Directors* is the percentage of independent directors on the board. *Chair\_Insider* equals one if the chair of the board also holds an executive position, and zero otherwise. *Staggered* equals one if the corporate directors have staggered terms and zero otherwise. *Busy\_Directors* is the number of outside directors who serve simultaneously on at least two boards scaled by the total number of directors. *Age\_69* is the number of outside directors who are at least 69 years old scaled by the total number of directors. *Indep\_Director\_Holdings* is the number of shares held by outside directors scaled by the total number of shares outstanding. *Institutional\_Holdings* is the number of shares owned by institutions scaled by the total number of shares outstanding. Panel C reports descriptive statistics about characteristics of the cartels in which the sample firms are involved. In Panel C, *Number\_Participants* is the number of firms involved in the cartel. *Duration* is the number of years from the beginning to the end of the cartel activities. *Cartel\_Sales* is the total revenues of the cartel firms during the collusive period (in million dollars). *Fines\_Cartel* is the total fines imposed on the cartel firms (in million dollars). *Leniency\_Cartel* equals one if the cartel prosecution was prompted by a leniency application, and zero otherwise. For each cartel firm, *Fines\_Firm* is the total fines imposed on the firm (in million dollars). *Recidivism* is the number of times the firm has been prosecuted for involvement in prior cartels.

**Panel A. Industry Distribution**

<i>Fama-French 12 industry groups</i>	<i>% of firms</i>
Business equipment	6.28%
Chemicals and allied products	9.42%
Consumer durables	5.76%
Oil, gas, and coal extraction and products	2.62%
Healthcare, medical equipment and drugs	8.38%
Manufacturing	14.14%
Financial firms	18.85%
Consumer nondurables	9.95%
Other	14.14%
Wholesale, retail, and some services	7.33%
Telephone and television transmission	2.09%
Utilities	1.05%
<i>Number of firms</i>	191

**Panel B. Firm Characteristics**

<i>Characteristics:</i>	<i>mean</i>	<i>median</i>
<i>Firm Controls:</i>		
<i>Market Cap (millions)</i>	43,574	10,774
<i>BM</i>	0.53	0.44
<i>Leverage</i>	0.25	0.24
<i>Past_Return</i>	0.02	0.01
<i>ROA</i>	0.01	0.01
<i>Volatility</i>	0.02	0.02
<i>Governance Controls:</i>		
<i>Independent_Directors</i>	0.76	0.80
<i>Staggered</i>	0.34	0.00
<i>Chair_Insider</i>	0.85	1.00
<i>Busy_Directors</i>	0.60	0.63
<i>Age_69</i>	0.13	0.11
<i>Indep_Director_Holdings (in %)</i>	0.49	0.09
<i>Institutional_Holdings</i>	0.72	0.73
<i>Firm-years with cartel prosecution announcements</i>		519

**Table 1. Descriptive statistics for the sample firms (cont'ed)**

**Panel C. Cartel Characteristics**

<i>Cartel_Controls:</i>	<i>mean</i>	<i>median</i>
<i>Cartel characteristics:</i>		
<i>Number_Participants</i>	7.68	6
<i>Duration</i>	6.22	5
<i>Cartel_Sales</i>	49,385	3,885
<i>Fines_Cartel</i>	139	6.17
<i>Leniency_Cartel</i>	0.32	0
<i>Jurisdiction:</i>		
<i>USA</i>	0.43	0
<i>European Union</i>	0.15	0
<i>Canada</i>	0.33	0
<i>Other</i>	0.58	1
<i>Cartel-firm characteristics:</i>		
<i>Fines_Firm</i>	67.25	5.9
<i>Recidivism</i>	1.87	1
<i>Number of cartels</i>		199

**Table 2. Market reaction to News of Cartel Prosecution**

**Panel A. Announcement Returns**

Panel A presents univariate results of analyzing stock returns around news of cartel prosecution. The panel includes statistics on the following measures of stock return (expressed in %): Buy-and-hold raw (unadjusted) returns, market-adjusted buy-and-hold returns, and the average daily alpha computed using a 3-factor (Fama-French + momentum) model. These measures are computed on the announcement day and over a (-5,+5) day window. *High (Low)* refers to observations with above (below) the median values of *Independent\_Directors* (i.e., the percentage of independent directors on the board). The first set of columns (*First Notice*) presents average stock returns on the first announcement date of each cartel prosecution. The second set of columns (*All announcements*) presents average stock returns on all prosecution announcements. t-statistics of group means are in parenthesis. t-statistics of group differences are in brackets.

Return measure	Event Window	<i>First Notice (N = 547)</i>			<i>All Announcements (N = 1,028)</i>		
		<i>Independent_Directors</i>			<i>Independent_Directors</i>		
		<i>Low</i>	<i>High</i>	<i>Difference</i>	<i>Low</i>	<i>High</i>	<i>Difference</i>
<i>Buy-and-Hold (Unadjusted)</i>	(0,0)	-0.99** (-2.58)	0.05 (0.29)	1.04*** [2.71]	-0.47*** (-2.58)	0.26* (1.93)	0.73*** [3.18]
	(-5,5)	-3.33*** (-3.13)	-0.53 (-0.82)	2.80** [2.36]	-1.37*** (-2.86)	0.01 (0.02)	1.38** [2.07]
<i>Buy-and-Hold (Market Adjusted)</i>	(0,0)	-0.95*** (-2.68)	0.18 (1.54)	1.13*** [3.40]	-0.53*** (-3.19)	0.12 (1.16)	0.65*** [3.26]
	(-5,5)	-3.41*** (-3.61)	-1.08* (-1.93)	2.32** [2.23]	-1.53*** (-3.60)	-0.54 (-1.37)	0.99* [1.69]
<i>Average Daily Alpha (3-Factor Adjusted)</i>	(0,0)	-0.88*** (-2.68)	0.14 (1.25)	1.01*** [3.29]	-0.38*** (-2.52)	-0.05 (-0.57)	0.33* [1.83]
	(-5,5)	-0.34*** (-3.11)	-0.11*** (-2.79)	0.23** [2.15]	-0.17*** (-3.81)	-0.07*** (-2.64)	0.10* [1.80]

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 2. Market reaction to News of Cartel Prosecution (cont'ed)**

**Panel B. Controlling for Risk**

Panel B presents multivariate results from a Monte Carlo analysis simulating the probability distribution of the coefficients obtained in the following model,

$$Abnormal\_Return = \beta_0 + \beta_1 Independent\_Directors + \beta_2 Size + \beta_3 BM + \beta_4 Past\_Return + \varepsilon$$

where *Abnormal\_Return* is the market-adjusted return on each of the key dates of the cartel detection (expressed as a %). *Independent\_Directors* is the percentage of independent directors on the board. The rest of the variables are as defined in Table 1. The simulation proceeds as follows. In each of the 1,000 iterations, the model is re-estimated using random dates generated from the range of dates within a window of (-6,+6) months around the announcement of the prosecution. For each coefficient, the expected value  $E[\beta]$  is the average of the empirical probability distribution of t-statistics obtained from the 1000 iterations. t-stats in parenthesis (columns (1), (2), (4), and (5)) correspond to testing the hypothesis that  $\beta=0$  and  $E[\beta]=0$ . t-stats in brackets (columns (3) and (6)) correspond to testing the hypothesis that the difference between the coefficients estimated using the real dates ( $\beta$ ) are equal to the mean coefficient of the empirical distribution  $E[\beta]$ . In the first set of columns (*First Notice*) *Abnormal\_Return* is computed including only first prosecution announcements. In the second set of columns (*All announcements*) *Abnormal\_Return* is computed including all prosecution announcements.

	<i>First Notice</i>			<i>All Announcements</i>		
	(1) Real dates $\beta$	(2) Random dates $E[\beta]$	(3) Difference $\beta - E[\beta]$	(4) Real dates $\beta$	(5) Random dates $E[\beta]$	(6) Difference $\beta - E[\beta]$
<i>Independent Variables:</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>Intercept</i>	-5.60*** (-2.83)	-0.03 (-0.06)	-2.77*** [-2.64]	-3.30*** (-2.80)	0.03 (0.01)	-2.81*** [-2.69]
<i>Independent_Directors</i>	5.38*** (3.40)	0.06 (0.09)	3.31*** [3.18]	2.86*** (2.92)	-0.01 (-0.02)	2.94*** [3.07]
<i>Size</i>	0.11 (1.04)	0.00 (0.03)	1.01 [0.95]	0.09 (1.32)	0.00 (0.00)	1.31 [1.33]
<i>BM</i>	0.38 (0.64)	-0.03 (-0.04)	0.67 [0.44]	0.46 (0.80)	-0.02 (0.01)	0.79 [0.70]
<i>Past_Return</i>	1.70*** (2.60)	0.17 (0.46)	2.14* [1.86]	0.80* (1.97)	0.13 (0.44)	1.53 [1.32]

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 3. Heckman's Sample Selection Model**

This table presents results of analyzing abnormal returns around news of cartel prosecution using a Heckman's sample selection model. The first-stage regression models the inclusion of a firm in the sample, that is, the probability of prosecution. The second-stage regression models average abnormal returns for each firm-cartel prosecution. In the first stage, the dependent variable *Prosecuted* equals one if the antitrust authorities announce the prosecution of the firm for involvement in a cartel in that year, and zero otherwise. For prosecuted firms, the tests only include years in which the firm's involvement in a given cartel was announced for the first time. For unprosecuted firms, the tests include all year observations between 2002 and 2012. In the second stage the dependent variable *Abnormal\_Return* is computed for each firm-cartel observation as the average market-adjusted return to prosecution announcements related to the prosecution of the firm for a given cartel (expressed as a %), including all jurisdictions in which the firm was prosecuted. In the first set of columns (*First Notice*) *Abnormal\_Return* is computed including only first prosecution announcements related to a given cartel. In the second set of columns (*All announcements*) *Abnormal\_Return* is computed including all prosecution announcements. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Characteristics* includes *Size* (defined as the natural logarithm of *Market Cap*), *BM*, *Leverage*, *Past\_Return*, *ROA*, and the natural logarithm of *Volatility*. *Governance\_Characteristics* includes *Staggered*, *Chair\_Insider*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. All these variables are as defined in Table 1. *Prosecution\_Effort* includes *Budget\_Increase* and *Punishment\_Severity*. *Budget\_Increase* is the inflation-adjusted increase in the budget of the Antitrust Division of the DOJ. *Punishment\_Severity* is the logarithm of the average fine imposed by the DOJ in that year. *Herfindahl* is the Herfindahl index of the industry. *Innovation* is the industry average of the R&D expenses scaled by total assets. *Barriers\_to\_Entry* is the industry average of the PP&E expenses scaled by total assets. *Number\_Competitors* is the number of firms in the industry. *Cost\_Assymetry* is the industry standard deviation of COGS scaled by total assets. *Market\_Power* is the industry average of the selling margin, computed as (sales revenues — COGS) / sales revenues. SIC code. *Heterogeneity* is the industry standard deviation of the selling margin, computed as (sales revenues — COGS) / sales revenues. *Demand\_Growth* is the percentage increase of industry sales. *Demand\_Volatility* is the standard deviation of industry sales as percentage of total assets. *Demand\_Elasticity* is the correlation between percentage changes in industry sales and percentage changes in the sum of sales across all Compustat firms. *Diversification* is computed as the number of business segments in which the company operates. Industry is defined as SIC code. For prosecuted firms, the right-hand side variables are computed in the year prior to the first announcement of prosecution for a given cartel. The second stage model includes the inverse Mills ratio (*Inverse\_Mills\_Ratio*) as an additional explanatory variable. *Inverse\_Mills\_Ratio* is constructed based on coefficient estimates of the first-stage regression predicting whether a firm is subject to cartel prosecution. The table presents the coefficient and *z-statistic* for each variable in the regression specification.

**Table 3. Heckman's Sample Selection Model (cont'ed)**

<i>Independent Variables:</i>	<i>First Notice</i>				<i>All announcements</i>			
	<i>First Stage</i>		<i>Second Stage</i>		<i>First Stage</i>		<i>Second Stage</i>	
	Coef.	z-stat	Coef.	z-stat	Coef.	z-stat	Coef.	z-stat
<i>Constant</i>	-4.66***	-8.82	-8.76***	-2.96	-4.66***	-8.79	-4.98***	-1.90
<i>Independent_Directors</i>	-0.06	-0.28	3.81***	3.05	-0.06	-0.29	2.28**	2.10
<i>Risk_Controls</i>								
<i>Size</i>			0.42**	2.11			0.25	1.43
<i>BM</i>			-0.13	-0.40			-0.05	-0.17
<i>Past_Return</i>			0.26	0.70			0.39	1.24
<i>Inverse_Mills_Ratio</i>			1.09***	18.62			0.93***	18.46
<i>Firm_Characteristics</i>								
<i>Size</i>	0.46***	17.70			0.46***	17.67		
<i>BM</i>	0.01	0.67			0.01	0.67		
<i>Past_Return</i>	-0.02	-0.29			-0.02	-0.28		
<i>ROA</i>	0.03	0.48			0.03	0.48		
<i>Leverage</i>	0.19	1.38			0.19	1.36		
<i>Volatility</i>	0.30***	4.12			0.31***	4.18		
<i>Governance_Characteristics</i>								
<i>Staggered</i>	-0.12*	-1.83			-0.13*	-1.90		
<i>Chair_Insider</i>	0.31***	3.38			0.31***	3.38		
<i>Busy_Directors</i>	0.28	1.59			0.30*	1.71		
<i>Age_69</i>	-0.11	-0.58			-0.14	-0.70		
<i>Indep_Director_Holdings</i>	-0.16***	-2.80			-0.16***	-2.77		
<i>Institutional_Holdings</i>	0.06	0.35			0.07	0.40		
<i>Prosecution_Effort</i>								
<i>Punishment_Severity</i>	-0.01	-0.28			-0.01	-0.25		
<i>Budget_Increase</i>	3.39***	3.80			3.32***	3.71		
<i>Collusion_Incentives</i>								
<i>Herfindahl</i>	-0.13	-0.53			-0.13	-0.53		
<i>Innovation</i>	0.06***	2.94			0.06***	2.75		
<i>Barriers_to_Entry</i>	-0.25	-1.54			-0.25	-1.52		
<i>Number_Competers</i>	-0.10***	-2.74			-0.10***	-2.65		
<i>Cost_Assymetry</i>	-0.01	-0.93			-0.01	-0.93		
<i>Market_Power</i>	0.00	-0.41			0.00	-0.42		
<i>Heterogeneity</i>	0.00	-0.48			0.00	-0.50		
<i>Demand_Growth</i>	-0.16	-0.92			-0.14	-0.84		
<i>Demand_Volatility</i>	-0.05	-0.62			-0.05	-0.61		
<i>Demand_Elasticity</i>	-0.60***	-3.28			-0.60***	-3.29		
<i>Diversification</i>	0.03**	2.14			0.03**	2.14		
<i>N</i>		32,592		373		32,592		373
<i>Wald <math>\chi^2</math></i>			15.01				8.15	

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 4. Effect of Prosecutions on Unprosecuted Competitors**

This table presents univariate results of analyzing the market reaction to news of cartel prosecution in unprosecuted peer firms. In the first set of columns, peer firms are defined using Hoberg and Phillips (2010)'s textual analysis. In the first set of columns, Hoberg and Phillips (2010)'s identification of peer firms is complemented by including all firms in the same SIC code. The dependent variable *Abnormal\_Return* is the market-adjusted return on each of the key dates of the cartel detection (expressed as a %). For each unprosecuted firm, the tests use two proxies for the probability of future prosecution,  $E[Prosecution]$ . In models (1) and (3) the proxy for  $E[Prosecution]$ , *Future prosecution*, equals one if the firm is prosecuted in the future (i.e., if the firm appears in the PIC dataset in later prosecutions). In models (2) and (4) the proxy for  $E[Prosecution]$ , *Fitted Value*, is computed as the fitted value of a logit model explaining the probability of cartel prosecution (i.e., the first stage of the Heckman model in Table 3).

	<i>Dependent variable: Abnormal_Return</i>							
	<i>Competitors defined as in Hoberg and Phillips (2010)</i>				<i>Competitors definition including firms in the same SIC code</i>			
	(1)		(2)		(3)		(4)	
<i>Independent Variables:</i>	<i>E[Prosecution]: Future prosecution</i>		<i>E[Prosecution]: Fitted Value</i>		<i>E[Prosecution]: Future prosecution</i>		<i>E[Prosecution]: Fitted Value</i>	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
<i>Constant</i>	-0.05	-0.35	0.13	0.74	-0.14	-1.07	-0.02	-0.11
<i>E[Prosecution]</i>	-1.90***	-3.71	-21.03***	-2.81	-1.76***	-3.82	-10.30**	-2.02
<i>Independent_Directors*E[Prosecution]</i>	2.02***	3.14	23.66***	2.81	1.85***	3.21	11.46*	1.88
<i>Independent_Directors</i>	-0.28*	-1.85	-0.37*	-1.82	-0.13	-0.96	-0.14	-0.80
<i>Size</i>	0.06***	3.72	0.04**	2.09	0.06***	4.06	0.04**	2.25
<i>BM</i>	0.02	0.59	0.03	0.74	0.01	0.28	0.02	0.31
<i>Past_Return</i>	0.18***	3.28	0.16***	3.02	0.18***	4.05	0.20***	3.97
<i>R</i> <sup>2</sup>	0.26%		0.18%		0.25%		0.21%	
<i>N</i>	20,255		18,651		26,949		24,292	

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 5. Independent Directors' Incentives**

This table presents results of analyzing abnormal returns around news of cartel prosecution. The dependent variable *Abnormal\_Return* is the market-adjusted return on each of the key dates of the cartel detection (expressed as a %). In Panel A, *Other\_Boards* is the logarithm of the number of outside boards (i.e., other than the prosecuted firm) on which the firm's outside directors serve. In Panel B, *Stock\_Options* is the number of options held by the firm's outside directors scaled by the number of shares held by the firm's outside directors. The rest of the variables are as defined in Table 1. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Controls* includes *Size* (defined as the natural logarithm of *Market Cap*), *BM*, *Leverage*, *Past\_Return*, *ROA*, and the natural logarithm of *Volatility*. *Governance\_Controls* includes *Chair\_Insider*, *Staggered*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. *Cartel\_Controls* includes the logarithmic transformations of *Number\_Participants*, *Duration*, *Cartel\_Sales*, *Fines\_Cartel*, *Fines\_Firm*, and *Recidivism*. The table presents the coefficient and *t-statistic* for each variable in the regression specification.

**Panel A. Other Directorships**

<i>Independent Variables:</i>	<i>Dependent variable: Abnormal_Return</i>			
	(1)		(2)	
	Coef.	<i>t-stat</i>	Coef.	<i>t-stat</i>
<i>Constant</i>	-1.74	-1.17		
<i>Independent_Directors</i>	1.76	0.78	-2.15	-0.81
<i>Independent_Directors*Other_Boards</i>	2.71**	2.29	3.85***	3.06
<i>Other_Boards</i>	-2.11**	-2.50	-3.09***	-3.21
<i>Firm_Controls</i>				Included
<i>Governance_Controls</i>				Included
<i>Cartel_Controls</i>				Included
<i>Fixed_Effects</i>				Included
<i>R</i> <sup>2</sup>		6.09%		25.02%
<i>N</i>		547		547

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Panel B. Stock Option Holdings**

<i>Independent Variables:</i>	<i>Dependent variable: Abnormal_Return</i>			
	(1)		(2)	
	Coef.	<i>t-stat</i>	Coef.	<i>t-stat</i>
<i>Constant</i>	-8.69***	-7.71		
<i>Independent_Directors</i>	10.60***	7.36	8.48***	5.24
<i>Independent_Directors*Stock_Options</i>	-0.28***	-4.74	-0.26***	-4.25
<i>Stock_Options</i>	0.23***	5.03	0.22***	4.64
<i>Firm_Controls</i>				Included
<i>Governance_Controls</i>				Included
<i>Cartel_Controls</i>				Included
<i>Fixed_Effects</i>				Included
<i>R</i> <sup>2</sup>		9.26%		26.66%
<i>N</i>		547		547

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 6. Ex-post Board Departures**

This table presents results of analyzing the effect of cartel involvement on directors' loss of directorships. Panel A analyzes the number of departures from public boards. For each director in year  $t$ , the dependent variable,  $NDepartures$ , is the number of departure announcements for each director in year  $t+1$ .  $NDepartures$  includes only unprosecuted directorships. Panel B analyzes changes in the total number of directorships for each director. In Panel B, the dependent variable  $\Delta NBoards$  is the difference between the total number of directorships (including both public and private firms) in year  $t+1$  and  $t-1$ .  $Cartel\_Involvement$  equals one if the director holds a board position in a firm in which there is a cartel prosecution announcement in year  $t$ , and zero otherwise.  $Age$  is the natural logarithm of one plus the age of the director.  $NBoards$  is the natural logarithm of one plus the number of directorships held by the director in year  $t$ .  $Wealth$  is the natural logarithm of one plus the value of the director's equity portfolio held in public directorships. The table presents the coefficient and  $t$ -statistic for each variable in the regression specification. Standard errors are clustered by director and year.

**Panel A. Departures from Unprosecuted Directorships**

<i>Independent Variables:</i>	<i>Dependent variable: NDepartures</i>			
	(1)		(2)	
	Coef.	t-stat	Coef.	t-stat
<i>Constant</i>	0.02***	11.22		
<i>Cartel_Involvement</i>	0.05***	6.39	0.04***	5.81
<i>Age</i>			0.02***	7.51
<i>NBoards</i>			0.03***	11.78
<i>Wealth</i>			0.002***	13.76
<i>Year effects</i>			Included	
<i>(Pseudo) R<sup>2</sup></i>	0.37%		13.01%	
<i>N</i>	177,577		177,577	

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Panel B. Change in Total Number of Directorships**

<i>Independent Variables:</i>	<i>Dependent variable: ΔNBoards</i>			
	(1)		(2)	
	Coef.	t-stat	Coef.	t-stat
<i>Constant</i>	0.02	1.12		
<i>Cartel_Involvement</i>	-0.06***	-3.91	-0.06***	-4.57
<i>Age</i>			-0.19***	-11.49
<i>NBoards</i>			0.10***	3.52
<i>Wealth</i>			-0.01***	-4.54
<i>Year effects</i>			Included	
<i>R<sup>2</sup></i>	0.02%		3.74%	
<i>N</i>	177,577		177,577	

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 7. Personal Wealth**

This table presents results of analyzing the effect of cartel involvement on changes in directors' wealth. The dependent variable,  $\Delta Wealth$ , is computed as the value of the director's equity portfolio (in million dollars) held in public directorships between the year after the prosecution ( $t+1$ ) and the year prior to the prosecution ( $t-1$ ). *Cartel\_Involvement* equals one if the director holds a board position in a firm in which there is a cartel prosecution announcement in year  $t$ , and zero otherwise. *Age* is the natural logarithm of one plus the age of the director in year  $t$ . *NBoards* is the natural logarithm of one plus the number of directorships held by the director in year  $t$ . *Wealth* is the natural logarithm of one plus the value of the director's equity portfolio held in public directorships in year  $t$ . The table presents the coefficient and *t-statistic* for each variable in the regression specification. Standard errors are clustered by director and year.

<i>Independent Variables:</i>	<i>Dependent variable: <math>\Delta Wealth</math></i>			
	(1)		(2)	
	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat
<i>Constant</i>	-0.16	-0.56		
<i>Cartel_Involvement</i>	-0.46*	-1.72	-0.46**	-2.29
<i>Age</i>			-0.11	-0.32
<i>NBoards</i>			0.08	0.42
<i>Wealth</i>			-0.11	-0.49
<i>Year effects</i>			Included	
$R^2$		0.02%		1.66%
<i>N</i>		56,604		56,604

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 8. Voting Support**

This table presents results of analyzing the effect of cartel involvement on directors' voting support. The analysis includes director elections across the director's portfolio of directorships. For each firm-director pair and each annual meeting in year  $t$ , the dependent variable,  $\Delta Support\_OtherFirms$ , is computed as the percentage voting support at the annual meeting held in year  $t$  minus the percentage voting support at the annual meeting held in year  $t-1$ . *Cartel\_Involvement* equals one if there is a cartel prosecution announcement related to another firm in the director's portfolio of directorships within 12 months prior to the annual meeting of year  $t$ , and zero otherwise. The rest of the variables are as defined in Table 1. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Controls* includes *Size* (defined as the natural logarithm of *Market Cap*), *BM*, *Leverage*, *Past\_Return*, *ROA*, and the natural logarithm of *Volatility*. *Governance\_Controls* includes *Chair\_Insider*, *Staggered*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. Directorships prosecuted for cartel involvement are excluded from the analysis (i.e., for directors involved in cartels we focus on the effect of cartel prosecution on voting support at other, unprosecuted directorships). The table presents the coefficient and  $t$ -statistic for each variable in the regression specification. Standard errors are clustered by director and year.

<i>Independent Variables:</i>	<i>Dependent Variable: <math>\Delta Support\_OtherFirms</math></i>			
	<i>(1)</i>		<i>(2)</i>	
	<i>Coef.</i>	<i>t-stat</i>	<i>Coef.</i>	<i>t-stat</i>
<i>Constant</i>	-0.04	-0.10		
<i>Cartel_Involvement</i>	-1.00***	-3.39	-0.72***	-2.50
<i>Firm_Controls</i>				
<i>Size</i>			0.00	-0.02
<i>BM</i>			-0.16	-0.93
<i>Leverage</i>			0.74***	5.97
<i>Past_Return</i>			-0.08	-0.24
<i>ROA</i>			0.85	0.20
<i>Volatility</i>			-0.85	-1.46
<i>Governance_Controls</i>				
<i>Independent_Directors</i>			-0.70	-0.78
<i>Staggered</i>			-1.70**	-2.09
<i>Chair_Insider</i>			-0.26**	-2.29
<i>Busy_Directors</i>			0.19	0.24
<i>Age_69</i>			0.30	0.50
<i>Indep_Director_Holdings</i>			0.02	0.99
<i>Institutional_Holdings</i>			0.75	1.14
<i>Fixed_Effects</i>				
<i>Year fixed effects</i>				Included
<i>Industry fixed effects</i>				Included
<i>N</i>		30,879		28,151
<i>R</i> <sup>2</sup>		0.04%		1.93%

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 9. Leniency Applications**

This table presents results of analyzing the association between the probability of applying for leniency and the presence of independent directors on the board. The dependent variable *Leniency* equals one if the company applies for leniency, and zero otherwise. The rest of the variables are as defined in Table 1. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Controls* includes *Size* (defined as the natural logarithm of *Market Cap*), *BM*, *Leverage*, *Past\_Return*, *ROA*, and the natural logarithm of *Volatility*. *Governance\_Controls* includes *Chair\_Insider*, *Staggered*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. *Cartel\_Controls* includes the logarithmic transformations of *Number\_Participants*, *Duration*, *Cartel\_Sales*, *Fines\_Cartel*, *Fines\_Firm*, and *Recidivism*. The table presents the coefficient and *t-statistic* for each variable in the regression specification.

	Dependent Variable: <i>Leniency</i>							
	(1)		(2)		(3)		(4)	
<i>Independent Variables:</i>	Coef.	<i>t-stat</i>	Coef.	<i>t-stat</i>	Coef.	<i>t-stat</i>	Coef.	<i>t-stat</i>
<i>Constant</i>	-0.09	-0.13	-1.60*	-1.64	-0.81	-0.46		
<i>Independent_Directors</i>	1.58**	2.46	1.74**	2.29	2.46*	1.94	9.04**	2.32
<i>Firm_Controls</i>								
<i>Size</i>	-0.28***	-5.22	-0.22***	-3.29	-0.19*	-1.73	-0.50	-1.45
<i>BM</i>	0.08	0.81	0.05	0.49	0.19	0.82	0.29	0.48
<i>Leverage</i>	0.16	0.32	0.54	0.95	0.88	1.05	8.58**	2.35
<i>Past_Return</i>	0.36*	1.94	0.29	1.41	0.18	0.65	-0.31	-0.43
<i>ROA</i>	-3.99	-1.51	-3.43	-1.22	-4.27	-0.92	0.36	0.05
<i>Volatility</i>	-3.07	-0.47	0.11	0.02	-7.08	-0.61	7.82	0.19
<i>Governance_Controls</i>								
<i>Staggered</i>			-0.26	-1.29	0.43	1.37	0.86	1.06
<i>Chair_Insider</i>			1.02***	2.87	0.76	1.28	0.99	0.77
<i>Busy_Directors</i>			-1.97***	-3.39	-3.50***	-4.07	-9.48***	-3.00
<i>Age_69</i>			-0.21	-0.30	0.90	0.77	-1.99	-0.74
<i>Indep_Director_Holdings</i>			0.08	1.32	0.05	0.52	-0.39**	-2.49
<i>Institutional_Holdings</i>			0.37	0.54	0.74	0.69	2.63	0.81
<i>Cartel_Controls</i>								
<i>Number_Participants</i>					0.11	0.53	1.09	1.34
<i>Duration</i>					-1.28***	-4.42	-3.51***	-2.76
<i>Cartel_Sales</i>					-0.13*	-1.82	0.22	1.09
<i>Fines_Cartel</i>					0.54***	6.50	1.74***	3.40
<i>Fines_Firm</i>					-1.17***	-5.68	-3.61***	-3.82
<i>Recidivism</i>					0.93***	4.29	2.97***	3.32
<i>Fixed_Effects</i>								
<i>Jurisdiction Fixed-Effects</i>								Included
<i>Year Fixed-Effects</i>								Included
<i>Industry Fixed-Effects</i>								Included
<i>Pseudo R<sup>2</sup></i>		18.35%		25.46%		63.32%		79.52%
<i>N</i>		585		585		585		585

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 10. Ex-ante Board Departures**

This table presents results of a monthly analysis of the association between board independence and director turnover in years with news of cartel prosecution. The dependent variable, *Departure*, equals one if there is at least one director departure announcement in that month, and zero otherwise. *Pre\_Prosecution* is an indicator variable that equals one for months before the news of cartel prosecution, and zero for months before the news of cartel prosecution. For the months in which there are prosecution announcements, *Pre\_Prosecution* equals one if there is a departure announcement before the prosecution announcement, and zero otherwise. The rest of the variables are as defined in Table 1. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Controls* includes *Size* (defined as the natural logarithm of *Market Cap*), *BM*, *Leverage*, *Past\_Return*, *ROA*, and the natural logarithm of *Volatility*. *Governance\_Controls* includes *Chair\_Insider*, *Staggered*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. *Cartel\_Controls* includes the logarithmic transformations of *Number\_Participants*, *Duration*, *Cartel\_Sales*, *Fines\_Cartel*, *Fines\_Firm*, and *Recidivism*. The table presents the coefficient and *t*-statistic for each variable in the regression specification. Standard errors are clustered by firm and year.

<i>Independent Variables:</i>	<i>Dependent Variable: Departure</i>							
	(1)		(2)		(3)		(4)	
	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat
<i>Constant</i>	-1.64***	-9.61	-2.11***	-8.75	-2.06***	-7.79		
<i>Independent_Directors</i>	-0.39**	-2.04	-0.60***	-3.06	-0.59***	-2.98	-0.23	-1.00
<i>Independent_Directors*Pre_Prosecution</i>	1.46***	5.84	1.36***	5.34	1.35***	5.26	0.87***	3.10
<i>Pre_Prosecution</i>	-0.77***	-3.94	-0.71***	-3.59	-0.71***	-3.54	-0.28	-1.29
<i>Firm_Controls</i>								
<i>Size</i>	0.10***	9.54	0.10***	7.13	0.08***	5.35	0.09***	5.12
<i>BM</i>	0.18***	5.00	0.21***	5.51	0.19***	4.82	0.33***	7.36
<i>Leverage</i>	-0.04	-0.31	-0.09	-0.77	-0.09	-0.76	0.19	1.48
<i>Past_Return</i>	-0.01***	-7.14	-0.01***	-7.12	-0.01***	-6.86	-0.004***	-6.05
<i>ROA</i>	-4.50***	-4.40	-4.16***	-3.97	-3.90***	-3.67	-2.93***	-2.62
<i>Volatility</i>	-1.14***	-0.69	-3.15*	-1.82	-2.79	-1.56	-2.19	-0.82
<i>Governance_Controls</i>								
<i>Chair_Insider</i>			-0.10**	-2.42	-0.06	-1.43	0.01	0.11
<i>Staggered</i>			-0.06	-1.34	-0.10**	-2.06	-0.04	-0.85
<i>Busy_Directors</i>			0.80***	8.06	0.76***	7.46	1.26***	10.90
<i>Age_69</i>			-0.09	-0.62	0.00	-0.03	0.15	0.87
<i>Indep_Director_Holdings</i>			-0.01	-0.43	-0.02	-1.24	0.13***	4.87
<i>Institutional_Holdings</i>			0.75***	5.63	0.79***	5.80	0.42***	2.79
<i>Cartel_Controls</i>								
<i>Number_Participants</i>					-0.10***	-3.19	-0.18***	-5.06
<i>Duration</i>					-0.03	-0.95	-0.04	-1.30
<i>Cartel_Sales</i>					0.03***	2.92	0.05***	5.12
<i>Fines_Cartel</i>					0.03***	4.10	0.03***	3.37
<i>Fines_Firm</i>					-0.07***	-5.12	-0.08***	-5.64
<i>Recidivism</i>					0.14***	5.20	0.14***	4.69
<i>Fixed_Effects</i>								
<i>Jurisdiction Fixed-Effects</i>								Included
<i>Year Fixed-Effects</i>								Included
<i>Industry Fixed-Effects</i>								Included
<i>(Pseudo) R<sup>2</sup></i>		6.49%		7.86%		8.69%		14.72%
<i>N</i>		7,464		7,464		7,464		7,464

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.

**Table 11. Ex-post CEO Turnover**

This table presents results of analyzing the association between CEO turnover after cartel prosecution announcements and the presence of independent directors on the board. The dependent variable, *CEO\_Turnover*, equals one if the CEO leaves the firm during the 12 months after the announcement of the cartel detection, and zero otherwise. The rest of the variables are as defined in Table 1. *Independent\_Directors* is the percentage of independent directors on the board. *Firm\_Controls* includes *Size* (defined as the natural logarithm of *Market Cap*), *BM*, *Leverage*, *Past\_Return*, *ROA*, and the natural logarithm of *Volatility*. *Governance\_Controls* includes *Chair\_Insider*, *Staggered*, *Busy\_Directors*, *Age\_69*, *Indep\_Director\_Holdings*, and *Institutional\_Holdings*. *Cartel\_Controls* includes the logarithmic transformations of *Number\_Participants*, *Duration*, *Cartel\_Sales*, *Fines\_Cartel*, *Fines\_Firm*, and *Recidivism*. The table presents the coefficient and *t*-statistic for each variable in the regression specification. \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tail) respectively.

<i>Independent Variables:</i>	<i>Dependent Variable: CEO Turnover</i>							
	(1)		(2)		(3)		(4)	
	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat	Coef.	<i>t</i> -stat
<i>Constant</i>	-2.09	-3.43	-1.52	-1.82	-2.45**	-2.46		
<i>Independent_Directors</i>	1.04*	1.90	1.09*	1.85	1.26**	2.04	1.38**	2.00
<i>Firm_Controls</i>								
<i>Size</i>	0.00	0.09	-0.01	-0.19	0.01	0.21	-0.03	-0.39
<i>BM</i>	-0.09	-1.24	-0.09	-1.21	-0.09	-1.17	-0.10	-1.08
<i>Leverage</i>	-0.64	-1.36	-0.85*	-1.73	-0.93*	-1.82	-0.67	-1.10
<i>Past_Return</i>	0.06	0.28	0.10	0.46	0.15	0.67	0.20	0.85
<i>ROA</i>	0.23	0.14	0.38	0.23	0.26	0.16	-1.65	-0.62
<i>Volatility</i>	9.53	1.58	10.75*	1.74	11.55*	1.79	5.14	0.53
<i>Governance_Controls</i>								
<i>Staggered</i>			0.04	0.24	0.10	0.58	0.04	0.22
<i>Chair_Insider</i>			-0.27	-1.33	-0.33	-1.62	-0.28	-1.26
<i>Busy_Directors</i>			0.32	0.74	0.36	0.81	0.60	1.21
<i>Age_69</i>			0.16	0.25	0.56	0.83	0.52	0.71
<i>Indep_Director_Holdings</i>			0.02	0.46	0.01	0.33	-0.01	-0.19
<i>Institutional_Holdings</i>			-0.51	-0.96	-0.63	-1.15	-0.64	-0.98
<i>Cartel_Controls</i>								
<i>Number_Participants</i>					0.22	1.57	0.27*	1.72
<i>Duration</i>					-0.24	-1.61	-0.16	-0.83
<i>Cartel_Sales</i>					0.09***	2.12	0.11**	2.06
<i>Fines_Cartel</i>					0.01	0.18	0.01	0.20
<i>Fines_Firm</i>					-0.09	-1.52	-0.10	-1.40
<i>Recidivism</i>					0.01	0.04	-0.08	-0.55
<i>Fixed_Effects</i>								
<i>Jurisdiction Fixed-Effects</i>								Included
<i>Year Fixed-Effects</i>								Included
<i>Industry Fixed-Effects</i>								Included
<i>Pseudo R<sup>2</sup></i>		2.86%		3.92%		7.28%		12.46%
<i>N</i>		519		519		519		519

Note: \*, \*\* and \*\*\* denote significance at the 10, 5 and 1% significance level (two-tailed), respectively.