Are banks too big to fine?*

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March 1, 2023

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Abstract

We test the overarching hypothesis that financial institutions face relatively milder fines due to financial stability concerns. To do so, we use an event study approach on a sample of 441 listed cartel members prosecuted by the European Commission between 1998 and June 2020. Our results suggest that banks face a positive effect on their market value upon the dawn-raid and the announcement of the cartel fine, whereas both events negatively (and significantly) affect non-banks. Using a novel measure of "harm", we show that this positive effect is not driven by the resolution of uncertainty, but is rather a consequence of "too big to fine" concerns.

Keywords: Banking regulation; antitrust; cartels; event study.

*We gratefully acknowledge funding from the Wallenberg Foundation (Wallenberg Stif.PWS 2015.0013) and research assistance from Thi Ngoc Dao (T.U.Dublin-City Campus), *Contact:* catarina.marvao@tudublin.ie, spagnologianca@gmail.com

1 Introduction

We test the overarching hypothesis that financial regulators have a conflict of interest and will impose relatively milder fines on financial intermediaries due to financial stability concerns.

A number of very large banking cartels have been detected recently, suggesting that bank cartels are rather common, and that the current enforcement system is not effective against banks. For example, one of the biggest financial scandals of recent times is the "Libor case," which involved 14 large international banks manipulating for years a core benchmark price for financial markets. Other banking cartels have been uncovered, such as cartels manipulating the Swiss franc (2014), Euro (2016) and Yen interest rate derivatives (2015); the FOREX cartel (2021) and the European Government bonds' cartel (2021), all of which involving several very large financial institutions[1]. A further bank cartel has been recently discovered and involves firms which, between 2006 and 2009, coordinated their behavior in order to jointly prevent exchanges from entering the CDS market. This cartel is also under investigation by the EU Commission. Alongside the damage caused directly through market manipulation, episodes of collusive behavior undermine trust in the financial sector[2].

The risk that fines are too low to deter misbehavior but high enough to undermine economic (operational and allocative) efficiency is particularly severe for banking cartels. Such cartels are principally problematic in terms of the appropriate level of fines and damages that induce deterrence, as banks impose externalities on society in terms of financial stability when they are undercapitalized and their fragility increases. The well-known "too big to fail" (TBTF) problem is linked to the unwillingness of governments and financial regulators to let large banks bear the bad consequences of their mistakes, when the risk of bank failure exists. This tends to reinforce the incentives of large banks to misbehave. Spagnolo (2012) suggests that the same concerns over externalities, in terms of financial stability, determines a "too big to fine" problem which makes banks judgement-proof. This is because regulatory agencies may wish to limit fines (and, similarly, Courts of law may limit damages, at least relatively to comparable non-financial firms) in order to prevent the need to recapitalize banks weakened by larger monetary sanctions. A related problem is that large fines might be read as a negative signal regarding the solidity and reliability of the banking institutions, and relatively uninformed bank customers might overreact, triggering a bank run. This might be costly for the taxpayer,

[1] These include e.g. JPMorgan, Mitsubishi Financial Group, Bank of America, HSB, Credit Agricole, Citigroup, Barclays, Societe Generale, Deutsche Bank, UBS, NatWest Group, UniCredit and Credit Suisse.

[2] Such trust is, according to relatively recent evidence (Sapienza and Zingales (2012), Hansen (2014)), already rather low after the so-called Global Financial Crisis in 2008-2009.

as the public lender-of-last-resort must typically bail out small depositors. This set of problems is potentially relevant for any type of financial misbehavior, besides bank cartels, and may be a source of regulatory capture when financial regulators are concerned about bank capitalization.

This is an extreme form of the "judgement proofness" problem discussed by law and economics scholars and according to which highly leveraged firms tend to be subject to lower fines (Shavell, 1997); and of the "strategic judgement proofness" problem, according to which firms which are at risk of being fined (due to misbehavior) strategically increase their leverage in order to prevent paying large fines (Che and Spier, 2008). These problems are neither purely theoretical constructs nor specific to banks (see (Buccirossi and Spagnolo, 2008) for a survey with an application to antitrust). The financial stability concerns specific to the banking industry, however, may make banks even more "judgement proof", increasing the probability that antitrust and regulatory enforcement is so restrained that it fails to deter bank misbehavior, possibly creating incentives for financial institution to engage in "strategic judgement proofing" more than other firms.

In this paper we explore whether, amongst firms found to be involved in cartels, banks are treated differently (i.e. given lower fines) from non-banking firms, and whether financial regulators are captured, i.e. whether they are softer with banks than are antitrust authorities. To do so, we use an event study approach on a sample of 441 listed cartel members prosecuted by the European Commission between 1998 and June 2020.

Our results suggest that, while news of the dawn-raid and the announcement of the cartel fine affect negatively and significantly non-banks, this is not the case for banks. The effect on the market value of banks is in fact positive, albeit to a statistically insignificant extent.

We then extend the analysis to include non-cartel infringements such as money-laundering, fraud, failures of disclosure and mortgage issues, and show that our results are robust.

Furthermore, we are able to discriminate between whether the positive effect on banks' market value is due to the resolution of uncertainty as suggested in previous research on non-antitrust banking infringements (Köster and Pelster, 2017; Flore, Degryse, Kolaric, and Schiereck, 2021; Degryse, Karagiannis, Tombeur, and Wuyts, 2021) or, consistent with the argument of regulatory capture, because of "too big to fine" concerns, in the sense that the fine is smaller than what the market anticipated.

The resolution of uncertainty argument rests on stock market investors' preference for early resolution of uncer-

tainty. Hence, if this explanation is correct, one should see a positive drift in the stock price as the fine announcement date gets close. There is evidence that this is the case in the money market, ahead of FOMC (Fed) announcements, and before nonfarm payrolls, ISM, and GDP announcements (Hu, Pan, Wang, and Zhu, 2022).[3] However, in section 4.2, we show that this is not the case. Moreover, the effect of both the dawn-raid and the announcement of the fine are very different for banks and non-banks. In fact, they take the opposite sign. This runs against the argument that resolution of uncertainty may be the main driver of the positive effect for banks, unless we are ready to posit that it operates only for banks and not for other types of firms.

We also find evidence consistent with the regulatory capture and the "too big to fine" argument. We observe that the positive price effect upon announcement of the fine is present only for banks, and it is strongest for larger banks, which are presumably the ones that pose the greatest systemic risk concerns and thus the ones that regulators are more reluctant to undermine with harsh fines.

The next section offers a review of key contributions in the literature. Section 3 provides details on the data we use and on our research design. Section 4 presents the results of our empirical investigation. Section 5 offers final remarks and draws conclusions.

2 Literature Review

An important finding of the recent literature is that the impact on stock market valuations of announcements of financial penalties on listed financial firms is positive, whereas it is often found to be negative in the case of non-financial firms (Bizjak and Coles, 1995; Karpoff, Lott, and Wehrly, 2005; Karpoff, Lee, and Martin, 2008, 2012; Gande and Lewis, 2009; Deng, Willis, and Xu, 2014)). Two recent contributions stand out. Köster and Pelster (2017), using a sample of 68 international listed banks, find positive abnormal returns with announcements of financial penalty, surmising that "investors are pleased that cases are closed, that banks successfully manage the consequences of misconduct". Flore et al. (2021), examining the announcement of fines for 25 amongst the largest banks, finds a positive association with stock market valuations. Like Köster and Pelster (2017), they argue that the positive reaction is likely driven by the resolution of uncertainty surrounding these proceedings.

The typical methodology in the literature is the event study (Boehmer, Masumeci, and Poulsen (1991), Aguzzoni,

[3] See Lucca and Moench (2015) and Ball and Kothari (1991) for early references on positive return drift before earnings announcements and FOMC interest rate announcements, respectively.

Langus, and Motta (2013), Armour, Mayer, and Polo (2017),[4] Bos, Letterie, and Scherl (2017); Mariuzzo, Ormosi, and Majied (2020)). Event studies are useful to handle the unbalanced nature of the available data panels and is suitable to make inference on both the sign and magnitude of the market price reaction to news and its timing. Both set of facts are important for inference on the causal mechanisms behind the price action.

Karpoff et al. (2008) find that the most severe consequences of misbehavior are often those imposed by the market in the form of an adverse price reaction, which are an order of magnitude larger than the financial implications (fines) of the sanctions inflicted by authorities. The type of misbehavior on which these author focus is financial misrepresentation, which shareholders are likely to care about. The same authors report much milder market reaction when firms are caught for bribery (Karpoff et al. (2012)). They investigate the nexus between misbehavior and severity of sanctions, demonstrating the existence of incentives to misbehave due to the lack of severity of the sanctions.[5] The findings of Dyck, Morse, and Zingales (2010) also imply that firms' decision to misbehave depends on the effectiveness of mechanisms for deterring misbehavior, though the focus of their study is incentives to whistleblowing.
Gunster (2016) focus on the impact of European antitrust policy and use an event study methodology to estimate the impact of European antitrust policy, which is of direct relevance to our investigation. They analyze the stock market response to European antitrust decisions and find that the response is large and negative for dawn raids and infringement decisions, fines and legal costs only explain a fraction of the total loss in market value, and thus conclude that the market anticipates convicted firms to lose profitability and reputation. Interestingly, they also find that smaller firms and cases with greater media coverage show a greater response. This is important in our context, because it suggests that we can expect that larger banks (that enjoy more visibility with investors) are the ones for which the "too big to fine" effect should be more noticeable.

Losses arising from the consequences of misbehavior can be seen as realizations of exposure to operational risk. These include losses due to monetary fines and other penalties resulting in restrictions placed by regulators on the firm's activities, and losses arises from reputational damage, which include loss of customers and of investors. There is an extensive literature that has examined the determinants of reputational risk, starting with the seminal work of Karpoff and Lott (1993). With regard to the banking sector, this literature includes the work of Gillet, Hübner, and

[4]These authors apply the methodology to estimate the effect of several types of misconduct. For example, they find that only 3rd-party wrongs attract reputational sanctions (like misselling of financial products), not 4rd-party wrongs (like money laundering).

[5]Karpoff et al. (2012) demonstrate that the net present value of projects that imply paying bribes remains positive even after the firms are caught. Bribery is associated with projects that are valuable, even considering the expected penalties. For firms that are caught, the average ex post NPV net of penalties is still non-negative and the reputational loss is negligible.

Plunus (2010), Fiordelisi, Soana, and Schwizer (2013) and, more recently, Barakat, Ashby, Fenn, and Bryce (2019).[6]

3 Data and Research design

This section explains the data and method used in our research design. We start by providing details on the data we use and then describe our research design, explaining how we use our data to make inferences on our overarching question of interest, namely whether financial regulators have a conflict of interest and will impose relatively milder fines on financial intermediaries due to financial stability concerns.

3.1 Data

3.1.1 Cartel Data.

Data on EU cartel cases was hand-collected by one of the authors through the European Commission's publicly available summary reports and associated press releases of the antitrust cases handled by the EC and accessible via the Commission's website.[7] The data include 161 cartels (within 124 cartel cases) and 613 unique cartel members convicted in the period of 1998 to June 1, 2020. The total sample comprises 838 observations (due to repeated or multiple offenses committed by some firms).

3.1.2 Data on other infringements.

Information on non-cartel banking infringements in European Union countries was also collected from public press releases. These include infringements such as money-laundering, fraud, failures of disclosure and mortgage issues. We collect data on 222 events. We could, however, only obtain accurate dates for the investigation / raid for 37 of these events. Since we are interested in the share price reaction following a raid, we focus on fine data for these events only.

[6] There is also an extensive literature on the determinants of banks' operational risk. This includes the work of Demirguc-Kunt and Huizinga (2010), Chernobai, Jorion, and Yu (2011), Heidinger and Gatzert (2018).

[7] A thorough description of this dataset can be found in Marvão (2015) and Levenstein, Marvão, and Suslow (2015).

3.1.3 Stock price data.

We obtain data on the firms convicted by the European Commission and other financial regulators with publicly listed firms on *Datastream*. We keep all firms listed on a stock exchange at either the time of the investigation or the fine. Thus, we exclude a small number of firms which were publicly listed at the time of the appeal but not at the time of the fine. Where a firm was not found, we included a listed parent company. Where a firm is listed in more than one stock exchange, we selected the home market. For all these firms, both the financial ones and the matched non-financial ones, we collected the daily share price (adjusted for dividends), total stock market capitalization and stock market capitalization of the firm. For 28 of these firms, we could not find share prices before the investigation date, likely because the firm was not yet public or had been delisted. This selection procedure produced a sample of 441 firms fined for collusion, of which 25 are banks; and 161 banks involved in other infringements.

3.2 Data concerns

One concern with the data is the possibility of sample selection bias. Since cartels are prohibited in the EU (article 101 of the TFEU), they are secret, so the available data include only cartel members that were prosecuted and convicted. Similarly, we only include detected non-cartel banking infringements. This problem of selection on the unobservables cannot be overcome in our setting, but its existence is acknowledged in the interpretation of the results.

Secondly, we include banks fined by the European Commission and financial regulators. The European Commission may be less sensitive to financial stability concerns than financial regulators. However, the event study by Armour et al. (2017) finds that the share price impact of sanctions for financial infringements in the UK is very similar to that for members of cartels fined by the EC, as found in Aguzzoni et al. (2013). Therefore, we assume that the market behaves in the same way for cartel and non-cartel infringements, whether the authority in charge of deciding on the penalties is the European Commission or a financial regulator.

Finally, there may be a concern that market priors might be different for financial and non-financial firms. The market may be more sensitive to non-banking cartels because consumers may expect banks to be more involved in antitrust infringements and other scandals. In section 5.2 we attempt to deal with this issue by comparing the total and reputational loss with the fines. If both the total loss and the fine are small, then the reputational loss can be larger than the fine, which allow us to calculate a lower bound for it.

3.3 Method

In order to measure the reaction of the stock market to an antitrust investigation, fine announcement and appeal resolution, we use the event study approach developed by Brown and Warner (1985).

An event study can capture the impact of the specific events on the value of a firm by identifying whether an abnormal stock price effect is associated with an unanticipated event. Based on the efficient market hypothesis (Fama, Fisher, Jensen, and Roll, 1969; Fama, 1970), share prices reflect the full range of available relevant information. Thus, investors' expectation of a positive (negative) value impact leads them to invest (divest), in turn causing the stock price to rise (decrease).

3.4 Event study methodology

We use the market model (Brown and Warner, 1985) in order to obtain daily abnormal returns for firm i:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{1}$$

where R_{it} is firm i's total stock, calculated as $R_{it} = lnP_{it} - lnP_{it-1}$, with P_{it} denoting the share price on day t. R_{it} is thus the investor's expectation on future earnings given the relevant information which arises between days t and $t-1$. R_{mt} is the total stock return on the domestic stock market index of firm i on day t during a specific time period. We assume that $E(\varepsilon_{it}) = 0$ and $E(\varepsilon_{it}^2) = \sigma^2$.

The daily abnormal return of firm i on day t (AR_{it}) is calculated by the difference between R_{it} and normal returns ($E(R_{it})$) and is given by the equation below. We use an estimation period of 200 trading days that ends 30 days before the event window ($T_0 = -229$ to $T_1 = -30$)[8] to estimate α_i and β_i. We compute abnormal returns as follows:

$$AR_{it} = R_{it} - E(R_{it}) = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \tag{2}$$

The cumulative average daily abnormal return ($CAAR$) for n firms and an event window between t_1 and t_2 is given

[8]The results are highly robust to using smaller estimation periods such as 101 days in Aguzzoni et al. (2013).

by the sum of the average abnormal returns (AAR):

$$CAAR = \sum_{t=t_1}^{t_2} (AAR_{it}) = \sum_{t=t_1}^{t_2} \left(\frac{1}{n} \sum_{i=1}^{n} AR_{it} \right). \tag{3}$$

We identify three main public events: the dawn raid (or inspection), which in some cases coincides with the end of the collusive agreement; the announcement of the fine; and the appeal decision. We use the same benchmark event windows as in Aguzzoni et al. (2013), spanning from 20 days before the event to 10 days after (31 days event window).

We check the null hypothesis that each event has an effect on mean returns (i.e. that the CAAR is zero) by using the adjusted BMP test Kolari and Pynnönen (2010)[9] which uses the J-statistic, given by:

$$J = \frac{\overline{sCAAR}\,\sqrt{n}}{S_{sCAR}\sqrt{1 + (n-1)\bar{r}}} \tag{4}$$

where $\overline{sCAAR}$ is the scaled CAAR, S_{sCAR} is the standard deviation of the scaled CAR and $\bar{r}$ is the average sample cross-correlation for the estimated time window.

4 Baseline empirical results

In this section, we present and discuss the baseline event study results, based on the traditional definition of CAAR as given in (3), first for all firms and then for banks and non-banks separately.

4.1 Overall results

The results of the event study for all the firms in the data (banks and non-banks) are reported in tables 1 and 2. These include the average abnormal return (AAR) from 20 days prior to the event to 10 days after the event. We also display the J-statistic (BMP test described above).

[9] In the adjusted BMP test, the average of the sample cross-correlations of the estimation period residuals is used to calculate the variance of the mean abnormal return and then calculate the t-test for scaled abnormal returns. With this test, we take into account cross-sectional correlation, and it is robust to serial correlation.

4.1.1 Cartel fines

In table 1, we estimate the effect of the three events for cartels only. On the day of the dawn raid, the average abnormal return (AAR) is negative and statistically significant at the 1% level. It suggests a 0.27% drop in the firm's share price on the day of the dawn raid is carried out. As in Aguzzoni et al. (2013), this illustrates that stock markets react rapidly to unexpected news.

As expected, the market continues to adjust to the dawn raid news for several days, and we find further share price drops of 7% and 21% in days 1 and 2 after the raid, and some mildly significant drops of 0.7% to 0.17% in days 4, 6, and 7 after the raid.

We also identify some significant drops in returns 18, 15, 11 and 1 day prior to the raid.[10]. Given that the investigation and the date of the raid is supposedly secret, this is unexpected. On this, Aguzzoni et al. (2013) and Mariuzzo et al. (2020) face the same results and attribute this to three main effects. First, "the leniency effect", as investigations may occur due to leniency applications and individuals in the reporting firms may spread the news that the authority might start an investigation. Second, the "domino effect" as there may be ongoing investigations on the same cartel in other jurisdictions such as the US. Third, the "failed cartel effect" given that leniency applications often arise after the cartel collapsed, so that firms race to avoid a fine.

The overall effect of the raid on abnormal returns is a highly significant decrease of 0.59% in the cumulative returns if we choose a 31-day window (-20,+10) and a decrease of 0.77% with a 7-day window (-1,+5).

The fine has statistically significant effects some days prior to the announcement (17, 12, 9, 8 and 6) and after the announcement (2, 4, 8 and 9), although the latter is less significant. This is in line with Aguzzoni et al. (2013), given that there will be rumors and an anticipation of the negative effect of the cartel conviction, and the market will further adjust to the fine after its announcement.

The overall effect of the fine announcement on the abnormal returns is a statistically significant decrease of 1.24% in the cumulative returns if we choose a 31-day window (-20,+10).

We find very little effect from the European Court of Justice appeal judgements. We find a significant effect 9 days after the appeal decision date. This effect is slightly larger if we consider only upheld appeals.

Overall, the estimated total effect of the cartel investigation (sum of the effects of the events in isolation) is 1.827%

[10] Aguzzoni et al. (2013) find significant drops in returns 20, 9 and 8 days prior to the dawn raid

drop in share prices.

$$\hat{\Delta}_{Total} = \hat{\Delta}_{Fine} + \hat{\Delta}_{Inv.} = 0.591\% + 1.236\% = 1.827\% \tag{5}$$

4.1.2 Robustness checks

We perform several robustness checks. First, in table 2, we increase the sample size of banks by including fines on non-cartel banking infringements in European Union countries. These include 222 fines for infringements such as money-laundering, fraud, failures of disclosure and mortgage issues. Given the unavailability of accurate data on the date of the dawn-raid or investigation, we use fine data only. The effect of the fine on the cumulative returns is not significant, and we find very mildly significant effects 12 and 9 days prior to the fine announcement.

Second, we check the robustness of the results using non-parametric tests and the mean model. In the mean model, the mean return of the individual security is used as the counterfactual return, such that: $R_{it} = ln\alpha_i - \eta_{it}$. The reasoning for this test is that a change in the share price of a very large firm may cause a change in the relevant stock market index, thus causing an endogeneity issue. The mean model takes this into account. We also perform non-parametric test as Dombrow et al. (2000) show that if the underlying distribution of the errors is uncertain, distribution free statistics (like non-parametric tests) are more robust. In both tests, the results are qualitatively identical.

Finally, in table 3 we split the data in different ways. Some results are noteworthy. For repeat offending firms (those previously fined for a cartel) and those in cartels already fined in the US, the negative impact of the investigation on cumulative returns is much larger (4.44% drop) but the effect of the fine is not statistically significant. It is also worth noting that both the investigation and the fine have no statistically significant effect on the cumulative returns of immunity recipients (reporting firms through the Leniency Program) reinforcing the evidence that firms already anticipated the down raid and the fine.

4.2 Bank vs. Non-banks

Table 4 reports the results for banks and non-banks, using different event windows.

We first note that the effect for banks is positive, remains at essentially the same level throughout the time that runs from between 20 days before the event and the day after the event, dissipating somewhat immediately before and after the announcement. This pattern is incompatible with an explanation centered on resolution of uncertainty, as otherwise

the effect would have to build up over time (i.e, it would have to be larger for the event windows that go back further in time), as the moment of the resolution of uncertainty approaches, since this moment is known in advance.
With a 30-day event window, we find that the overall effect of the cartel conviction is positive, but it is not statistically significant for banks, whereas the effect is negative and highly significant for non-banks.

$$\hat{\Delta}_{Total,banks[-20,+10]} = \hat{\Delta}_{Fine,banks} + \hat{\Delta}_{Inv.,banks} = 3.62\% \quad (non - significant) \tag{6}$$

$$\hat{\Delta}_{Total,non-banks[-20,+10]} = \hat{\Delta}_{Fine,non-banks} + \hat{\Delta}_{Inv.,non-banks} = -2.09\% \tag{7}$$

Given that we have estimated the effects of the three events in isolation, these calculations overestimate the true total effect (Δ_{Total}). This further strengthens our result on banks not experiencing a significant loss in stock price. Further, we have also not weighted the estimated effects of the events for the firms' capitalization which may be important, given that the effect of antitrust convictions are likely different for small and large firms. Below, we estimate the weighted average effect of antitrust events. To complete our analysis, we formally test the null that the effect for bank is less negative than the effect for non-banks. To this end, we use the following statistic:

$$t_{diff} = \frac{CAAR_{banks} - CAAR_{non-banks}}{\sqrt{\frac{\hat{\sigma}^2(CAAR_{banks})}{n_{banks}} + \frac{\hat{\sigma}^2(CAAR_{non-banks})}{n_{non-banks}}}} \tag{8}$$

Here, $\hat{\sigma}^2(.)$ denotes an estimate of the (cross-sectional) variance of the CAARs in the cross-section of the firms (either banks or non-banks). If we make the assumption that these CAARs (treated as cross-sectional averages of CARs) are uncorrelated within the bank and non-bank groups of firms and across the two groups, then the statistic is distributed in large samples as a standard random variable.

5 Weighted average effect of antitrust events

In this section, we introduce an alternative measure of the effect of the event under consideration. This alternative measure can be seen as a market capitalization weighted CAAR, obtaining using market capitalization weights in (3) in place of the equal weights of the baseline version considered in the previous section. In what follows, we first formally define this measure, and then present and discuss event study results based on such measure of the event

effect, first for all firms and then for banks and non-banks separately.

5.1 Effect of each antitrust event

We follow Aguzzoni et al. (2013), in defining the weighted estimate of the market losses to capitalization ratio ($\hat{\Delta_{Fine,Inv}}$) due to the fine or the investigation.

Let us define L_{Inv} and L_{Fine} as the estimated loss in market value from the investigation or the fine, respectively, and CAP as firm i's capitalization at the day of the event, in the subset of S firms (with S ≤ 554). Finally, we use $CAAR_i^{Inv}$ and $CAAR_i^{Fine}$ to denote the estimated effect of the investigation or the fine.

One can then compute the weighted estimate of the market losses to capitalization ratio, for the investigation and the fine, which is given by:

$$\hat{\Delta_{Inv}} = \frac{L_{Inv}}{CAP_{383}} = \frac{\sum_{j=1}^{383}(CAAR_i^{Inv} CAP_i)}{\sum_{s=1}^{383} CAP_s} = -0.59\% \tag{9}$$

$$\hat{\Delta_{Fine}} = \frac{L_{Fine}}{CAP_{463}} = \frac{\sum_{i=1}^{554}(CAAR_i^{Fine} CAP_i)}{\sum_{s=1}^{463} CAP_s} = -0.85\% \tag{10}$$

As in Aguzzoni et al. (2013) (where $\hat{\Delta_{Inv}} = -1.61\%$, $\hat{\Delta_{Fine}} = -2.12\%$), we find that these estimates are lower than the unweighted average effects of the events, thus suggesting that for bigger firms (size is proxied by capitalization) the effect of antitrust events is lower, ceteris paribus.

5.2 Total effect of the antitrust event

In calculating the overall effect of the antitrust event, we can use two different methods. The first method is to consider all firms but treat the firms for which we have no observation about the dawn-raid date as if they had an estimated CAAR for the dawn-raid equal to zero. This allows us to approximate the total loss as $L_{TOT,554}$. This is an underestimation (in absolute value) of the total effect, since we expect that, were we able to observe it, on average the estimated CAAR of the Investigation would be negative. This effect is as follows:

$$\hat{\Delta_{TOT,554}} = \frac{L_{TOT,554}}{CAP_{554}} = \frac{\sum_{i=1}^{554}(CAAR_i^{Fine} CAP_i) + \sum_{j=1}^{383}(CAAR_i^{Inv} CAP_i)}{CAP_{554}} = -1.078\% \tag{11}$$

The second method is to include only the subset of firms for which we have estimations of the effects of both the dawn-raid and the fine. This gives us the following estimate:

$$\hat{\Delta_{TOT,383}} = \frac{L_{TOT,383}}{CAP_{383}} = \frac{\sum_{i=1}^{383}(CAAR_i^{dec}CAP_i) + \sum_{i=1}^{383}(CAAR_i^{Inv}CAP_i)}{CAP_{383}} = -1.44\% \tag{12}$$

We can then estimate that the total effects of the antitrust action upon the firm's market valuation is between -1.08% and -1.44%.

5.3 Market loss due to Antitrust actions

Next, we want to understand the causes of the overall loss in market value. One obvious source is the direct effect of the antitrust fine, but there may be other factors impacting this loss. Three additional sources of loss in value can be distinguished. First, the legal and consulting fees for antitrust proceedings might be significant (Aguzzoni et al., 2013). Secondly, the firm may be forced to give up profitable projects, because the management is focused on the antitrust action or because the fines impacted the firm's ability to take on these projects (Aguzzoni et al., 2013). Finally, there may be a reputational loss to the firm (Armour et al., 2017).

We therefore calculate the overall loss in capitalization due to the fines ($\hat{\Phi_S}$) as the ratio between the total value of the fines for a subset of S firms, and the capitalization value for the same subset S. We do this for each of the two methods used in the previous section (4.3.2).

First, considering the complete sample, we calculate that the loss in capitalization due to the fine is $\hat{\Phi_{554}} = 0.159\%$, and that the fines explain only 14.73% of the overall loss in market value due to antitrust action, as shown in the equation below:

$$\frac{\hat{\Phi_{554}}}{\hat{\Delta_{TOT,554}}} = \frac{\frac{FINE_{TOT,554}}{CAP_{554}}}{\hat{\Delta_{TOT,554}}} = \frac{\frac{\sum_{s=1}^{554} FINE_s}{CAP_{554}}}{\hat{\Delta_{TOT,554}}} = \frac{-0.159\%}{-1.078\%} = 14.73\% \tag{13}$$

Second, if we include only the subset of firms for which we have estimations of the effects of both the dawn-raid and the fine, we obtain the following:

$$\frac{\hat{\Phi_{383}}}{\hat{\Delta_{TOT,383}}} = \frac{\frac{FINE_{TOT,383}}{CAP_{383}}}{\hat{\Delta_{TOT,383}}} = \frac{\frac{\sum_{s=1}^{383} FINE_s}{CAP_{383}}}{\hat{\Delta_{TOT,383}}} = \frac{-0.225\%}{-1.44\%} = 15.63\% \tag{14}$$

We can then conclude that the fines explain around 15% of the loss in market value due to the antitrust events. As such, non-fines explain around 85% of the loss in market value due to the antitrust and banking infringement events.

5.4 Banks vs. Non-Banks

We can now do the same calculations for banks and non-banks. The weighted estimate of the market losses to capitalization ratio, for the investigation and the fine, for banks and non-banks, is as follows:

$$\hat{\Delta_{Inv,Banks}} = 3.33\%, \hat{\Delta_{Inv,Non-Banks}} = -0.77\%$$

$$\hat{\Delta_{Fine,Banks}} = 0.29\%, \hat{\Delta_{Fine,Non-Banks}} = -1.32\%$$

Using the two methods described above, the overall effect of the antitrust event is the following:

$$\hat{\Delta_{Total\_25,Banks}} = 0.56\%, \hat{\Delta_{Total\_393,Non-Banks}} = -1.96\%$$

$$\hat{\Delta_{Total\_17,Banks}} = 3.62\%, \hat{\Delta_{Total\_366,Non-Banks}} = -2.09\%$$

Overall, the loss in market value due to antitrust action is as follows:

$$\frac{\hat{\Phi_{25,Banks}}}{\hat{\Delta_{TOT,25}}, Banks} = |\frac{-0.030\%}{0.56\%}| = 5.36\%$$

$$\frac{\hat{\Phi_{17,Banks}}}{\hat{\Delta_{TOT,17}}, Banks} = |\frac{-0.207\%}{3.62\%}| = 5.72\%$$

$$\frac{\hat{\Phi_{393,Non-banks}}}{\Delta_{TOT,393}, \hat{Non} - banks} = \frac{-0.24\%}{-1.96\%} = 12.21\%$$

$$\frac{\Phi_{366}, \hat{Non} - banks}{\Delta_{TOT,366}, \hat{Non} - banks} = \frac{-0.27\%}{-2.09\%} = 12.68\%$$

Table 5 summarizes the above results and compares them with the full sample. Overall, the results suggest that banks see an increase in the market value to capitalization ratio, following both a dawn-raid and a cartel fine. Further, only 5% to 6% of the change in the market value of banks is explained by the antitrust action, whereas for non-banks, the antitrust action explains 12% to 13% of the change in market value.

We further examined the bank size and find that the fine to capitalization ratio is much lower for larger banks, which suggests that the level of harm is lower for bigger banks.

5.5 Reputational Loss

Following from the discussion in section 4.3.3, regarding the sources of market value loss, if we assume that the loss from (1) legal fees, and (2) missed profitable projects, are both small, then we can assume that the total loss in market value is the sum of the direct effect of the fine and that of reputational loss.

The analysis then suggests that the reputational loss explains around 87% ($= 1 - 12.68\% \approx 13\%$) of the change in market value for non-banks, and 94% ($= 1 - 5.72\% \approx 6\%$) for banks.

If we assume that the reputational loss contains information on the gravity of the infringement, then we can assume that the reputational loss is a proxy for harm, although imperfect. Then, the above computations offer an alternative way to see that, in the case of banks, the authorities' hand is more restrained, as it can be interpreted as showing that fines are a smaller fraction of the harm they cause with their misbehavior.

6 Conclusion

We test the overarching hypothesis that financial institutions face relatively milder fines due to financial stability concerns. To do so, we use an event study approach on a sample of 441 listed cartel members prosecuted by the European Commission between 1998 and June 2020. Our results suggest that banks face a positive effect on their market value upon the dawn-raid and the announcement of the cartel fine, whereas both events negatively (and significantly) affect non-banks.

We are then able to discriminate between whether the positive effect on banks' market value is due to the resolution of uncertainty as suggested in previous research on non-antitrust banking infringements (Köster and Pelster, 2017; Flore et al., 2021; Degryse et al., 2021) or, consistent with the argument of regulatory capture, because of "too big to fine" concerns, in the sense that the fine is smaller than what the market anticipated.

The resolution of uncertainty rests on stock market investors' preference for early resolution of uncertainty. Hence, one should see a positive drift in the stock price as the fine announcement date gets close. There is evidence that this is the case in the money market, ahead of FOMC (Fed) announcements. We show, however, that this is not the case and, moreover, the effect of both the dawn-raid and the announcement of the fine are very different for banks and non-banks. In fact, they go in opposite directions, such that the resolution of uncertainty does not appear to drive the

results.

We find instead evidence consistent with the regulatory capture and the "too big to fine" argument. We observe that the positive price effect upon announcement of the fine is present only for banks and it is strongest for larger banks, which are presumably the ones that pose the greatest systemic risk concerns and thus the ones that regulators are more reluctant to undermine with harsh fines.

Table 1
Daily (AAR) and Cumulative average abnormal returns (CAAR), 1998-6/2020; cartels only.

Days to event	Investigation (383 obs.)		Fine (411 obs.)		Appeal (374 obs.)	
	AAR	J	AAR	J	AAR	J
-20	0.126	-0.854	-0.018	0.53	0.287**	2.119
-19	0.116	0.51	-0.01	-0.393	-0.092	0.343
-18	-0.239***	-3.096	0.009	0.817	0.170*	1.558
-17	-0.143*	-1.335	-0.252***	-2.797	0.146**	1.857
-16	0.143	1.786	0.204	1.572	-0.178	-1.951
-15	-0.426***	-3.41	0.119	0.759	-0.116	-1.347
-14	0.049	0.568	0.194	2.137	-0.233	-2.341
-13	0.002	-0.434	-0.147	0.571	0.076*	1.376
-12	0.12	-0.029	-0.194***	-2.446	0.172	1.106
-11	-0.227**	-2.075	-0.001	0.591	-0.023	-1.006
-10	-0.055	-1.201	-0.125	-1.214	0.059	0.946
-9	-0.049	-1.01	-0.305***	-3.568	-0.001	-0.115
-8	0.05	0.929	-0.084**	-2.237	0.215	1.171
-7	0.36	0.983	0.005	0.345	0.068	-0.54
-6	0.128	1.031	-0.135**	-1.905	-0.047	0.039
-5	0.137	1.517	0.126	-0.124	-0.075	-1.059
-4	0.085	1.342	0.102	0.223	0.17	1.041
-3	0.058	-0.136	0.068	-0.003	-0.075	-0.109
-2	0.109	1.374	-0.016	0.176	0.108	0.932
-1	-0.209**	-2.26	0.006	1.314	0.037	-0.317
0	-0.265***	-3.706	-0.057	-1.022	-0.109	-1.722
1	-0.068**	-2.004	-0.211	-0.844	-0.036	-0.881
2	-0.209***	-2.415	-0.253**	-1.955	0.032	-0.618
3	0.02	-0.737	-0.01	-0.363	0.049	0.576
4	-0.073*	-1.577	-0.193**	-2.073	-0.055	-0.552
5	0.029	0.827	0.172	2.022	0.014	0.751
6	-0.102*	-1.43	0.084	0.795	0.004	0.424
7	-0.165*	-1.413	-0.033	-0.478	-0.105	-1.851
8	0.02	0.932	-0.139*	-1.53	0.018	-0.01
9	0.051	-1.154	-0.122*	-1.408	0.308***	3.538
10	0.037	-0.489	-0.019	0.467	-0.266	-2.69

Event window	Investigation (383 obs.)		Fine (411 obs.)		Appeal (374 obs.)	
	CAAR	J	CAAR	J	CAAR	J
(-20; +10)	-0.591***	-3.381	-1.236**	-1.791	0.521	0.12
(-5; +5)	-0.385***	-2.513	-0.266	-0.902	0.06	-0.506
(-1; +5)	-0.774***	-4.888	-0.546	-1.24	-0.068	-1.025
(-1; +1)	-0.541***	-4.945	-0.262	-0.391	-0.108	-1.687

Table 2
Robustness Check (I). Daily (AAR) and Cumulative average abnormal returns (CAAR) for Fine date, 1998-6/2020; including other banking infringements.

Event window	Fine (554 observations)	
	CAAR	J
(-20; +10)	-0.853	0.740
(-5; +5)	-0.116	0.938
(-1; +5)	-0.480	0.523
(-1; +1)	-0.251	0.579

Table 3
Robustness check (II). Cumulative average abnormal returns (CAAR), 1998-6/2020.

(-20,+10)	Investigation			Fine			Appeal		
	N	CAAR	J	N	CAAR	J	N	CAAR	J
Mean Model	383	-0.84***	-2.46	554	-1.22*	-1.602	374	-0.42	-2.06
Repeat offender	34	-4.44**	-2.24	35	-1.89	-1.13	34	0.42	-0.86
Single offender	173	-0.17	-1.14	185	-2.79***	-2.82	174	0.05	-0.3
US fine	181	-1.16***	-2.87	188	-0.1	0.47	176	-0.53	-0.55
No US fine	197	-0.03**	-1.66	211	-2.01***	-2.87	197	1.53	0.78
Immunity recipient	55	-0.61	-1.21	58	1.93	0.41	55	1.63	-0.02
Non-imm.recipient	321	-0.59***	-3.23	346	-1.9***	-2.85	312	0.47	0.57

Table 4
Cumulative average abnormal returns (CAAR), 1998-6/2020. Cartel fines.

	Banks (N=25)			Non-Banks (N=386)				
Window	Investigation	Fine	Appeal	Investigation		Fine		Appeal
(-20,+10)	3.33	0.29	0.77	-0.77	***	-1.32	**	0.51
(-10,+10)	0.78	0.30	2.35	-0.15	***	-1.11	**	0.21
(-5,+5)	-1.20	0.09	1.65	-0.35	***	-0.2		-0.02
(-5,+1)	-0.88	0.40	1.06	-0.12	***	-0.01		-0.03
(-1,+5)	-2.53	-0.46	1.21	-0.69	***	-0.49		-0.13
(-1,+1)	-2.21	-0.15	0.62	-0.46	***	-0.29		-0.15

Table 5
Weighted average effect of antitrust events

	All firms	Banks	Non-banks
$\hat{\Delta}_{Inv}$	-0.59%	+3.33%	-0.77%
$\hat{\Delta}_{Fine}$	-0.85%	+0.29%	-1.32%
$\hat{\Delta}_{Total\_Method1}$	-1.08%	+0.56%	-1.96%
$\hat{\Delta}_{Total\_Method2}$	-1.44%	+3.62%	-2.09%
Market loss due to fines:			
$\frac{\hat{\Phi}_{Method1}}{\hat{\Delta}_{TOT,Method1}}$	14.73%	5.36%	12.21%
$\frac{\hat{\Phi}_{Method2}}{\hat{\Delta}_{TOT,Method2}}$	15.63%	5.72%	12.68%

References

Aguzzoni, L., G. Langus, and M. Motta (2013). The effect of EU antitrust investigations and fines on a firm's valuation. Journal of Industrial Economics *61*(2), 290–338.

Armour, J., C. Mayer, and A. Polo (2017, August). Regulatory sanctions and reputational damage in financial markets. *Journal of Financial and Quantitative Analysis 52*(4), 1429–1448.

Ball, R. and S. P. Kothari (1991). Security returns around earnings announcements. *The Accounting Review 66*(4), 718–738.

Barakat, A., S. Ashby, P. Fenn, and C. Bryce (2019). Operational risk and reputation in financial institutions: Does media tone make a difference? *Journal of Banking Finance 98*, 1 – 24.

Bizjak, J. M. and J. L. Coles (1995). The effect of private antitrust litigation on the stock-market valuation of the firm. *The American Economic Review 85*(3), 436–461.

Boehmer, E., J. Masumeci, and A. B. Poulsen (1991). Event-study methodology under conditions of event-induced variance. *Journal of Financial Economics 30*(2), 253 – 272.

Bos, I., W. Letterie, and N. Scherl (2017). Industry impact of cartels: Evidence from the stock market.

Brown, S. and J. Warner (1985). Using daily stock returns: the case of event studies. *Journal of Financiial Economics 14*.

Buccirossi, P. and G. Spagnolo (2008). Corporate governance and collusive behaviour. Chapter in *Dale W Collins (ed.) Issues in Competition Law and Policy, , Antitrust Section, American Bar Association*.

Chernobai, A., P. Jorion, and F. Yu (2011). The determinants of operational risk in u.s. financial institutions. *The Journal of Financial and Quantitative Analysis 46*(6), 1683–1725.

Degryse, H., N. Karagiannis, G. Tombeur, and G. Wuyts (2021). Two shades of opacity: Hidden orders and dark trading. *Journal of Financial Intermediation 47*, 100919.

Demirguc-Kunt, A. and H. Huizinga (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics 98*(3), 626–650.

Deng, S., R. H. Willis, and L. Xu (2014). Shareholder litigation, reputational loss, and bank loan contracting. *Journal of Financial and Quantitative Analysis 49*(4), 1101–1132.

Dyck, A., A. Morse, and L. Zingales (2010). Who blows the whistle on corporate fraud? *Journal of Finance 65*, 2213–2253.

Fama, E. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance 25*(2), 383–417.

Fama, E., L. Fisher, M. Jensen, and R. Roll (1969). The adjustment of stock prices to new information. *International Economic Review 10*(1), 1–21.

Fiordelisi, F., M.-G. Soana, and P. Schwizer (2013). The determinants of reputational risk in the banking sector. *Journal of Banking Finance 37*(5), 1359 – 1371.

Flore, C., H. Degryse, S. Kolaric, and D. Schiereck (2021). Forgive me all my sins: How penalties imposed on banks travel through markets. *Journal of Corporate Finance 68*(C), S092911992100033X.

Gande, A. and C. M. Lewis (2009). Shareholder-initiated class action lawsuits: Shareholder wealth effects and industry spillovers. *Journal of Financial and Quantitative Analysis 44*(4), 823–850.

Gillet, R., G. Hübner, and S. Plunus (2010). Operational risk and reputation in the financial industry. *Journal of Banking Finance 34*(1), 224 – 235.

Gunster, Andrea ad van Dijk, M. (2016). The impact of european antitrust policy: Evidence from the stockmarket. *International Review of Law and Economics 46*, 20–33.

Hansen, T. (2014). The role of trust in financial customer-seller relationships before and after the financial crisis. *Journal of Consumer Behaviour 13*(6), 442–452.

Heidinger, D. and N. Gatzert (2018). Awareness, determinants and value of reputation risk management: Empirical evidence from the banking and insurance industry. *Journal of Banking Finance 91*, 106 – 118.

Hu, G. X., J. Pan, J. Wang, and H. Zhu (2022). Premium for heightened uncertainty: Explaining pre-announcement market returns. *Journal of Financial Economics 145*(3), 909–936.

Karpoff, J. M., D. S. Lee, and G. S. Martin (2008, 9). The cost to firms of cooking the books. *Journal of Financial and Quantitative Analysis 43*, 581–611.

Karpoff, J. M., D. S. Lee, and G. S. Martin (2012, 1). The impact of anti-bribery enforcement actions on targeted firms. *SSRN Electronic Journal*.

Karpoff, J. M., J. R. Lott, and E. W. Wehrly (2005, 10). The reputational penalties for environmental violations: Empirical evidence. *Journal of Law and Economics 48*, 653–675.

Karpoff, J. M. and R. Lott (1993). The reputational penalty firms bear from committing criminal fraud. *Journal of Law and Economics 36*, 757–802.

Kolari, J. W. and S. Pynnönen (2010). Event study testing with cross-sectional correlation of abnormal returns. *Review of Financial Studies 23*(11), 3996–4025.

Köster, H. and M. Pelster (2017). Financial penalties and bank performance. *Journal of Banking Finance 79*(C), 57–73.

Levenstein, M., C. Marvão, and V. Suslow (2015). Preventing cartel recidivism. *Antitrust 30*(3), 157–171.

Lucca, D. O. and E. Moench (2015). The pre-fomc announcement drift. *The Journal of Finance 70*(1), 329–371.

Mariuzzo, F., P. Ormosi, and Z. Majied (2020). Fines and reputational sanctions: The case of cartels. International Journal of Industrial Organization *69*(102584), .

Marvão, C. (2015). The EU Leniency Programme and Recidivism. Review of Industrial Organization *49*(1), 1–27.

Sapienza, P. and L. Zingales (2012). A trust crisis. *International Review of Finance 12*(2), 123–131.

Shavell, S. (1997). The fundamental divergence between the private and the social motive to use the legal system. *Journal of Legal Studies 24*(4), 575–.

Spagnolo, G. (2012). Saving the banks, but not reckless bankers. *VoxEU article, 13 August*.