Busted! Now What?

Effects of Cartel Enforcement on Firm Value and Policies

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Abstract

In a cross-country study we look at the staggered passage of national leniency laws over 1990-2012. We show that these laws lead to more convictions of cartels, and generally increase the costs of collusion by reducing the average gross margins of the affected firms. We further examine how changing costs of collusion shape firm boundaries and show that firms reorganize their activities by engaging in more horizontal acquisitions, both in the roles as the acquirer and the target. These acquisitions tend to be associated with higher announcement returns. We find little evidence of the increase in strategic alliances or greenfield investments.

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Ever since Coase (1937), the theoretical literature has discussed what defines the boundaries of the firm and how they evolve over time. This issue has not received adequate attention in the empirical analysis, possibly because of the inability to observe exogenous sources of variations in the firm's boundaries. We take the case of antitrust actions against collusive behavior to investigate how convicted firms adjust their boundaries and what effect this has on their corporate policies.

Anecdotal evidence from the passage of the Sherman Act in the United States suggests that cartel prohibition might lead to rearrangements of the firm's organization and even to merger waves (e.g., Bittlingmayer, 1985). This unanticipated policy effect was surprising. If mergers can provide a solution out of the cartel prohibition, the very raison d'être of cartel prohibition can be called into question. Can this anecdotal evidence be confirmed in the data? If so, which firms are more lured into merging when cartel prohibition strengthens? May higher collusion costs be one of the industry-based reasons for merger waves? What alternative strategies do firms with higher cartel forming costs pursue?

We address these questions by focusing on the global cartel convictions over the period of 1990-2012. As with the other forms of organized crime, we can only observe the convicted cases, whose investigations might be endogenous to the expected industry's profits, competitor whistleblowing and other factors that are unobservable to the empiricist. Therefore, as exogenous variation, we exploit a staggered passage of leniency legislation around the world. By allowing reduced fines or even providing immunity for the cartel members that collaborate in the conviction cases, leniency laws should have increased the costs of forming cartels and the benefits of breaking them up.[1]

[1] See Spagnolo (2008) for a recent review of theoretical and empirical literature.

Our first contribution is to show that leniency laws have indeed reduced collusive practices. We exploit a difference-in-difference setting based on the staggered passage of leniency laws in 63 countries. As countries passed leniency laws at different points in time between 1993 and 2011, we are able to identify their causal effect on the firm operating performance. After the passage of leniency laws, controlling for firm and time fixed effects, we find that the gross margin of the firms involved decreases by 6 percentage points (relative to the control group), a 23% drop compared to the unconditional average gross margin of 26%. We find even larger effects if we measure profitability by the returns on assets. Moreover, the negative effect on profitability is larger in the industries where collusion is expected to be less stable.

The negative effect of leniency laws on cartels can come both from the convictions and from unobservable breakups of existing cartels and lower probability of their formation. Our results on profitability provide evidence of an average effect coming from both of these channels. However, in addition, we look at the actual convictions in the cartel cases. By relying on the complete hand-collected information on the sanctions imposed on the 7,496 members of 746 large international cartels, we find that leniency laws have led to more cartel convictions. More specifically, the passage of a leniency law tripled – with respect to the unconditional average – the number of cartels convicted, and increased the number of convicted firms by a factor of eight. Leniency laws have primarily affected larger cartels – i.e., the size of the market convicted as a cartel has risen by 130-180%.

We are also able to directly quantify the actual effect of the convictions on firm value. The stock price of the firm drops by 0.7% over a three-day period after the conviction and on average by 2.8% in the first month after the probe has been initiated by the first antitrust authority. The latter effect is even larger if we consider the resolution of the case – i.e. when the

first penalty has been awarded. We find no reversal over the longer period. Moreover, we document that the stock price of the firm reacts negatively to the rival firms being investigated in the collusion case even if the firm itself is not investigated. These stock price drops are proxies for a future drop in firm profitability. This provides the first (to the best of our knowledge) evidence that both the passage of leniency laws as well as the actual cartel convictions have adverse effects on the firm performance and value.

Our second contribution is to establish what actions the firms take after the collusion costs increase. We propose that higher collusion costs change the incentives to redefine the boundaries of the firm and induce new corporate policies. We suggest that as the creation of informal oligopolistic arrangements becomes more difficult, the firms will consolidate more formally by pursuing horizontal mergers. We exploit the same differences-in-differences strategy of leniency law passage around the world and show that the restrictions on the ability to create a cartel increase the incentives to engage in M&As. The passage of the leniency law raises the probability of becoming an acquirer by 3-4% while it increases the probability of becoming a target by 1-2%. Even more importantly, restrictions on the ability to run a cartel make it more likely that the firm will be acquired by another firm that operates in the same industry and country. We find no such effect for diversifying acquisitions, either geographically or sector-wise. In contrast to the findings on M&As, we find no evidence that firms resort to strategic alliances, or pursue greenfield investments by increasing capital expenditures.

How does the market react to these cartel-busting related M&As? We find that the effect is positive. In particular, if we focus on the cumulative abnormal returns over a 3 day [0,2] window, we find a positive relationship between either the target or the acquirer being convicted in a cartel case over the prior 5 years and the abnormal return. The magnitude of the

effect corresponds to 5% price increase in the case the acquirer has been convicted and to a 1.5% increase in the case the target has been convicted.

One interpretation of our results is that the passage of the laws that make collusion harder reduces product prices and markups in the industry and induces firms to increase output to cover their fixed costs. One way how to do it by quickly realizing economies of scale is to merge with competitors. We explore this as well as other alternative explanations and find evidence consistent with the economies of scale channel.

We contribute to several strands of literature. First, we relate to the literature on the effects on leniency laws. Recent empirical literature has mainly shown that leniency laws have a positive effect on competition. For example, Miller (2009) shows that leniency increases cartel deterrence and enhances detection, while Borrell, Jiménez and García (2013) document that cross-country leniency law passages have improved the managerial perception of the competition in the affected countries. We contribute by establishing the link between passage of leniency laws and firm profitability and value. In addition, we are the first, to the best of our knowledge, to show how firms react to leniency laws. In doing this, we thus contribute by providing empirical evidence to the literature on the corporate effects of collusion (e.g. Maksimovic, 1988; Spagnolo, 2001).

Second, we contribute to the literature on the way firms expand and grow. We provide evidence on how such an expansion path is related to anti-trust regulations across countries. This also allows us to contribute to the determinants of alliances and M&As on a world scale. We show that M&As triggered by cartel-busting decisions have positive effects also for the acquirer. This is a relatively rare case of M&A in which the market appreciates the decision of the buyer to engage in an acquisition. In this we also relate to the literature on merger waves.

We suggest that some of the waves can be fostered by a more difficult collusion. This is in line with the findings of Harford (2005) that merger waves might be fostered by industry shocks.

Third, we contribute to the empirical literature on the boundaries of the firm. Robinson (2008) has shown in which cases strategic alliances are a preferred way of creating integrated firms. We show that exogenous shocks to even weaker arrangements between firms – the cartels – lead to more mergers.

The remainder of the paper is organized as follows. Section II describes our data. Section III describes leniency laws and the identification strategy that we use. Section IV provides the results on the relation between cartel restrictions and firm value. Section V relates cartel restrictions to investment and the firm expansion choice (M&A and alliances) and how the market evaluates the corporate policies as a reaction to cartel-busting restrictions. Section VI discusses the explanations for this result. A brief conclusion follows.

II. Data and Main Variables

Our main source of data on collusion come from the Private International Cartel dataset on cartel sanctions created by John Connor and described in detail in Connor (2010). This hand-collected dataset covers all the major private cartels discovered, disclosed and sanctioned by regulators around the world since January 1986. The dataset omits the cartels for which no sanctions were imposed within five years of the authorities' discovery. It contains 746 cartels involving 7,496 firms (some firms are recidivists and are thus members of multiple cartels).

Connor (2010) has collected the data by reading filings, documents, reports, and press releases from the antitrust authorities in different countries, as well as newspaper and magazine articles retrieved through search engines like Factiva or Lexis-Nexis. The dataset reports involved firms, their executives (if they are personally prosecuted), the country of

incorporation, the markets and continents in which collusion took place, the duration of the collusive agreement, and if known, the fines imposed, leniency granted by regulators, and estimated overcharges to consumers. We manually name-match the firms to the Compustat Global and North America datasets and assign the affected industries their closest relevant SIC code. Wherever in doubt, we exclude the firm or the involved cartel from the analysis. We consider years 1990-2012 in our analysis.

We report some descriptive statistics of the final sample in Table 1. Our sample covers 561,870 firm-years. The median (mean) cartel involves five (ten) companies and lasts five (seven) years before it gets discovered by the regulator. These cartels have a global nature and are particularly large. The estimated median (mean) overcharge is 18.8% (24.3%) while the dollar value of affected commerce is $2bn ($26.7bn).

One typical example of a cartel is the arrangement by which Argos and Littlewoods, two UK retailers, fixed prices for some of the children's toys with the help of their manufacturer, Hasbro. The cartel was set-up in 1999 and lasted for 27 months. Britain's leniency laws made Hasbro come forward in 2002 and provide incriminating evidence in return for having a potential $9.8m fine waived. The retailers were eventually fined $27.5m and $8.5m, respectively, which was a UK record, according to The Economist (2003). The dollar value of the cartel-affected commerce in this case was $969m while the overcharges were 42%.

The data on international expansion choices come from the Securities Data Corporation (SDC) Database, from which we extract all alliances and M&As for the period between 1990 and 2012. We then relate these data to the accounting information from Compustat Global and North America, as well as to the stock returns from Datastream.

We consider all the cross-border alliances and M&A transactions. We define alliances as all partnership agreements in which two or more entities combine the resources to form a new, mutually advantageous business arrangement to achieve predetermined objectives. This includes joint ventures, strategic alliances, research and development agreements, sales and marketing agreements, manufacturing agreements, supply agreements, and licensing and distribution agreements. Following Rossi and Volpin (2004) and Bris and Cabolis (2008), we only look at the M&A transactions for the majority of the shares of the target firm – i.e., the ownership percentage after the deal is above 50%, and where the deal is completed by the end of our sample period. We exclude from the sample repurchases, minority stake purchases, and privatizations. We report descriptive statistics for the main variables in Table 1.

III. Identification Strategy

Our identification relies on the staggered passage of leniency laws around the world. Therefore, in this section, first we briefly describe the leniency laws and then we validate our identification strategy by looking at whether the passage of the leniency laws predicts the conviction of cartels in the country. We end by describing an alternative identification strategy that we use for our robustness.

A. Leniency Laws

Leniency laws allow the courts and/or regulators to grant full or partial immunity to the companies that have participated in illegal cartels but cooperate in providing information about the cartel. The United States was the first country to pass leniency laws in 1973 but they remained largely ineffective until 1993. In 1993, the leniency laws were revised and strengthened by making the case for amnesty clearer and broader. The revised law posits that, if

no investigation of cartel is underway (or if Department of Justice does not have sufficient evidence), the first self-reporting cartel member gets automatic amnesty and that includes its managers, employees and directors. The revised nature of the law proved to be successful in destabilizing the existing cartels and in deterring new cartel formation and has thus inspired a number of other countries to pass similar laws. Our Appendix 1 lists information on the leniency law passage in 63 large countries. Our primary source of this information is the Cartel Regulation 2013, published by Getting the Deal Through. We manually double check this information and complement it using press releases and news articles.

The passage of the leniency laws over the past twenty years has been highly influenced by the continuing attention given to the issue by the United States and the European Union (Lipsky, 2009). The United States regularly bargains for strengthening of other country's competition law regime in its negotiations for the free trade agreements (e.g. the ones with Singapore and Chile). The European Union has fostered the adoption of leniency laws in its member states and it also often seeks similar provisions in its various bilateral association and trade agreements. Such external pressure makes the passage of leniency laws rather exogenous to political and economic conditions in the passing country.[2]

We hereby describe a typical leniency law, adopted by the European Commission (EC), as described by Competition Directorate (2013). In order to obtain total immunity under the leniency policy, a firm which participated in a cartel must be the first one to inform the EC of an undetected cartel by providing sufficient information to allow the EC launch the investigation. If the EC is already in possession of enough information to launch the investigation, the firm must provide evidence without which the EC would be unable to prove the existence of the cartel. In all cases, the firm must fully cooperate with the EC throughout its procedure, provide

[2] Controlling for country's levels of trade does not affect our results.

it with all the evidence in its possession and stop its participation in the cartel immediately. Also, it cannot disclose the existence and the content of the investigation to any other firm. The firm may not benefit from immunity if it has coerced other firms to participate in the cartel.

Firms that do not qualify for total immunity may benefit from a reduction of fines if they provide evidence that represents "significant added value" to that already in the EC's possession – i.e. it reinforces the EC's ability to prove the existence of the cartel. The first firm to meet these conditions is granted a 30-50% reduction, the second is granted a 20-30% reduction, while the subsequent firms are granted an up to 20% reduction.

The impact of the leniency laws on the cost of collusion depends on the firm incentives to apply for leniency. For example, information about potential or ongoing antitrust investigation might leak from the antitrust authority, providing a strong incentive to apply for leniency. Also, a new management might learn about past involvement in the cartel and consider that as reputationally damaging for them or as a potential liability for the firm. Moreover, the incentives to apply for leniency in one sector may be related to cartel busting in others. Indeed, firms compete on multiple product markets and might have formed multiple cartel activities. The investigation of cartel in one product market increases the probability of the cartel detection in the other. For example, in 1999, United States introduced Amnesty Plus and Penalty Plus programs. Even if the firm cannot apply for leniency in the cartel case in which it is already being investigated, under Amnesty Plus program it can reduce the fine in the ongoing investigation by disclosing the information about its collusion in other product markets (for which it would receive full amnesty). However, if it does not do that and the second cartel is discovered, the Penalty Plus program enhances the severity of the penalties in both investigations.

Theoretically, the effect of leniency laws on the costs of collusion is uncertain. On the one hand, leniency laws destabilize the cartels as they reduce the firm's costs of defection and potentially increase the costs of the rivals if the firm is able to impose fines on them (Ellis and Wilson, 2001; Harrington, 2008). On the other hand, ex ante the costs of collusion might decrease if the firms take into account the reduced fines (Spagnolo, 2000; Motta and Polo, 2003). This would stabilize existing cartels or even induce the formation of new ones. Another reason how stronger antitrust enforcement can increase cartel stability is that it makes meetings – and thus renegotiation of prices – more difficult (McCutcheon, 1997).

B. Leniency Laws and Cartel Convictions

We now investigate whether the passage of the leniency laws predicts the conviction of cartels in that country. We define the cartel market to be either the geographic market in which the cartel is operated (e.g., Italy, global), or the jurisdiction that investigated or sanctioned the cartel (e.g., the European Commission), whichever of the two is a smaller region.

We estimate a panel specification defined at the country level for the years 1990-2012. Since the total number of convictions in the country is a count variable that takes the value of zero with high frequency (82% of the observations are zero), we hypothesize that the expected number of convictions is an exponential function of the leniency law treatment and estimate a Poisson model (e.g., Hausman, Hall and Griliches, 1984). In particular, we use the method of Quasi-Maximum-Likelihood, which provides consistent estimates as long as the conditional mean is correctly specified even if the true underlying distribution is not Poisson (Wooldridge, 1999). To control for generic differential characteristics between countries, we control for country- as well as time-fixed effects. We cluster the standard errors at the country level. As robustness check, we also provide simple OLS estimates with country- and time-fixed effects.

We report results in Table 2. In Column (1) of Panel A, we document that the passage of a leniency law more than doubles the number of convicted cartels, by increasing them by 154%. This result is robust to controlling for the time-varying macroeconomic conditions in the country (Column 2).

One potentially contaminating effect is that many European countries are both governed by EU and national antitrust laws. Therefore, as a robustness check, in Column (3), we report the results of the analysis in which we consider all the EU countries as one country and consider the passage of EU leniency laws rather than the passage of the individual country leniency laws. The results are similar.

Column (4) reports a fixed effect OLS regression, while Column (5) reports a specification that additionally controls for regional economic effects and other trends[3] by adding region*year fixed effects. Also these specifications deliver consistent results.

Column (6) reports the results of a placebo analysis in which, for all the countries, we anticipate the passage of the law by three years. We find that such placebo treatment does not have an influence on the cartel conviction.

In Column (7), we also control for the introduction of competition law. Very few countries introduced competition law over our study period but we want to make sure that our leniency law treatment is by itself an important determinant on cartel stability over the general restrictions on anti-competitive behavior. We find that this is the case. As expected, we also find that introduction of competition law is also an important determinant for cartel conviction.

Next, we investigate the changes in the type of convicted cartels. In particular, we relate the size of the convicted cartels to the passage of the leniency laws. We report the results in Panel

[3] We allocate countries into seven geographic regions: North America, Latin America, Western Europe, Central and Eastern Europe, Asia, Africa and Oceania.

B. We define the size of the cartel in terms of the total sales of the "cartelized market" (also known in the literature as the dollar value of the cartel-affected commerce). In Columns (1)-(3), we show that leniency laws lead to the prosecution of the larger cartels. In particular, after the passage of leniency laws the dollar value of convicted cartel affected commerce is higher by 133%. It is interesting to note that, while in Panel A we find that considering EU leniency law leads to a smaller economic effect than individual country leniency laws in terms of the number of convicted cartels, the economic effect in terms of the convicted cartel-affected commerce is much larger. In this case, leniency laws lead to 186% more damaging cartels being prosecuted.

Also, in Columns (4)-(5), we show that the mean pre-conviction market share of the convicted cartels is larger by 7.4 percentage points after the passage of the leniency laws if compared to the pre-passage period and the number of convicted members of cartel is higher by a factor of eight.

Overall, these results not only validate the use of our difference-of-difference strategy of the next sections, but they also provide, to the best of our knowledge, the first empirical evidence of the effect of the global passage of leniency laws on the cartel conviction. Before moving on to see the implications for firm value and corporate strategies, we describe an additional identification strategy that we use in our analysis to support our conclusions.

C. Additional Identification

A possible critique of the identification using the passage of leniency laws is that these may not be exogenous to the political and economic conditions in the firm's country. So, in addition to exploiting the passage of leniency laws in the firm's headquarter country, we also rely on an additional identification strategy which is based on the passage of laws in the countries whose firms have a high market share in the examined firm's industry. This additional variable that we

call "global leniency law passage" is estimated as the weighted average of the passage of laws in all other countries, excluding the country of the firm's headquarter:

$$Global\ leniency\ law_{t\hat{k}j} = \sum_{k \neq \hat{k}} w_{kjt} L_{kt},$$

where *k* indexes countries, ($\hat{k}$ is the country of firm *i*), *j* indexes three-digit SIC industries and *t* indexes time. L_{kt} takes the value of 1 if the leniency law is passed in country *k* by year *t*. The weights w_{kjt} are equal to the share of each country's output in the total global output of firm *i*'s three-digit SIC industry *j*, as reported in the Compustat in year 1990. For instance, German car manufacturers produce 24.7% of the global output of car manufacturing firms. So, the passage of German leniency law in 2000 should have increased the value of this variable for all non-German car manufacturers by 24.7%. We claim that, by making it more difficult to form international cartels with industry peers as it is easier for them to apply for leniency, the passage of other country's leniency laws also increases the costs of collusion. This variable is even more exogenous to the political and economic conditions in the firm's country.[4] The results that use this variable are equally robust in terms of both statistical and economic significance.

IV. Firm Value

To investigate the impact of the changed costs of conviction on the firm value we take a two-pronged approach. We start by using an event study methodology to show how cartel conviction affects the stock prices of the convicted firms as well as those of their competitors. Then, we look at firm profitability and investigate how it is affected by the passage of the leniency laws as well as by the convictions in the cartel cases.

[4] The correlation between the two treatment variables is -0.08.

A. Market Value

We start by showing how the start of an investigation of price-fixing and the award of penalties affect the stock price of the firms involved. We employ an event study methodology, in which we compute the cumulative abnormal returns by using three alternative factor-pricing models: Model 1 estimates the expected returns using a two-factor model (domestic market factor and global market factor); Model 2 estimates the expected returns using a three-factor model (domestic market, SMB, HML factors); Model 3 estimates the expected returns using a six-factor model (domestic market, SMB, HML factors and global market, SMB, HML factors). We use two alternative estimation periods – 180 days, or 60 days – and four alternative windows around the event – i.e., 3 day [0,2], 5 day [0,4], 30 day [0,29] and 3 month [0,89]. We winsorize the abnormal returns at the 1% level. We define as event day either the day the first case was opened by any global antitrust authority ("First probe day"), or the day the first decision was made to award penalties by any global antitrust authority ("First penalty day").

In Table 3, Panel A, we show that the stock price of the firm drops by 0.7% over three day period and on average by 2.8% in the first month after the probe has been initiated by the first antitrust authority. The latter – longer term – effect is even larger if we consider the resolution of the case. The stock price of the firm drops on average by 4.1% in the first month when the first penalty has been awarded. These effects on stock returns are consistent across different time periods and event windows.

Next, we look at how the stocks prices reacted to the opening of antitrust investigation of the rival firms. We posit that the investigation of a cartel in a specific industry makes it more likely that existing – even if not investigated – cartels will break and new ones will not form as

the industry is in the spotlight of the antitrust authorities. Also, we expect that, as some of the potential collaborators are now being investigated, the set of firms that could collude is smaller.

We focus on the rival firms which operate within the four-digit SIC industries and investigate separately the firms that are headquartered in the countries where the cartelized market is being investigated from those which are headquartered in other countries.

We report the results in Table 3, Panel B. For the sake of brevity, we only report the results for the abnormal returns around the first probe day. We document that the stock price of a firm reacts negatively to the opening of an investigation of the firm's rivals in the firm's country. The economic size is very similar to the stock price reaction experienced in the case of an opening of investigation on the firm itself. The stock price reaction for rivals in other countries, as expected, is smaller but also significantly negative.

Taken together, the results of Table 3 suggest that the negative stock price reaction of the firm most likely captures the breakage of the existing cartel and the deterrence of the new cartels rather than simply a direct effect of potential penalties.[5]

B. Profitability

Next, we employ a difference-in-difference methodology to investigate the effect of the passage of leniency laws on the gross margins of the affected firms. We report our baseline specification in Column (1) of Table 4, Panel A. After controlling for firm fixed effects and time fixed effects, we find that the passage of the leniency laws lowers gross margins by 6 percentage points. This represents a 23% drop with respect to the average sample gross margin of 26%. These results provide evidence that leniency laws have a sizable negative effect on profitability.

[5] Eckbo (1983) studies a similar case how corporate events of rival firms affect future cartel stability. He looks at the rival reactions to horizontal mergers and finds that these generate positive abnormal returns as they increase the probability of successful collusion.

Given the size of the loss on profitability if compared to the potential changes in the expected costs of collusion, these results suggest that the passage of leniency laws has a destabilizing effect on the cartels (Ellis and Wilson, 2001; Harrington, 2008), rejecting the alternative predictions that, due to lower expected costs of collusion, the cartel stability increases (Spagnolo, 2000; Motta and Polo, 2003).[6]

Our results are robust, both in terms of statistical significance and economic magnitudes of the effect. In Column (2), we control for firm and country characteristics. In Column (3), instead of clustering standard errors at the country level, we cluster them at the country*industry level. Since US firms constitute a significant fraction of the sample, in Column (4), we restrict the sample to non-US firms. We see that although the impact is lower in non-US countries than in the US (possibly due to different degrees of enforcement), it is equally statistically strong. In Column (5), we restrict the sample to the firms that do not change their headquarter countries to take away any strategic relocation effects, and cluster standard errors at the country level. In Column (7), we replace our measure of profitability using the returns on assets and in economic terms we find even larger effects.

Column (6) includes an additional global leniency law variable that measures the passage of laws in the countries whose firms have a high market share in the firm's industry. We find that the effect of this variable is comparable to the passage of the leniency laws in the firm's country. That is, if the leniency laws were passed in the same year in all the countries whose firms have a high market share in the firm's industry, the firm's gross margin would drop by additional 6 percentage points.

[6] Note that with this estimation we are also capturing potentially changing tacit collusion. Indeed, tacit collusion could increase if the cost of explicit collusion rises. We are thus identifying the net effect.

In Column (8), we additionally control for the introduction of the first competition law in the country. By controlling for the first competition law over, we want to make sure that with our leniency law treatment (that only affects the collusive behavior) we are not capturing restrictions on other anti-competitive actions. We find that competition law also negatively affects firm profitability but does not remove the importance of leniency laws.

Next, we investigate in which industries the impact is larger. We expect a more negative effect on profitability to be present in the industries in which sustaining collusion is more difficult, as only very profitable cartels would be present in such cases. We rely on Hay and Kelley (1974) and Whinston (2006) to identify two dimensions that characterize the ability to support collusion: the number of competitors and the presence of major customers. The likelihood of competitors detecting each other's price reductions decreases with the number of firms involved, suggesting that cartels are more stable if there are fewer competitors in the market. Moreover, industries that rely on few major customers should also be associated with lower observability of firms' offered prices, as well as higher lumpiness in demand, both of which make sustaining a collusive scheme more difficult. We should thus find a more negative effect on profitability in the presence of many competitors and few major customers.

We thus split our sample according to these industry characteristics, and present our results in Table 4, Panel B. In Columns (1)-(2) split the sample according to whether the industry is expected to have large customers.[7] Column (1) reports the results for the subsample of the firms in industries with top customer sales fraction over sample median 19% and Column (2) reports the results for the subsample of the firms in industries with top customer sales fraction less than

[7] We rely on data on the US firms and, following the same approach as Rajan and Zingales (1998), we apply the measures estimated on the basis of US firms to the industries in other countries. In particular, we split the sample using the median fraction of top customer sales out of all the firm's sales in the SIC four-digit industry, estimated across all US firms in year 1990, at the beginning of our sample.

19%. We find a much larger drop in profitability in industries that rely on few major customers. Similarly, in Columns (3)-(4), we split the sample according to whether the median fraction of top 4 customer sales is above or below the sample median 29%, and find consistent results.

In other columns we split the sample according to the number of firms in the firm's industry in its country as well as the degree of concentration in that industry. In particular, in Columns (5)-(6), we split the sample according to the number of competitors globally in Compustat sample in year 1990. We find that the effect of leniency law passage is more negative in the cases where firms have fewer competitors.

Finally, we look at the direct effect of conviction on the convicted firm's profitability. We consider annual panel of firm profitability. Our main variable of interest is whether the firm is convicted in a cartel case over the prior five years. We cluster the errors at the country*industry level as cartel conviction is likely to have correlated industry effects within the country. We report the results in Table 4, Panel C. In Column (1), we test the effect without any additional controls. We find that cartel conviction reduces gross margin by 3.6 percentage points.

Then, we provide robustness checks. In Column (2), we control for firm and country characteristics and we find that the effect is qualitatively and quantitatively similar. In Column (3), we cluster the standard errors at the country level. The effect also holds if we limit the sample to non-US firms, as in Column (4). In Column (5), we restrict the sample to the firms that do not change their headquarter countries, and cluster the standard errors at the country level. Also in these cases our results hold.

In Column (6), we look at the effect of conviction over the prior three year period. We find a slightly smaller but still a statistically significant effect, suggesting that the effect of conviction on the firm profitability is persistent and has long term consequences. We finally look at the

cases in which the conviction involves a firm that has been previously convicted in another cartel case during our sample period. In Column (7), we report that such recidivism is associated with a bigger drop in profitability. This can be explained with larger fines in recidivist cases as well as the fact that, a convicted firm is more likely to be in the spotlight of regulatory authorities. It would therefore only get involved in the cartels that are particularly profitable and thus being convicted again would produce a bigger drop in profitability.

Overall, these results provide a clear evidence of the impact of cartel busting on firm value. The evidence has different econometric reliability. Unfortunately, we cannot treat cartel conviction as exogenous since the conviction might be endogenous to the firm's current or expected profits, competitor whistleblowing or other unobservable factors. Nor can we instrument it with, say, the passage of leniency laws, as they might affect the collusion stability through other channels than legal conviction – e.g., existing cartels can break, or new cartels would not form. We thus believe that our difference-in-differences estimates in Table 4, Panel A, should better reflect the true causal effect of rising cost of collusion on the firm profitability, while the event study in Table 3 should better reflect the costs of conviction.

V. Firm Strategies

We now investigate how the firms adapt their corporate policies. We posit that given increased costs of maintaining or starting new links with the firm's competitors, firm's boundaries might change. As our identification strategy, we again rely on difference-in-difference estimation, looking at the effects of the passage of leniency laws on different corporate policies such as investment, M&A activities and the formation of strategic alliances.

A. Investment, M&A Activity and Strategic Alliances

We first look at how firm's investment is affected. We measure investment as the firm's change in the property, plant and equipment and goodwill, adjusted for depreciation and amortization and scaled by one-year lagged asset size. Our measure thus includes both capital expenditures as well as acquisitions. We estimate a specification similar to the previous one, using the same identification approaches. We report the results in Table 5. In Column (1), we find that the investment of the affected firms increases by 3%. The result is robust to controlling for firm and country characteristics (Column (2)) as well as to restricting the sample to non-US firms (Column (3)). In Column (4), we document that the passage of leniency laws in the countries whose firms have a high market share in the firm's industry contribute an additional 1.9% increase of investment. Interestingly, we find no effect if, the dependent variable is just the capital expenditures of the firm, scaled by one-year lagged asset size (Columns (5)-(6)). This suggests that most of the effect from the passage of leniency laws on the investment should be coming from the M&A activity.

As a second step, we therefore further investigate the M&A activity of the affected firms. We draw the data from SDC Platinum database. In Table 6, we look at the firm decision to engage in M&A either as an acquirer or as a target. Our baseline specification uses log dollar value of acquisitions as the dependent variable. Panel A shows that the passage of the leniency laws and thus higher collusion costs increase the total deal size of firm's acquisitions by 5.2%. This result is robust to different specifications. In Column (2), we add firm and country level controls, while in Column (3), we limit the sample to non-US firms. In Column (4), we also find that the passage of leniency laws in the countries whose firms have a high market share in the firm's industry also contributes to larger M&A transactions. The results are also robust if we simply look at the probability of acquiring another firm – i.e., extensive margin of getting

involved in M&A transactions. In Column (5), we show that the passage of the leniency laws raises the probability of an acquisition by 4%. This result suggests that most of the effect comes from more acquisitions rather than their larger size. We then focus on the probability of becoming a target in the acquisition. In Columns (6)-(7) we find a lower, albeit still statistically significant, effect of 1.8-2%.

Finally, we look at strategic alliances. The rise in covert collusion costs may induce the colluding firms to make their ties more explicit by forming publicly visible strategic alliances. We therefore test this possibility focusing strategic alliances. Given that we do not have the firm-level identifiers of the members of strategic alliances, we can only perform the estimation using the panel at an industry*country level. In particular, we focus on the three-digit SIC industries as reported in Compustat Global and North America, and check the number of firms involved in alliances in each of them by country and year. We then relate them to the passage of the leniency laws. All the regressions include industry*country and time fixed effects.

The results, reported in Table 7, display no effect on either the number of firms involved in strategic alliances (Columns (1)-(3)) or the number of alliances formed (Columns (4)-(5)). This result is the same whether we control for different industry and country specific variables, or when we employ our additional identification strategy of laws passed in countries strong in firm's industry. Since this analysis uses a more coarse methodology than the one we used for the M&A analysis, we reconfirm that our M&A results hold in this case too. In Columns (6)-(8), we show that the number of M&A transactions at the industry*country level rises after the passage of leniency law. It is worth mentioning that, here, unlike Table 6, here we also capture the M&A transactions between private firms. This suggests that that leniency laws have wider economic effects beyond publicly listed firms.

B. Market Reaction to M&A Announcements

We now investigate how these M&A transactions induced by cartel busting are perceived by the stock market. As with the cartel conviction effects, we use three models to estimate the cumulative abnormal returns, defined as before. Either 180 day, or 60 day estimation periods are used. The cumulative abnormal returns are estimated over 3 day [0,2] and 5 day [0,4] windows. We winsorize abnormal returns at 1% level. We separately look at the effect on the acquirer's stock, depending on whether the acquirer or the target has been convicted in the cartel case recently (over last three, five years, or since the start of our sample). The results, reported in Table 8, Panel A, display that the effect on acquirer's stock if acquirer has been convicted is negative while if it was target that was convicted, the effect is positive.

We then employ a multivariate framework and compare the abnormal returns of cartel busting-related M&As to the other M&A transactions. We find that the announcement returns are higher when either the acquirer or the target has been convicted than in the M&As in which none of the parties has been investigated. Column (1) reports the baseline specification, where expected returns are estimated using domestic country and global market returns over 180 days estimation period. We find a positive relationship between the dummy for the case the target or the acquirer had been convicted in the cartel case over the prior 5 years and the abnormal return. The effect corresponds to 5% abnormal return in the case the acquirer has been convicted and to 1.5% abnormal return in the case the target has been convicted.

The results are robust across different models and specifications. More specifically, Column (2) adds acquirer country fixed effects and acquirer three-digit SIC industry fixed effects. Column (3) clusters the standard errors at the acquirer country level. In Column (4), the expected returns are estimated using a model with three domestic factors, while in Column (5)

they are estimated using a model with three domestic factors and three global factors. Column (6) reports the results in which the main variables of interest are dummies representing whether the target and acquirer were convicted in the cartel case over the prior 3 years while in Column (7) they represent whether they were convicted since the start of the sample period.

All in all these findings suggest that there is a pecking order structure in organizational form. By revealed preference, firms thus first prefer to collude, and when such opportunities became more difficult, they pursue M&A activities.

VI. Economies of Scale

The findings why firms engage in more acquisitions following increased collusion costs can be explained in terms of economies of scale. The laws that make collusion harder reduce prices and markups in the industry require the firms to increase their output to cover their fixed costs. Mergers and acquisitions are thus one way of realizing the required economies of scale. To provide evidence for this hypothesis, we perform two sets of tests. First, we explore the cross-sectional dimension and study the subsamples where we expect economies of scale to be more important. Second, we look into the type of M&A activity that follows after the passage of leniency laws.

A. Proxies for Economies of Scale

We first split the sample according to several measures that proxy for the presence of increasing returns to scale in the industry. The economies of scale hypothesis predicts that M&A results should be primarily present in the industries with increasing returns to scale. We therefore replicate our baseline specification of Table 7 where we estimate the effect of the leniency laws on firm's log dollar value of acquisitions, conditioning for the presence of returns to scale in the industry. Table 9 reports the results.

We consider five different approaches. The first classifies the firms on the basis of whether the industry in which they operate had increasing or decreasing returns to scale in year 1996. We measure the latter by estimating a two factor Cobb-Douglas production function for each two-digit SIC industry in year 1996, using all the Compustat Global and North America firms. We proxy for the firm's output by its sales, for the firm's labor by the number of its employees and for the firm's capital by the firms' property, plants and equipment. We then add the coefficients for the proxies for labor and capital, and define those industries in which the sum of coefficients is higher than one as having increasing returns to scale, and those in which the sum of the coefficients is lower than one as having decreasing returns to scale. In Columns (1)-(2), we show that the results are strongest in the industries with increasing returns to scale.

The second approach is based on the semi-parametric methodology of Olley and Pakes (1996). This method controls for selection and simultaneity biases by allowing for firm-specific productivity differences and endogenizing the firm's liquidation decision.[8] In particular, Olley and Pakes (1996) method assumes that productivity is observed by the firm before it makes decisions on its variable input (labor). This gives rise to the simultaneity problem as both labor and output are affected by the level of productivity that is unobservable for econometrician. For instance, following a positive productivity shock, a firm will increase its use of labor and thus OLS estimation of production functions will yield biased parameter estimates. This simultaneity problem is addressed by using investment to proxy for an unobserved time-varying productivity shock. In addition, Olley and Pakes (1996) approach controls for the selection problem that recognizes the relationship between the productivity shocks and the firm's exit from the market. For instance, after a low productivity shock a firm with a larger capital stock is more likely to

[8] An alternative widely accepted method to specify firm production function is developed by Levinsohn and Petrin (2003) who use materials used in production in their specifications to proxy for productivity. Since data on materials is not readily available to us, we follow Olley and Pakes (1996) to estimate firm level productivities.

stay in the market than a firm with a smaller capital stock, and so the coefficient on the capital variable tends to be biased downward. Such selection problems are addressed by using survival probabilities.[9]

As before, we proxy for firm's output by its sales, for labor by the number of employees and for capital by the property, plants and equipment. Then, in line with Olley and Pakes (1996), we proxy for the observable firm level productivity by its investment decisions – i.e., the changes in the property, plants and equipment and intangible assets. We assume that leniency laws did not have any significant effect on global returns of scale indices for each industry, or at least it did not affect their broad ranking – i.e. which industries were above or below the median value of economies of scale.

We estimate the equations for each global two-digit SIC industry and add the coefficients for labor and capital proxies. We use the full sample and estimate the parameters of the productivity equation. We find few industries with increasing returns to scale: the ones in which the sum of the coefficients is higher than one. We therefore split the sample according to the median value of 0.716. In Columns (3)-(4), we show that the results are strongest where this value is higher – i.e. in the industries with more increasing returns to scale.

The third approach relies on the growth literature and as estimates of the industry's returns to scale uses the estimates of the sensitivity of the industry's growth of value added to changes in industry level capital and labor input growth (Hall, 1988; Caballero and Lyons, 1989). In particular, we draw estimates from Burnside (1996) and sort the two-digit SIC manufacturing industries according to whether industry's returns to scale are increasing (Column (5)) or decreasing (Column (6)) based on whether value to returns to scale parameter gamma is greater

[9] In the previous approach, we did not face this issue as we estimated a cross-sectional rather than a panel regression.

than one.[10] We find that after the passage of leniency laws M&A activity increased in industries with increasing returns to scale.

The fourth approach is based on sorting industries according to the engineering estimates of minimum efficient scale of production in each industry. This approach constructs hypothetical production cost functions at different output levels. Sutton (1991) shows that it has high correlation with the proxies of minimum efficient scale of the plant such as medium size of the plant in the industry. We use the qualitative ranking in Pratten (1988) to split the industries in terms of engineering estimates of minimum efficient scale of production. The results are consistent with the previous ones. In particular, as reported in Columns (7)-(8), we find stronger M&A effect in industries with more increasing economies of scale.

Finally, the fifth approach relies on the intuition that the smallest firms are the most likely to face higher need to cover fixed costs, so most of the benefit from merging should be reaped by the smallest firms. We therefore split the sample on the basis of the firm size within its country of domicile (i.e. we perform the splits at the country level) in year 1996, before the beginning of most of the leniency law passage. In Columns (9)-(11), we find that the results on the acquisition activity are only present among the smallest firms in the sample. For these firms the passage of the leniency law and thus higher collusion costs increase the probability that the firm is an acquirer by 3.8%. In fact the acquisition activity does not increase for the medium and the largest firms.

In summary, all sample splits suggest that M&A activity primarily increased in the industries associated with higher returns to scale.[11]

[10] In particular, according to Burnside's (1996) estimates, two-digit SIC industries 24-27 and 32-38 have increasing returns to scale while others have decreasing returns to scale. We report the results based on the model that only considers internal returns to scale (as in Table 1 in Burnside, 1996). The results based on the overall returns to scale that include external factors (as in Table 2 in Burnside, 1996) are very similar and we do not report them due to brevity. Our results are also consistent if we use estimates from Caballero and Lyons (1989).

B. Horizontal M&A

Economies of scale hypothesis should also predict that firms pursue a horizontal integration by merging (getting acquired or acquiring) with competitors rather than following diversifying acquisitions. We test this explicitly. The results, reported in Table 10, display evidence that following leniency laws firms increase acquisitions of competitors that come from the same industry and country. In particular, in Columns (1)-(2), as dependent variable we use the log dollar value of acquisitions *in the same* three-digit SIC industry as the firm. We find that both leniency laws as well as leniency laws in countries strong in the firm's industry increase such acquisitions. In Columns (3)-(6), we further split the log dollar value of acquisitions in the same three-digit SIC industry into the acquisitions of firms headquartered in the firm's country (Columns 3-4) and headquartered outside of firm's country (Columns 5-6). We find that although leniency law in the country increases within-country acquisitions of competitors, leniency laws passed in other countries also affect the international acquisitions of competitors. It is indeed expected that these firms now experience larger costs of collusion and seek merger partners. Finally, in Columns (7)-(8), we focus on diversifying acquisitions by using as dependent variable the log dollar value of acquisitions in a different three-digit SIC industry from the firm. We do not find that the passage of leniency law in firm's country affects these acquisitions. Such finding is in line with the economies of scale hypothesis.

Second, we investigate whether this cartel busting-related M&A activity is directed towards other firms that used to be part of the busted cartel. In other words, we ask whether the affected firms merge with the former cartel members. After manually inspecting the names indicted in

[11] One may argue that this effect comes from the fact that industries with decreasing returns to scale simply experience less bursting of cartels. However, if we perform the regressions as in Table 2 at the country*industry level we find that the effect of leniency law is present among industries with both higher and lower returns to scale. These results are available at request.

the cartels, we find only a handful of cases where former cartel members – private or publicly listed – merged after the conviction, possibly due to antitrust concerns. These results suggest that firms react to the cartel sanction by acquiring size and market power that helps them to replace the cartel, without necessarily doing it by aggregating former cartel members.

C. Alternative Motives

Overall, these results suggest that our findings on changing boundaries of the firm can be interpreted in light of the need to preserve economies of scale. That is, by making collusion harder and negatively impacting profitability, cartel busting requires the firms to increase their output to cover their fixed costs. Firms react to it by engaging in non-diversifying horizontal mergers and acquisitions.

Our results could also be explained in alternative ways. For instance, one may argue that these findings could be related to distress. As the leniency law is passed and/or a firm is convicted, the ensuing drop in profitability triggers a corresponding increase in the probability of distress. This makes it more difficult to access the external capital markets and induces the firm to form stronger internal capital markets (Stein, 1997), and M&As are one way of achieving. However, in this case the firms should follow diversifying acquisitions that increase the usefulness of internal capital markets, contrary to what we find and report in Table 10.

Moreover, the industrial organization literature (Eckbo, 1983; Compte, Jenny and Rey, 2002; Vasconcelos, 2005; Bos and Harrington, 2010) argues that, as collusion costs rise, firms merge to reduce the asymmetry between the market participants, so as that to facilitate collusion in the future. However, this hypothesis predicts that the effect is strongest for medium sized firms (Bos and Harrington, 2010), while in Table 9 we find that most of the effect comes from the smallest firms in the sample.

Finally, one may argue that mergers are pursued to recreate the market power and the existing cartels. We find such reasons to be extremely implausible as any horizontal concentration in a potentially cartelized industry is very likely to attract significant scrutiny by antitrust authorities.

Conclusion

In this paper, we show that the leniency laws have a negative effect on the firm value and performance. By looking into a wide sample of firms across 63 countries and employing a difference-in-difference strategy using the passage of leniency laws in different countries, we find that increasing costs of collusion stability reduce firm gross margins by 6 percentage points. Leniency laws also lead to more cartel convictions that are associated with negative abnormal returns on firm's stock of 0.7% over three day period. Moreover, we document that following increased costs of collusion stability, firms reorganize their activities by pursuing more M&A transactions, especially those in the same industry. Compared to other M&A transactions, these M&A have higher abnormal announcement returns. We interpret these findings as a need of firms, whose profitability has been negatively impacted by cartel busting, to increase their output to cover their fixed costs. Firms react to it not by greenfield organic growth or alliances but by engaging in non-diversifying horizontal M&As.

These results provide a first understanding on the effect of increased cost of collusion and in particular the passage of the leniency laws on the firm behavior. Our results provide a more precise explanation on how industry effects contribute to the merger waves. We also show that sometimes firms prefer weaker integration in the form of cartels over the integration by merging, and only resort to the latter when collusion costs increase.

Our results are also critical for the competition policy. By showing that mergers to some extent undo the cartel prohibition, we call for a more holistic competition policy that would take into account the potential dynamics of competition.

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Table 1. Summary statistics

This table reports summary statistics for the main variables used in the subsequent analysis. The summary statistics are reported at a firm, industry/country or cartel level.

Panel A. Firm variables

	N	Mean	Median	St. Dev.
ROA	461,445	0.03	0.1	0.4
Gross margin	489,094	0.26	0.3	0.97
Leverage (debt over book equity)	518,755	0.82	0.4	2.13
Investment	411,136	0.13	0	0.32
Assets	521,952	4.87	4.88	2.37
Acquiror dummy	561,870	0.04	0	0.2
Target dummy	561,870	0.02	0	0.14

Panel B. Industry variables

	N	Mean	Median	St. Dev.
Dollar value of acquisitions in the country/industry	706,974	50.81	0	1741.56
No. of acquisitions in the country/industry	706,974	0.72	0	12.63
No. of strategic alliances in the country/industry	706,974	0.14	0	4.38
No. of participants in strategic alliances in the country/industry	706,974	0.17	0	4.59

Panel C. Convicted cartels

	N	Mean	Median	St. Dev.
Number of cartel participants per cartel	746	10.04	5	30.55
Dollar value of cartel affected commerce (m)	526	26,752.24	1967	139,174.6
Market share of convicted cartel participants	292	0.87	0.93	0.16
Overcharge (%)	242	24.34%	18.83%	21.76%
Cartel length (year)	616	7.39	5	9.17

Table 2. Leniency laws

Panel A. Number of convicted cartels

This table reports Poisson quasi maximum likelihood regressions. All regressions include country fixed effects and time fixed effects. Standard errors are clustered at the country level. The dependent variable is number of cartels convicted in the country in a particular year.

Our main variable of interest is Leniency law dummy. Column (1) provides baseline specification. Column (2) controls for the country's macroeconomic conditions. In Column (3) we treat EU as one country, and consider the passage of leniency law legislation at EU level (we keep one observation for EU). Column (4) reports OLS estimates. Column (5) also reports OLS estimates but controls for regional trends by adding region*year fixed effects. Column (6) reports estimates for the placebo treatment, where the passage of the leniency laws is anticipated by three years. In Column (7) we control for the presence of the competition law. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Leniency law	0.935***	0.835***	0.716*	0.635***	0.667***		0.828***
	2.987	2.851	1.686	3.755	3.528		2.878
Placebo law		0.997**					
		2.101					
GDP per capita						0.579	
						1.48	
Competition law							15.100***
							29.185
Constant				0.063	-0.063		
				0.528	-0.239		
R-squared				0.475	0.542		
N	1449	1359	1049	1449	1449	1449	

* p<0.10, ** p<0.05, *** p<0.01

Panel B. Importance of convicted cartels

This table reports OLS and Poisson quasi maximum likelihood regressions. All regressions include country fixed effects and time fixed effects. Standard errors are clustered at the country level. Dependent variables are various measures of importance of convicted cartels.

Our main variable of interest is Leniency law dummy. In Column (1)-(3) the dependent variable is the log value of cartel affected commerce. Column (1) reports the baseline regression. Column (2) treats EU as one country, and consider the passage of leniency law legislation at EU level (we keep one observation for EU). Column (3) controls for regional trends by adding region*year fixed effects. In Column (4) the dependent variable is the mean market share of the convicted cartels. In Column (5) the dependent variable is the number of convicted firms. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Leniency law	1.343***	1.902***	1.393***	0.073**	2.274***
	3.863	3.43	3.624	2.513	3.565
Constant	0.205	0.205	-0.16	0.031*	
	1.383	0.512	-0.129	1.862	
R-squared	0.373	0.62	0.397	0.223	
N	1449	1449	1449	1449	1449

* p<0.10, ** p<0.05, *** p<0.01

Table 3. Stock price reaction

Panel A. Convicted firms

This table reports univariate comparisons of cumulative abnormal returns on the stock of firm indicted in the collusion case. Cumulative abnormal returns are estimated over either 3 day [0,2], 5 day [0,4], 30 day [0,29] and 3 month [0,89] window. Three models are used to estimate abnormal returns: Model 1 estimates expected returns using domestic country and global market returns; Model 2 estimates expected returns using three domestic factor (domestic market, SMB, HML) model; Model 3 estimates expected returns using three domestic factor (domestic market, SMB, HML) and three global factor (global market, SMB, HML) model. Either 180 day, or 60 day estimation periods are used. Abnormal returns are winsorized at 1%.

First probe refers to the day when the first case was opened by any global antitrust authority. First penalty refers to the day when the first decision has been made on the awarded penalties by any global antitrust authority.

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	First probe			**First penalty**		
	Mean	**t stat**	**N**	**Mean**	**t stat**	**N**
CAR(0,2), Model 1, 180 day est.	-0.007***	-6.007	905	-0.006***	-4.259	827
CAR(0,4), Model 1, 180 day est.	-0.010***	-6.503	905	-0.012***	-6.713	827
CAR(0,29), Model 1, 180 day est.	-0.028***	-5.109	905	-0.041***	-7.092	827
CAR(0,89), Model 1, 180 day est.	-0.087***	-6.098	905	-0.120***	-7.537	827
CAR(0,2), Model 2, 180 day est.	-0.007***	-6.608	863	-0.006***	-4.232	797
CAR(0,2), Model 3, 180 day est.	-0.005***	-4.23	863	-0.002*	-1.647	797
CAR(0,2), Model 1, 60 day est.	-0.006***	-4.904	934	-0.006***	-3.742	850

* p<0.10, ** p<0.05, *** p<0.01

Panel B. Rivals of convicted firms

This table reports univariate comparisons of cumulative abnormal returns on the stock of firms whose (same four-digit SIC code) rivals were indicted in the collusion case. Cumulative abnormal returns are estimated over either 3 day [0,2], 5 day [0,4], 30 day [0,29] and 3 month [0,89] window over the time when the first case on rivals was opened by any global antitrust authority. Three models are used to estimate abnormal returns: Model 1 estimates expected returns using domestic country and global market returns; Model 2 estimates expected returns using three domestic factor (domestic market, SMB, HML) model; Model 3 estimates expected returns using three domestic factor (domestic market, SMB, HML) and three global factor (global market, SMB, HML) model. Either 180 day, or 60 day estimation periods are used. Abnormal returns are winsorized at 1%.

Same country as convicted market refers to rivals that are headquartered in the country where the investigated cartel took place. Other countries refer to rivals that are not headquartered in the country where the investigated cartel took place.

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	Same country as convicted market			**Other countries**		
	Mean	**t stat**	**N**	**Mean**	**t stat**	**N**
CAR(0,2), Model 1, 180 day est.	-0.008***	-5.16	1421	-0.004***	-12.501	26067
CAR(0,4), Model 1, 180 day est.	-0.012***	-6.097	1421	-0.007***	-15.273	26067
CAR(0,29), Model 1, 180 day est.	-0.036***	-5.706	1421	-0.020***	-15.402	26067
CAR(0,89), Model 1, 180 day est.	-0.097***	-6.52	1421	-0.051***	-15.482	26067
CAR(0,2), Model 2, 180 day est.	-0.010***	-6.127	1344	-0.005***	-15.077	23340
CAR(0,2), Model 3, 180 day est.	-0.002	-1.323	1344	-0.002***	-5.045	23340
CAR(0,2), Model 1, 60 day est.	-0.006***	-3.845	1465	-0.003***	-9.35	26411

* p<0.10, ** p<0.05, *** p<0.01

Table 4. Profitability

Panel A. Differences-in-differences estimation

This table reports OLS regressions, where the dependent variable is gross margin in Columns (1)-(6) and return on assets (ROA) in Column (7). All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the country level.

Our main variable of interest is Leniency law dummy. In Column (1) we test its effect without any additional controls. In Column (2) we control for firm and country characteristics. In Column (3) we instead cluster standard errors at country*industry level. In Column (4) we restrict the sample to non-US firms. In Column (5) we restrict the sample to the firms that do not change their headquarter countries, and cluster standard errors at the country level. Column (6) includes an additional variable Global leniency law which measures the passage of laws in the countries that are strong in firm's industry. Column (7) controls for the introduction of competition law. Column (8) uses ROA as the dependent variable. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Leniency law	-0.062**	-0.049*	-0.049***	-0.021***	-0.052**	-0.056**	-0.060**	-0.013***
	-2.213	-1.987	-4.787	-2.763	-2.023	-2.455	-2.171	-3.106
Global leniency law						-0.062**		
						-2.474		
Assets		0.080***	0.080***	0.059***	0.078***	0.079***		
		6.694	7.126	4.011	6.41	6.642		
Leverage		0	0	-0.001	0	0		
		-0.541	-0.435	-1.61	-0.48	-0.549		
GDP per capita		-0.104***	-0.104***	-0.076***	-0.119***	-0.098***		
		-3.191	-7.114	-5.216	-2.827	-3.097		
Unemployment		0.008*	0.008***	0.007***	0.008*	0.008*		
		1.761	3.539	4.196	1.747	1.79		
Competition law							-0.054**	
							-2.495	
Constant	0.251***	0.860***	0.860***	0.747***	1.013**	0.816***	0.302***	0.056***
	9.998	2.711	7.735	7.404	2.614	2.681	14.847	3.217
R-squared	0.523	0.531	0.531	0.524	0.534	0.531	0.524	0.597
N	473369	404107	404048	237098	398173	404107	473369	445760

* p<0.10, ** p<0.05, *** p<0.01

Panel B. Cross-sectional variation

This table reports OLS regressions, where the dependent variable is gross margin. All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the country level.

Our main variable of interest is Leniency law dummy. Columns (1)-(2) split the sample according to whether industry is expected to have large customers. The split variable is defined as the median fraction of top customer sales out of all firm's sales in SIC four-digit industry, estimated across all US firms in year 1990. Column (1) is the subsample of the firms in industries with top customer sales fraction over 19% and Column (2) is the subsample of other firms. Columns (3)-(4) split the sample according to whether industry is expected to have large customers. The split variable is defined as the median fraction of top 4 customer sales out of all firm's sales in SIC four-digit industry, estimated across all US firms in year 1990. Column (1) is the subsample of the firms in industries with top 4 customer sales fraction over 29% and Column (2) is the subsample of other firms. Columns (5)-(6) split the sample according to number of firms in SIC four-digit industry in 1990. Column (5) is the subsample of the firms with high number of competitors in its SIC four-digit industry within its country and Column (6) is the subsample of the firms with low number of competitors. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Leniency law	-0.078***	-0.044*	-0.080***	-0.041*	-0.072***	-0.040*
	-3.181	-1.861	-3.134	-1.773	-3.081	-1.697
Global leniency law	-0.085***	-0.057**	-0.070***	-0.068***	-0.072	-0.046**
	-5.495	-2.022	-4.489	-2.713	-1.194	-2.643
Assets	-0.100***	-0.092**	-0.105***	-0.087**	-0.086**	-0.098***
	-3.617	-2.516	-3.926	-2.334	-2.412	-2.727
Leverage	0.013*	0.006	0.012*	0.006	0.008	0.008*
	1.948	1.501	1.966	1.461	1.597	1.717
GDP per capita	0.098***	0.054***	0.096***	0.055***	0.100***	0.053***
	6.312	5.941	6.578	4.21	6.45	7.132
Unemployment	0.001	0	0	0	-0.001	0
	0.883	-0.734	0.288	-0.121	-1.616	0.425
Constant	0.656**	0.941***	0.715**	0.896***	0.565	0.979***
	2.223	2.808	2.48	2.668	1.522	2.941
R-squared	0.531	0.491	0.531	0.491	0.543	0.484
N	178393	187002	182882	182513	195917	207916

* p<0.10, ** p<0.05, *** p<0.01

Panel C. Actual convictions

This table reports OLS regressions, where the dependent variable is gross margin. All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the industry level.

Our main variable of interest is whether the firm has been convicted in a cartel case over the last five years. In Column (1) we test the effect without any additional controls. In Column (2) we control for firm and country characteristics. In Column (3) we instead cluster standard errors at country level. In Column (4) we limit the sample to non-US firms. In Column (5) we restrict the sample to the firms that do not change their headquarter countries, and cluster standard errors at the country level. In Column (6) our main variable of interest is whether the firm is convicted in a cartel case over the last three years. Column (7) splits Convicted variable into the first conviction for the firm in our sample and the recidivist conviction. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Convicted	-0.036***	-0.037***	-0.037**	-0.032**	-0.036***	-0.031***	
	-3.529	-3.022	-2.545	-2.203	-2.947	-3.468	
Recidivist convicted							-0.068***
							-4.128
First conviction							-0.025**
							-2.368
Assets		0.080***	0.080***	0.059***	0.079***		
		7.129	6.668	4.011	6.794		
Leverage		0	0	-0.001	0		
		-0.318	-0.397	-1.59	-0.286		
GDP per capita		-0.099***	-0.098***	-0.071***	-0.110***		
		-7.183	-4.102	-5.086	-6.814		
Unemployment		0.012***	0.012**	0.008***	0.012***		
		4.172	2.335	4.551	4.212		
Constant	0.268***	0.795***	0.795***	0.693***	0.914***	0.268***	0.268***
	27.255	7.789	3.45	7.201	7.644	27.3	27.226
R-squared	0.522	0.53	0.531	0.524	0.533	0.522	0.522
N	488980	404048	404107	237098	398114	488980	488980

* p<0.10, ** p<0.05, *** p<0.01

Table 5. Investment

This table reports regressions where the dependent variables are various measures of investment by a firm in a particular year. All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the country level.

In Columns (1)-(5) the dependent variable is the change in the value of tangible and intangible assets, adjusted for depreciation, scaled by last year's assets. In Columns (1)-(4) our main variable of interest is Leniency law dummy. In Column (1) we test its effect without any additional controls. In Column (2) we control for firm and country characteristics. In Column (3) we restrict the sample to non-US firms. Column (4) includes an additional variable Global leniency law which measures the passage of laws in the countries that are strong in firm's industry.

In Columns (5)-(6) the dependent variable is capital expenditures by the firm, by last year's assets. Our main variable of interest is Leniency law dummy. Column (5) reports the regression with firm and country controls, equivalent to Column (2). Column (6) includes an additional variable Global leniency law which measures the passage of laws in the countries that are strong in firm's industry. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Leniency law	0.028**	0.031***	0.023***	0.033***	0.003	0.003
	2.603	2.81	3.71	2.931	0.698	0.661
Global leniency law				0.022*		-0.001
				1.779		-0.174
Assets		0.078***	0.090***	0.078***	0.013***	0.013***
		11.211	27.479	11.167	3.897	3.903
Leverage		0.001	-0.001	0.001	-0.000**	-0.000**
		1.111	-1.289	1.109	-2.111	-2.113
GDP per capita		-0.027	-0.022***	-0.029	-0.003	-0.003
		-0.867	-2.96	-0.934	-0.273	-0.273
Unemployment		-0.002	-0.003***	-0.002	-0.002*	-0.002*
		-0.979	-4.232	-0.987	-1.907	-1.892
Constant	0.040**	-0.095	-0.016	-0.09	0.07	0.069
	2.619	-0.277	-0.231	-0.256	0.726	0.752
R-squared	0.166	0.193	0.2	0.193	0.409	0.409
N	397697	340207	208938	340207	180778	180778

* p<0.10, ** p<0.05, *** p<0.01

Table 6. M&A activity

This table reports regressions where the dependent variables are various measures of M&A activity by a firm in a particular year. All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the country level.

In Columns (1)-(5) the dependent variable is the log dollar value of the acquisitions by a firm in a particular year. In Columns (1)-(4) our main variable of interest is Leniency law dummy. In Column (1) we test its effect without any additional controls. In Column (2) we control for firm and country characteristics. In Column (3) we restrict the sample to non-US firms. Column (4) includes an additional variable Global leniency law which measures the passage of laws in the countries that are strong in firm's industry. In Column (5) the dependent variable is dummy variable if the firm has completed any M&A transactions in a particular year.

In Columns (6)-(7) the dependent variable is the dummy variable if the firm has been acquired in a particular year. Our main variable of interest is Leniency law dummy. Column (6) reports the regression with firm and country controls, equivalent to Column (2). Column (7) includes an additional variable Global leniency law which measures the passage of laws in the countries that are strong in firm's industry. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Leniency law	0.052**	0.055***	0.035***	0.066***	0.040*	0.018*	0.020*
	2.132	5.411	3.07	6.313	1.943	1.878	1.908
Global leniency law				0.101***	0.037**		0.014*
				4.571	2.157		1.775
Assets		0.060***	0.135***	0.061***	0.013	0	0
		7.083	11.303	7.147	1.451	-0.091	-0.028
Leverage		-0.002***	-0.004***	-0.002***	-0.001	0	0
		-2.9	-2.812	-2.929	-1.551	0.695	0.699
GDP per capita		-0.110***	-0.136***	-0.118***	-0.045	-0.019	-0.02
		-4.88	-5.676	-5.21	-1.585	-0.974	-1.034
Unemployment		0.002	-0.006**	0.001	-0.002	-0.001	-0.001
		0.662	-2.148	0.594	-0.61	-0.377	-0.395
Constant	0.082	0.899***	0.810***	0.965***	0.387	0.186	0.195
	1.409	4.293	3.979	4.599	1.396	1.045	1.094
R-squared	0.252	0.264	0.251	0.264	0.191	0.086	0.086
N	543736	434791	260809	434791	434860	434860	434860

* p<0.10, ** p<0.05, *** p<0.01

Table 7. Strategic alliances

This table reports regressions, where in Columns (1)-(2) the dependent variable is number of strategic alliances in the country/industry, in Columns (3)-(4) the dependent variable is the number of participants in strategic alliances in the country/industry, and in Columns (5)-(6) the dependent variable is the number of M&A transactions in the country/industry. All regressions include country*industry fixed effects, time fixed effects. Standard errors are clustered at the country level.

Our main variable of interest is Leniency law dummy. In Columns (1), (3) and (5) we test its effect without any controls. In Columns (2), (4) and (6) we control for industry and country characteristics.

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Leniency law	0.168	0.169	0.613	0.155	0.642	0.586*	0.583*	1.256*
	0.932	0.934	1.252	0.91	1.339	1.821	1.813	1.763
Convicted		-0.104					0.735***	
		-0.779					5.179	
Industry size			-0.032		-0.007			0.274
			-0.689		-0.231			0.923
GDP per capita			1.184**		0.666			-0.534
			2.629		1.269			-0.403
Unemployment			-0.085		-0.082			-0.184
			-1.281		-1.412			-1.621
Constant	0.166***	0.166***	-9.616**	0.129***	-5.148	0.496**	0.496***	4.688
	3.784	3.741	-2.44	2.706	-1.052	2.617	2.677	0.39
R-squared	0.725	0.725	0.756	0.647	0.674	0.822	0.822	0.846
N	408618	408618	71390	408618	71390	408618	408618	71390

* p<0.10, ** p<0.05, *** p<0.01

Table 8. M&A announcement effects

Panel A. Univariate results

This table reports cumulative abnormal returns on the acquirer's stock after M&A announcement by whether acquirer or target has been convicted in the cartel case. Cumulative abnormal returns are estimated over either 3 day [0,2] or 5 day [0,4] window. Three models are used to estimate abnormal returns: Model 1 estimates expected returns using domestic country and global market returns; Model 2 estimates expected returns using three domestic factor (domestic market, SMB, HML) model; Model 3 estimates expected returns using three domestic factor (domestic market, SMB, HML) and three global factor (global market, SMB, HML) model. Either 180 day, or 60 day estimation periods are used. Abnormal returns are winsorized at 1%.

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	Convicted Acquirer			Convicted Target		
	Mean	**t stat**	**N**	**Mean**	**t stat**	**N**
Convicted over last 5 years						
CAR(0,2), Model 1, 180 day est.	-0.005***	-3.07	720	0.015***	3.301	314
CAR(0,4), Model 1, 180 day est.	-0.007***	-3.673	720	0.016***	3.017	314
CAR(0,2), Model 2, 180 day est.	-0.005***	-3.439	700	0.014***	3.204	308
CAR(0,4), Model 2, 180 day est.	-0.007***	-3.652	700	0.014***	2.764	308
CAR(0,2), Model 3, 180 day est.	-0.003**	-2.229	700	0.019***	4.219	308
CAR(0,4), Model 3, 180 day est.	-0.004**	-2.035	700	0.021***	4.135	308
CAR(0,2), Model 1, 60 day est.	-0.003**	-1.971	724	0.016***	3.53	320
CAR(0,4), Model 1, 60 day est.	-0.004**	-2.06	724	0.018***	3.53	320
Convicted over last 3 years						
CAR(0,2), Model 1, 180 day est.	-0.004**	-2.379	552	0.015***	2.952	221
CAR(0,4), Model 1, 180 day est.	-0.008***	-3.253	552	0.015**	2.515	221
Convicted since the start of the sample						
CAR(0,2), Model 1, 180 day est.	-0.005***	-3.503	885	0.014***	3.918	456
CAR(0,4), Model 1, 180 day est.	-0.007***	-4.317	885	0.014***	3.312	456

* p<0.10, ** p<0.05, *** p<0.01

Panel B. Multivariate comparisons

This table reports regressions, where the dependent variable is cumulative abnormal returns on the acquirer's stock after M&A announcement, estimated over 3 day [0,2] window, and winsorized at 1%. All regressions include year fixed effects. In the baseline specifications, the standard errors are clustered at the three-digit SIC industry level.

In Columns (1)-(5) our main variables of interest are dummies whether the target and acquirer were convicted in the cartel case over the last 5 years. Column (1) reports baseline specification, where expected returns are estimated using domestic country and global market returns over 180 days estimation period. Column (2) adds acquirer country fixed effects and acquirer three-digit SIC industry fixed effects. Column (3) clusters standard errors at the acquirer country level. Expected returns in Column (4) are estimated using three domestic factor (domestic market, SMB, HML) model while in Column (5) they are estimated using three domestic factor (domestic market, SMB, HML) and three global factor (global market, SMB, HML) model. Column (6) reports the results where the main variables of interest dummies whether the target and acquirer were convicted in the cartel case over the last 3 years while in Column (7) whether they were convicted since the start of the sample period.

*, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Acq. cartel last 5 years	0.005**	0.004*	0.005*	0.004**	0.005**		
	2.147	1.892	1.802	2.028	2.033		
Target cartel last 5 years	0.015***	0.014***	0.015***	0.014***	0.016***		
	2.748	2.609	3.285	2.63	2.988		
Acq. cartel last 3 years						0.006**	
						2.418	
Target cartel last 3 years						0.014**	
						2.378	
Acq. cartel since start							0.004**
							2.018
Target cartel since start							0.013***
							2.876
Investment	-0.020***	-0.028***	-0.020***	-0.018**	-0.018**	-0.020***	-0.020***
	-2.8	-3.906	-3.056	-2.344	-2.239	-2.791	-2.802
Profitability	0	0	0	0	-0.001	0	0
	-0.387	-0.287	-0.891	-0.172	-0.781	-0.391	-0.386
Leverage	0.004	0.003	0.004	0.004	0.003	0.004	0.004
	1.308	1.279	1.27	1.335	1.008	1.304	1.304
Assets	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	-15.041	-17.245	-10.627	-14.505	-13.929	-15.148	-14.97
Constant	0.057***	0.100***	0.057***	0.057***	0.058***	0.057***	0.057***
	11.122	14.034	12.819	11.319	12.024	11.15	11.108
R-squared	0.023	0.027	0.023	0.024	0.016	0.023	0.023
N	86840	86840	86840	85557	85557	86840	86840

* p<0.10, ** p<0.05, *** p<0.01

Table 9. Cross-sectional variation of M&A

This table reports OLS regressions where the dependent variables are various measures of M&A activity by a firm in a particular year. All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the country level.

Our main variable of interest is Leniency law dummy. Columns (1)-(2) split the sample according to the economies of scale in firm's industry, as measured in year 1996. Column (1) reports results for firms in industries with increasing economies of scale, defined when the sum of betas in Cobb-Douglas production function is larger than 1, while Column (2) reports results for those with the sum of betas lower than 1. Columns (3)-(4) split the sample according to the economies of scale in firm's industry, as estimated using Olley and Pakes (1996) procedure. Column (3) reports results for firms in industries with the sum of betas in production function larger than 0.716, while Column (4) reports results for those with the sum of betas lower than 0.716. Columns (5)-(6) split the sample according to the estimates of economies of scale as reported in Burnside (1996). Column (5) reports estimates for firms in manufacturing industries with higher economies of scale while Column (5) reports results for those with lower economies of scale. Columns (7)-(8) split the sample according to the engineering estimates of economies of scale with Column (7) reporting results for manufacturing industries with higher economies of scale while Column (8) reporting results for those with lower economies of scale. Columns (9)-(11) split the sample according to firm size within its country in year 1996. Column (9) is the tercile of the smallest firms, Column (10) is tercile of the medium sized firms and Column (11) is the tercile of the largest firms. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
Leniency law	0.060*	0.049	0.065**	0.04	0.050*	0.028	0.055*	0.018	0.071***	0.034	0.086
	1.894	1.458	2.052	1.229	1.8	0.711	1.683	0.516	2.758	0.988	1.112
Assets	0.053	0.068	0.054	0.074*	0.06	0.063	0.051	0.090**	0.032	0.049	0.083
	1.534	1.518	1.475	1.713	1.553	1.596	1.453	2.075	1.193	1.201	1.201
Leverage	-0.001	-0.003	-0.002	-0.001	-0.002	-0.002	-0.001	-0.003	0	-0.001	-0.004
	-1.278	-1.385	-1.503	-0.97	-1.244	-1.302	-1.062	-1.257	-0.252	-0.774	-1.299
GDP per capita	-0.089	-0.103	-0.095	-0.102	-0.074	-0.068	-0.066	-0.08	0.048	-0.062	-0.372**
	-1.072	-1.036	-0.958	-1.231	-0.847	-0.79	-0.841	-0.782	1.071	-0.59	-2.179
Unemployment	0.006	-0.002	0.007	-0.004	0.004	-0.003	0.003	-0.001	0.005	0.001	0.012
	0.81	-0.209	0.843	-0.458	0.543	-0.408	0.306	-0.112	0.895	0.076	0.525
Constant	0.689	0.796	0.766	0.764	0.531	0.511	0.504	0.473	-0.527	0.443	3.265*
	0.871	0.864	0.828	0.966	0.669	0.688	0.72	0.521	-1.276	0.438	1.969
R-squared	0.257	0.245	0.231	0.265	0.24	0.247	0.239	0.251	0.15	0.199	0.311
N	224742	208863	204532	203542	117606	73469	127038	64037	79037	80617	98343

* p<0.10, ** p<0.05, *** p<0.01

Table 10. Horizontal and diversifying M&A

This table reports regressions where the dependent variables are various measures of M&A activity by a firm in a particular year. All regressions include firm fixed effects, time fixed effects. Standard errors are clustered at the country level.

Our main variable of interest is Leniency law dummy. In Columns (1)-(2) the dependent variable is the log dollar value of acquisitions in the same three-digit SIC industry as the firm. In Columns (3)-(4) the dependent variable is the log dollar value of acquisitions in the same three-digit SIC industry and located in the same country as the firm. In Columns (5)-(6) the dependent variable is the log dollar value of acquisitions in the same three-digit SIC industry as the firm but located in a different country. In Columns (7)-(8) the dependent variable is the log dollar value of acquisitions in a different three-digit SIC industry from the firm. Columns (2), (4), (6) and (8) include an additional variable Global leniency law which measures the passage of laws in the countries that are strong in firm's industry. *, **, and *** denote significance at the 10%, 5%, and 1%, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Leniency law	11.190*	13.116*	2.402***	2.983***	8.804	10.15	6.542	8.67
	1.871	1.979	2.69	2.82	1.446	1.536	1.122	1.436
Global leniency law		17.863**		5.383*		12.484**		19.728***
		2.331		1.875		2.107		3.183
Assets	5.06	5.14	1.274	1.298	3.799	3.855	5.802	5.891
	1.328	1.338	1.295	1.309	1.204	1.211	1.444	1.459
Leverage	-0.217	-0.218	-0.033	-0.034	-0.184	-0.185	-0.126	-0.128
	-0.83	-0.83	-0.827	-0.822	-0.73	-0.731	-0.346	-0.35
GDP per capita	-3.204	-4.624	-1.584	-2.012	-1.666	-2.659	-4.37	-5.939
	-0.637	-0.961	-0.688	-0.846	-0.404	-0.684	-0.645	-0.854
Unemployment	0.464	0.435	0.371	0.362	0.096	0.075	0.46	0.427
	0.494	0.459	1.134	1.113	0.11	0.086	0.309	0.286
Constant	5.064	16.681	6.613	10.114	-1.13	6.989	14.336	27.165
	0.087	0.313	0.27	0.418	-0.025	0.17	0.229	0.437
R-squared	-0.043	-0.043	-0.05	-0.05	-0.049	-0.049	0.02	0.02
N	434860	434860	434860	434860	434860	434860	434860	434860

* p<0.10, ** p<0.05, *** p<0.01

Appendix 1. Leniency laws

This table reports leniency law passage by country. Our primary source of information is Cartel Regulation 2013, published by Getting the Deal Through. We complement this dataset using press releases and news articles.

Country	Year	Country	Year
Argentina	None	Lithuania	2008
Australia	2003	Luxembourg	2004
Austria	2006	Malaysia	2010
Belgium	2004	Mexico	2006
Brazil	2000	Netherlands	2002
Bulgaria	2003	New Zealand	2004
Canada	2000	Nigeria	None
Chile	2009	Norway	2005
China	2008	Oman	None
Colombia	2009	Pakistan	2007
Croatia	2010	Peru	2005
Cyprus	2011	Philippines	2009
Czech Republic	2001	Poland	2004
Denmark	2007	Portugal	2006
Ecuador	2011	Romania	2004
Estonia	2002	Russia	2007
Finland	2004	Singapore	2006
France	2001	Slovakia	2001
Germany	2000	Slovenia	2010
Greece	2006	South Africa	2004
Hong Kong	None	Spain	2008
Hungary	2003	Sweden	2002
Iceland	2005	Switzerland	2004
India	2009	Taiwan	2012
Indonesia	None	Thailand	None
Ireland	2001	Turkey	2009
Israel	2005	Ukraine	2012
Italy	2007	United Kingdom	1998
Japan	2005	USA	1993
Jordan	None	Venezuela	None
Korea	1997	Zambia	None
Latvia	2004		