Economics Bulletin

Volume 39, Issue 3

Cartel Destabilization and Leniency Programs – Empirical Evidence

Gordon Jochem Klein
Westfälische Wilhelms-Uniersität Münster

Abstract

This study evaluates the success of the introduction of corporate leniency programs against cartels, tackling one key problem in the existing literature of leniency program evaluation: the measurement of the effects of leniency programs on the population of detected and undetected cartels. In contrast to previous studies, the present work does not rely on strong assumptions, based on the predictions of theoretical models, to infer conclusions on the population of undetected cartels from the behavior of detected cartels. Rather, it uses a standard competition intensity measure at the industry level and identifies a significant effect of deterrence in the population of both detected and undetected cartels.

Centrum für angewandte Wirtschaftsforschung Münster (CAWM), Westfälische Wilhelms-Universität Münster, Germany, Am Stadtgraben 9, 48143 Münster, Germany. E-Mail: gordon.klein@wiwi.uni-muenster.de. I would like to thank seminar participants and their comments at the Düsseldorf, Leuven and Mannheim Seminars on Competition and Innovation: Düsseldorf 2010; internal ZEW Seminar, Mannheim 2010; ZEW-Conference on Quantitative Analysis in Competition Assessment, 2010, Mannheim, Germany; EEA Oslo 2011; EARIE Stockholm 2011. In addition, I would like to thank Irene Bertschek, Daniel Cerquera, Ralf Dewenter, Tomaso Duso, Christina Gathmann, Hanna Hottenrott, Ulrich Heimeshoff, Justus Haucap, Mark McCabe, Evgenia Motchenkova, Martin Peitz, Mayra Rebolledo and Christine Westermann-Klein for comments and suggestions. This paper is a revised version of earlier discussion paper versions and my Dissertation at the Heinrich-Heine-University of Düsseldorf. Gordon J. Klein acknowledges financial support from the ANR-DFG research grant of the project "Competition and Bargaining in Vertical Chains." All remaining errors are mine.

Citation: Gordon Jochem Klein, (2019) "Cartel Destabilization and Leniency Programs – Empirical Evidence", *Economics Bulletin*, Volume 39, Issue 3, pages 1918-1924

Contact: Gordon Jochem Klein - gordon.klein@wiwi.uni-muenster.de.

Submitted: July 03, 2018. **Published:** August 20, 2019.

1. Introduction

Motivated by the theoretical predictions of corporate leniency programs that allow for positive as well as negative effects on cartel deterrence (for a survey, see Spagnolo 2008), various studies empirically analyzed the success of these programs (e.g., Miller 2009, Brenner 2009). The main difficulty in the identification of the effects of such programs is that the most common indicator of a program's success, a change in the rate of cartel detection, can be misleading. This measure only captures a selected part of the overall population of cartels – i.e., the detected and undetected ones – to derive inference. A typical question is whether higher detection rates may be attributed either to better detection or to increased numbers of cartels (e.g., Miller 2009). Various scholars have acknowledged this problem and identified the impact of leniency programs with sophisticated empirical methods using data on cartel detection still conditioning the behavior of undetected cartels on the behavior of detected ones (e.g., Miller 2009, Brenner 2009). It is therefore uncertain whether this captures the effect on the overall population given that the behavior of the unobserved cartels may countervail the possibly positive effects on cartel deterrence. Recently, studies investigate how to infer the population of cartels. Hyytinen *et al*. (2018), propose a Hidden Markov Model process to identify the overall population of cartels including undetected ones, however, without dealing with the impact of leniency programs. Although they show the reliability of their approach in a Finnish dataset, it is still rather complex and the implementation for treatment evaluation is reliant on several assumptions regarding the model's calibration.

The aim of this study is to now fill the gap in the literature of evaluating the introduction of leniency programs, taking into account the overall population of cartels, including the undetected ones. This study suggests a different approach to evaluate the success of corporate leniency programs, using a more direct and simpler measure, i.e., competition intensity, operationalized by a price-cost, margin-related, *average profitability measure* (Griffith *et al*. 2007/2010). This approach relies on few assumptions (such as a particular underlying population of cartels) and allows the efficiency of leniency programs to be measured without typical pitfalls; i.e., it does not rely on observed cartel collapse, but attribute differences in the industry outcome to cartelization. This also helps to avoid the potential detection of already collapsed cartels being wrongly identified as a success of leniency programs in terms of increasing the competitive level within industries. To do so, the study uses a fixed-effects instrumental variable panel estimation to analyze international industry-level data of the OECD STAN database over 16 years (1992–2008) regarding the impact of leniency programs implemented across different OECD countries.

The main contribution of the paper is, therefore, that it provides evidence that corporate leniency programs causally deter the overall population of cartels – detected and undetected – and significantly enhance the competition intensity within industries. Hereby, the study circumvents the typical problem of former studies, only taking into account the population of detected cartels to derive inference. As a secondary finding, the study has shown an indirect, easy applicable approach to measure the effects on the overall cartel population that may be used in other frameworks as well.

2. Empirical Strategy and Data

The main argument of the study takes advantage of a definition of the objectives of leniency programs provided by Spagnolo (2008), and considers Becker's (1968) objectives of law enforcement, defined as effectively deterring ex-ante and ex-post cartelization – i.e., preventing

behavior that reduces competition. This leads to the hypothesis that leniency programs increase the level of competition after their introduction, which is directly testable.

The analysis operationalizes the level of competition by a standard competition intensity measure used in studies at the industry level, the *average profitability measure,* which is – in the absence of economies of scale – a price-cost margin equivalent measure (Griffith *et al*. 2010, p. 399). A convenient feature is that the measure is easily built using standard international databases for productivity research. It allows identification of the leniency programs' impacts on the level of competition within an industry constituted by both detected and undetected cartels.

The analysis is based on a panel for 21 NACE 2-digit industries at a country level (23 OECD countries, dominated by EU countries).[1] It uses the OECD STAN database with annual information from 1992 to 2008, which constitutes the time when corporate leniency programs were introduced.[2] The Construction of the dependent *average profitability measure* follows Griffith *et al*. (2007/2010).[3]

$$Average\ Profitability = \frac{Value\ Added}{Labor\ Costs + Capital\ Costs}$$

Although this measure may be sensitive to industry restructuring (Boone 2008), the analysis considers changes between the treatment in two periods (pre- and post-leniency) via fixed-effects estimations, such that this bias should not be too prevalent, since the industry restructuring that may harm the measures' results requires a longer period. In addition, this approach allows us to identify the impact on both detected cartels that have been destroyed and undetected cartels that have been deterred.[4]

The estimation uses a standard fixed-effects instrumental variable model capturing the time-invariant heterogeneity of industries and countries. To control for various sources of time-variant heterogeneity, several control variables were used (supranational EU leniency programs, EU Single Market Program, GDP trend, product market regulation, import penetration). Those variables were similarly proposed by Buccirossi *et al*. (2013) and partially by Griffith *et al*. (2007), to control for factors affecting competition intensity and reduce the omitted variable bias up front. Continuous variables, built with monetary values, are used with their natural logarithm to allow interpretation in percentage changes.

---

[1] While for studies of the identification of single cartels' effects (e.g., Blanckenburg *et al*. 2012), the level of aggregation may be too high, for the evaluation of a general, presumably severe, effect, it is sufficient as long as that occurs across several industries and cartels. Importantly, while an identified effect serves well as a clear indicator of an effect, the opposite may not be true since a no-effect result may just result from a lack of disaggregation.

[2] Notice that STAN database incorporates updates up to 2016. Beyond 2008, the industry data that was used would be subject to structural breaks due to the financial crisis. This particularly affects measures, like interest rates, that are used to build the dependent variable. Therefore, any usage of this more recent data would lead to measurement and causality problems and finally biased measures.

[3] For data description, see table I.

[4] This means that if we find a cartel destabilizing effect, i.e., decreased industry margins, this can be interpreted as evidence of the effectiveness of leniency programs. In the case where no effect can be found, however, this may be driven by a reduction of X-inefficiencies, which may increases productivity and, thus, margins, eventually partially compensating a margin's decreasing deterrence effect.

Any industry-level estimation faces the problem that regardless of a careful model selection, some industry variation may be caused by variables omitted in the model. Those factors regularly lead to biased regression coefficients and, thus, possibly biased effect identification. In addition, there may be simultaneity or reverse causality problems in the estimation resulting from parallel observation of the introduction of leniency programs and direct observation of competition intensity. It cannot be excluded that to a certain degree the introduction of leniency is driven by low competition intensity. To tackle the two problems that lead to endogeneity bias, the study introduces an instrumental variable estimation that addresses both issues in one approach, allowing for causal inference.[5]

The strategy relies on the instruments proposed by Buccirossi *et al*. (2013), which first consider Hausman instruments, for which I use the percentage of other OECD countries that have implemented a leniency program and, second, uses policy indicator instruments from the Manifesto database. The Manifesto database includes the countries' political programs, indicating which party has stronger or weaker preferences policies. These parties' positions are weighted with the electoral results to gain some indication of the general political preference for liberal or state-oriented policy attitudes. These attitudes are captured by considering the political parties' attitudes regarding welfare programs. The underlying idea is that the governments' attitude of interference is negatively related to the trust in competition or the belief in the importance of competition-enhancing policies in general. If this is the case, it reduces the likelihood of the implementation of leniency programs, which leads to a slower implementation.

3. Results

Table II shows the estimation results. Column (1) provides a baseline estimation controlling for several competition intensity measures (e.g., import penetration, and a variable capturing whether an economy is above or below the average growth-path) as well as time-fixed effects to control for a time trend. Additional controls for political changes are included, such as the introduction of supranational leniency programs by the EU, changes in the product market competition, and the single market program. The impact of the leniency program is negatively significant and indicates that leniency programs increase competition intensity and deter cartels.

To control for omitted variable bias, column (2) introduces the first instrument (percentage of OECD countries with a leniency program).[6] The coefficient of leniency remains significant and negative. The Hausman test indicates that there is no evidence of endogeneity bias, such that the estimation in column (1) is more precise. Column (3) introduces the policy instruments, which change the coefficient of leniency, though it remains negative and significant. The Hausman test shows that there is no evidence of endogeneity and the Sargan-test confirms the validity of the

[5] To tackle simultaneity, I also tested several lag structures, but find AIC and BIC Information criterions decreasing in the lag size. Still, the main results hold almost in any lag structure. Given that the instrumental variable estimation captures bias from simultaneity, I rely on this standard approach to overcome potential simultaneity issues.

[6] The instrumental variables approach also serves as a robustness check. While the result of the common fixed effect specification may change given the implementation of one or another variable, the instrumental variable estimator is robust for almost any combination of the control variables. This is logical since it tackles omitted variables and, thus, is not dependent on a full model as the common fixed effects estimator is.

instruments.[7] This leads to the conclusion that the specification provided in column (1) is most precise. Hence, I find a negative and highly significant impact of leniency programs on the average profitability measure, which translates into a positive impact on competition intensity.

4. Conclusion

The study finds that corporate leniency programs are successful and, relying on the identification strategy, causally improve the competition intensity within industries due to cartel deterrence.

These results are important given that they confirm the previous findings on the efficacy of leniency programs to help to deter cartels. However, contrary to existing studies these programs rely not only on the observation of actual cartel detection but they evaluate the impact on the overall population of cartels, both observed and unobserved. This confirms the importance of corporate leniency programs in cartel deterrence and of improving the competition intensity of industries. Moreover, the approach used may be helpful for further policy evaluation of cartel deterring policies.

[7] I use the xtoverid STATA® command by Schaffer & Stillman (2010) for the Sargan test.

References

Becker, G. (1968) "Crime and Punishment: An Economic Approach" *Journal of Political Economy* **76**, 169-217.

Blanckenburg, K.v., A. Geist, and K.A. Kholodilin (2012) "The Influence of Collusion on Price Changes: New Evidence from Major Cartel Cases" *German Economic Review* **13**, 245-256.

Boone, J. (2008) "A New Way to Measure Competition" *The Economic Journal* **118**, 1245-1261.

Brenner, S. (2009) "An Empirical Study of the European Corporate Leniency Program" *International Journal of Industrial Organization* **27**, 639-645.

Buccirossi, P., L. Ciari, T. Duso, G. Spagnolo, and C. Vitale (2013) "Competition Policy and Productivity Growth: An Empirical Assessment" *The Review of Economics and Statistics* **95**, 1324-1336.

Griffith, R., R. Harrison, and G. Macartney (2007) "Product Market Reforms, Labour Market Institutions and Unemployment" *The Economic Journal* **117**, C142-C166.

Griffith, R., R. Harrison, and H. Simpson (2010) "Product Market Reform and Innovation in the EU" *Scandinavian Journal of Economics* **2**, 389-415.

Hall, B. and J. Mairesse (1995) "Exploring the relationship between R&D and productivity in French manufacturing firms" *Journal of Econometrics* **65**, 263-293.

Hyytinen, A., F. Steen, and O. Toivanen (2018) "Cartels Uncovered" *American Economic Journal: Microeconomics* **10**, 190-222.

Klingemann, H.D., A. Volkens, J.L. Bara, I. Budge, and M.D. McDonald (2006) "Mapping Policy Preferences II, Estimates for Parties, Electors, and Governments in Eastern Europe, European Union, and OECD 1990-2003" Oxford University Press Inc.: New York.

Miller, N.H. (2009) "Strategic Leniency and Cartel Enforcement" *American Economic Review* **99**, 750-768.

Ohnemus, J. (2009) "Productivity Effects of Business Process Outsourcing – A Firm-level Investigation Based on Panel Data" ZEW Discussion Paper No. 09-088: Mannheim.

Schaffer, M.E. and S. Stillman (2010) "xtoverid: Stata module to calculate tests of overidentifying restrictions after xtreg, xtivreg, xtivreg2 and xthtaylor" http://ideas.repec.org/c/boc/bocode/s456779.html [20.07.2014].

Spagnolo, G. (2008) "Leniency and Whistleblowers in Antitrust" in *Handbook of Antitrust Economics* by P. Buccirossi, Ed., MIT Press: Cambridge Massachusetts.

Volkens, A., O. Lacewell, P. Lehmann, S. Regel, H. Schultze, and A. Werner (2009) "The Manifesto Data Collection" by Manifesto Project (MRG/CMP/MARPOR), Update 2009, Berlin: Wissenschaftszentrum Berlin für Sozialforschung (WZB).

Appendix

Table I:
Descriptive Statistics

Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min.*	*Max.*	*Description*	*Data Source*
Average Profitability	2892	1.28	0.30	0.04	2.47	$Avereage\ Profitability_t = \frac{Value\ Added_t}{Labor\ Costs_t + Capital\ Costs_t}$	Value added and labor cost: OECD STAN; capital costs, see below; sample cleaned for outliers above 95th percentile (all in nominal terms)
Capital (in Billions)	2892	515.88	6261.49	0.001	192367.8	$Stock_t = Stock_{t-1} * (1 - Depreciation_t) + Capital\ Investment_t$; Starting Value: $Stock_{t=1} = Stock_{t-1} * (1/(Depreciation_t + Growth_t)$	Capital Investment OECD STAN. Method following Hall and Mairesse (1995).
Capital Costs (in Billions)	2892	36.35	489.41	-0.43	16371.51	$Capital\ Costs_t = (Interest_t - Inflation_t + Depreciation_t) * Stock_t$	US long-run interest: OECD Reference Series, inflation: OECD Key Economic Indicators database, depreciation per industry (capital consumption/capital, following Ohnemus 2009); benchmark country: Germany (largest country with all necessary information available), or if not available mean of others: OECD STAN;
National Leniency Program	2892	0.30	0.46	0	1	Leniency Availability	European Competition Network 2009, http://ec.europa.eu/competition/ecn/model_leniency_programme_annex1.pdf, for UK legal basis introduction1998 is used
1st EU Leniency Program	2892	0.58	0.49	0	1	New EU Members treated at EU entry	
2nd EU Leniency Program (revision)	2892	0.31	0.46	0	1		
EU Single Market Program	2892	0.70	0.46	0	1		
Product Market Regulation Index	2892	1.79	0.55	0.82	3.97	Index, 3 survey periods with linear interpolation in between those periods	OECD Product Market Regulation Index
Percentage of OECD Countries with Leniency	2892	0.31	0.32	0	1	Percentage of other OECD countries' leniency	European Competition Network 2009, http://ec.europa.eu/competition/ecn/model_leniency_programme_annex1.pdf, for UK legal basis introduction1998 is used
Manifesto Instrument: Welfare	1766	11.70	4.90	3.59	31.57	Index of frequency of a parties election program regarding the topic indicated; weighted by percent of seats in parliament. Compound variable of the items *Social Justice* and *Welfare State Expansion*	Manifesto Database; Version used: Klingemann *et al*. (2006) with its update (Volkens *et al*. 2009)
GDP Trend	2892	0.51	3.33	-8.68	14.89	ln(predicted value from OLS with linear and quadratic trend) – ln(real GDP value)	OECD STAN
Import Penetration	2892	3.39e-09	2.23e-08	5.09e-14	7.76e-07	Imports / Value Added (nominal terms)	

Table II
Estimations

Ln (Average Profitability)	(1)	(2)	(3)
Leniency	-0.0200*	-0.0301**	-0.0744***
	(0.0118)	(0.0146)	(0.0168)
1st EU Leniency	-0.0277	-0.0269*	-0.0080
	(0.0214)	(0.0158)	(0.0166)
2nd EU Leniency	0.0375**	0.0360***	0.0561***
	(0.0184)	(0.0128)	(0.0146)
EU Single Market Program	-0.0302	-0.0283	0.1214***
	(0.0217)	(0.0185)	(0.0314)
Product Market Regulation Index	0.0389	0.0439*	0.0490**
	(0.0526)	(0.0233)	(0.0242)
GDP Trend (difference in logs)	0.0053	-0.0053***	0.0059***
	(0.0033)	(0.0019)	(0.0020)
Ln (Import Penetration)	-0.1635***	-0.1639***	-0.1765***
	(0.0446)	(0.0073)	(0.0098)
Country-Industry Fixed Effects	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes
Constant	-3.1206***	-3.1263 ***	-3.6055***
	(0.9164)	(0.1542)	(0.2079)
Instruments $_{t-1}$		Leniency in OECD countries	Leniency in OECD countries, Welfare
First Stage, F-Value		1410.73	450.50
R^2	0.22	0.22	0.22
Wu-Hausman Test		1	1
Sargan Test, P-Value			0.67
Observations	2892	2892	1813

*Column 1, Clustered Robust Standard errors in brackets, column 2 & column 3, Standard errors in brackets, R^2 within shown. Significant at 1% ***, significant at 5% **, significant at 10% **