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Enforcement of European Competition Policy - Impact on Competition and Efficiency

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Enforcement of European Competition Policy - Impact on Competition and Efficiency.

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Abstract

The study analyzes the impact of European antitrust enforcement on industry performance measured as competition intensity (Price Cost Margin) and productivity (labor productivity and distance to the frontier). For a panel of OECD countries on the industry level since 1988, we estimate the impact of an infringement decision by the European Commission on the competitive market structure. We find that enforcement has a considerable effect, both on competition intensity and on productivity. However, the impact differs with the anticompetitive economic conduct. Cartels behave as theoretically predicted with an increase in competition and productivity after the cartel break-up. The impact of vertical conduct is more complex, with positive and negative efficiency effects of antitrust enforcement depending on the exclusivity of the vertical restraint.

Keywords: Competition Intensity, Productivity, Antitrust Enforcement, Industry Level Data. **JEL Classification:** L40, K21 .

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1 Introduction

The effectiveness and success of antitrust enforcement and more generally of regulatory intervention is of large interest in academic discourse and public discussion. The first attempts testing the effect of US antitrust policy use event study methodology to estimate the firms' stock market reaction or the ones of their competitors around an investigation and/or prohibition (Burns 1977, Garbade et al. 1982, Binder 1988, Gilligan 1986, Bosch and Eckard 1991, Mullin et al. 1995, Bizjak and Coles 1995, Bittlingmayer and Hazlett 2000).¹ In analogy, Langus and Motta (2009) and Guenster and VanDijk (2011) test the effect of enforcement in the European Union.² All these studies find a statistically significant share price drop around the event date, attributing the market value loss to three factors: legal costs (fines, legal and economic counseling, etc.), foregone potential future (collusive) profits, and loss of reputation. The suggested decrease in future profits is perceived as evidence for the effectiveness of the policy. Studies evaluating antitrust enforcement more directly focus either on the policy in general (e.g., Buccirosi et al. 2009) or on particular aspects of enforcement like the leniency program (e.g., Brenner 2009, Miller 2009, Sovinsky and Helland 2010, Klein 2010).

In contrast to previous studies using the stock price reaction as a indirect measure, inferring from a policy change the effectiveness of the policy more generally or testing enforcement variables on a more aggregate level, we access the direct impact of each infringement decision issued by the Commission since 1988 on a sector's competition intensity and efficiency at the national level. We are the first to provide an analysis of the direct impact of a Commission decision. We use competition and productivity measures introduced by a second literature strand.

Nicoletti and Scarpetta (2003) laid the foundation for identifying the impact of more general regulations on productivity and growth for OECD industry level data forming the base for similar studies (Buccirosi et al. 2009, Griffith et al. 2007, Griffith et al. 2010). Importantly, those studies also introduce a framework for productivity analysis

¹For a description and a statistical overview of US enforcement, see (Posner 1970, Gallo et al. 1985, Salop and White 1986, Gallo et al. 1986, Gallo et al. 1994, Gallo et al. 2000, Lin et al. 2000, Kovacic and Shapiro 2000, Acemoglu et al. 2001, Posner 2001, Baker 2003, Ghosal and Stennek 2007).

²For a description and a statistical overview of EU enforcement, see (Nilsen 1997, Duso et al. 2007, Lyons 2004, Bergman et al. 2005, Duso et al. 2006, Davies and Lyons 2007, Russo et al. 2010b, Schinkel 2007, Veljanovski 2007, Stephan 2005, Bos and Schinkel 2007, Wils 2002, Wils 2005, Carree et al. 2010).

which we combine with data on enforcement. Related literature like Griffith et al. (2010) shows on the industry level that the European Single Market Program had an impact on competition intensity affected industries' R&D spendings. The study also relates to the large literature analyzing the effect of competition on firm and industry performance in general. For instance Aghion et al. (2009) analyze the impact of firm entry on innovation and performance while Aghion et al. (2005) analyze the relationship between competition and innovation. Evidently, these are only some of the various studies linking industry structure and competition to other measures of performance. Ultimately, this discussion begins with the popular and widely referred to work of Schumpeter (1942/1947) and Leibenstein (1966) identifying dynamic and x-efficiency as a growth engine.

Given the known difficulties with measuring efficiency and its underlying concept (see, e.g., the discussion of, Spagnolo 2008), our strategy is to uncover the impact in two dimensions: competition intensity (e.g., Griffith et al. 2010), productivity (e.g., Buccirossi et al. 2009). Our analysis relies on a dataset built at the industry level, which uses the commonly used (e.g., Griffith et al. 2007, Griffith et al. 2010) OECD STAN data (OECD 2010d) as well as several additional OECD data sources comprising a period of 20 years and combining it with unique data set including consistently all decisions of the European Commission since 1964 set described by (Carree et al. 2010, Russo et al. 2010a). Our competition intensity measure is "average profitability" (Griffith et al. 2010, p. 389) interpreted in the literature as a Price Cost Margin (e.g. Griffith et al. 2007, Griffith et al. 2010). Efficiency is measured as total factor and labor productivity. The advantage of using this measure in contrast to the competition intensity is that it is implemented in a standard framework and is not subject to several problems (e.g., Buccirossi et al. 2009). In particular, Boone (2008a) and Boone (2008b) identify the PCM as not perfectly representing different levels of competition.

We find that enforcement has a considerable effect, both on competition intensity and on productivity. The impact is not identical for the different economic conduct: It differs in being of vertical or horizontal nature. In particular, the detection of cartels, the most frequent anticompetitive horizontal conduct (Carree et al. 2010), restores competition intensity. In contrast, cartels have a higher productivity which we interpret as a cartel profit effect. Taking into account productivity as the distance to the technological frontier (Acemoglu et al. 2003) the profit effect might be mitigated and cartel detection pushes former cartel members closer to the technological frontier. Vertical restraints show a

completely different picture. Their detection reduces industries competition intensity and pushes them farer away from the technological productivity frontier. Therefore, our results suggest a more careful treatment of vertical restraints. Another policy suggestion might be that the effect of antitrust enforcement related to vertical restraints may be more difficult to uncover and to verify.

2 Empirical Strategy and Data

2.1 Empirical Strategy

The aim of our analysis is to identify the impact of antitrust enforcement on industry performance and efficiency. The main objective of antitrust policy is increasing competition intensity and efficiency which should result in an overall welfare increase which optimally comprising lower prices, better products, more efficient production etc. (see for a detailed discussion of the objectives of antitrust policy Spagnolo 2008). To identify competition intensity, we employ a version of the Price Cost Margin (Griffith et al. 2010, Klein 2010). To ensure that we have normally distributed left and right hand side variables, we use all continuous variables in their natural logarithms throughout the study. In the second step, two measures of productivity are employed. In particular, we estimate first the following specification to derive competition intensity:

$$\begin{aligned} \ln(Y_{i,t}) = & \beta_C \text{Conduct}_{i,t-2} + \beta_D \text{Detection}_{i,t-2} + \beta_P \text{Policies}_{i,t-2} \\ & + \beta_X \ln(X_{i,t-1}) + \text{year}_i + ci_t + u_{i,t} \end{aligned} \quad (1)$$

Secondly, we analyze the possible impact on efficiency measured as productivity (Buccirossi et al. 2009), using in first instance a standard framework of a log linear reformulation of the Cobb-Douglas Production function:

$$\begin{aligned} \ln(Y_{i,t}) = & \beta_K \text{Capital}_{i,t-1} + \beta_L \text{Labour}_{i,t-1} + \beta_I \text{Intermediate} + \\ & \beta_C \text{Conduct}_{i,t-2} + \beta_D \text{Detection}_{i,t-2} + \beta_P \text{Policies}_{i,t-2} \\ & + \beta_X \ln(X_{i,t-1}) + \text{year}_i + ci_t + u_{i,t} \end{aligned} \quad (2)$$

and thereafter, a measure of the distance to the frontier (Acemoglu et al. 2003), allowing us to investigate how close the firm is located to a specific industry benchmark:

$$\begin{aligned} \text{Min}(0; \ln(Y_{i,t}^{95th})/L - \ln(Y_{i,t})/L) = & \beta_K \text{Capital}_{i,t-1} + \beta_L \text{Labour}_{i,t-1} + \beta_I \text{Intermediate} + \\ & \beta_C \text{Conduct}_{i,t-2} + \beta_D \text{Detection}_{i,t-2} + \beta_P \text{Policies}_{i,t-2} \\ & + \beta_X \ln(X_{i,t-1}) + \text{year}_i + \text{ci}_t + u_{i,t} \end{aligned} \quad (3)$$

Clearly, all estimations involve some endogeneity biases well identified in the literature (e.g., Buccirossi et al. 2009, Griffith et al. 2010). We are aware of the potential reverse causality problem also well discussed (e.g., Buccirossi et al. 2009, Griffith et al. 2010). We try to tackle this problem following the literature closely, by using fixed effects controlling for unobserved characteristics of the industries potentially affecting the actual level of competition intensity and lagged explanatory variables (e.g. Aghion et al 2009, Buccirossi et al. 2009).³

Additional lags of our conduct identifier proxy the imprecision of the conduct starting date and ensure that we consider fully treated years which may already reduce at least some part of the reverse causality problem. In addition, we retrieve information on the starting years of the collusive and vertical agreements from the Commission decisions. Therefore, we identify the whole timespan from cartel formation/vertical conduct application to collusion/vertical restraint detection to the particular destruction. Given that those changes are identifiable, we measure the actual impact which is more sophisticated than identifying only simple correlations. A final data driven problem is omitted variable bias. Following the mentioned literature, we try to control for different major policy introductions happening during the years to explain as much variation as possible with year fixed effects. However, there still remains the possibility of additional sources of bias. The main weakness of our estimation is that we do not have a proper instrument accounting for endogeneity problems.

³However, their strategies are using additional means to tackle those issues.

2.2 Data

The data we use come from two main sources. First, we have information on antitrust enforcement that has been described by Carree et al. (2010). It comprises detailed information on all European antitrust cases decided under Articles 101 and 102 where cartels and vertical restraints make up for the majority of the sample Carree et al. (2010) for the period we consider (i.e. 1988-2008).⁴ We have to limit our analysis to detected collusion and vertical restraints, neglecting abuses of dominant positions, licensing and joint venture cases since there are too few cases. The two later do not lead to infringements often and are therefore not part of the analysis Carree et al. (2010). The information on the cases is detailed, ranging from the time when the conduct took place, information on detection, report route, responsible Commissioner to several law related technical issues of the proceedings.

We define as one variable the existence of either a cartel (*CAR*) or a vertical conduct (*VC*) and define a pre- an post detection period, indicating if we are in the timespan after a cartel (*DEC*) or vertical conduct detection (*VDEC*). For the moment, we focus only on infringement decisions prohibiting the underlying anticompetitive practice thereby neglecting horizontal, vertical, licensing and joint venture agreements ending with a positive outcome for the firms in form of a negative clearance and/or exemption jointly constituting 50% of the sample (Carree et al. 2010) over our sample period.⁵

The second main data source is the OECD STAN database (OECD 2010d) extensively described and used in various studies (e.g., Griffith et al. 2010, Klein 2010). Additional sources are used to construct our data set (OECD 2010c, OECD 2010b, OECD 2010a). The data provided by STAN comprises industry level data regarding production outputs (e.g., Value Added) and inputs (e.g., Labor inputs, Intermediate inputs, Capital stock and capital formation) presented in table (1). However, the capital stock variable mentioned by Buccirossi et al. (2009) is not as widely available as capital formation. Therefore, we construct this variables using the Perpetual Inventory method (e.g., Hall and Mairesse 1995, Griffith et al. 2007, Buccirossi et al. 2009, Ohnemus 2009, Griffith et al. 2010).

⁴The current enumeration was adopted in the Treaty of Lisbon (2010). Previously, under the Treaty of Amsterdam (1997), the Articles were enumerated 81 and 82.

⁵For the legal basis of decision making, see *Council Regulation (EC) No 1/2003 of 16 December 2002 on the implementation of the rules on competition laid down in Articles 81 and 82 of the Treaty*, (2003) OJ L 1/1 of 4.1.2003. Regulation 1/2003 replaced *Council Regulation No 17 (EEC): First Regulation Implementing Articles 85 and 86 of the Treaty*, (1962) OJ 13/204 of 21.02.1962.

The construction requires particular information on interest rates, inflation and different details provided by additional data sources (OECD 2010c, OECD 2010a).

We construct several additional variables, e.g. a measure of competition intensity proposed by Griffith et al. (2010) ("average profitability" (Griffith et al. 2010, p. 389)). It is a PCM measure constructed analogously to (Griffith et al. 2010, p. 399) as the ratio of industry value added over labor and capital costs.⁶ Capital Costs are computed as explained in Griffith et al. (2007), multiplying capital stock with a capital cost factors (Griffith et al. 2007, p. C163, Griffith et al. 2010, p.399).

Following the analysis of (Griffith et al. 2007, Aghion et al. 2009, Buccirosi et al. 2009, Griffith et al. 2010), controls for the current economic situation and the deviations of actual GDP from a predicted GDP growth (OECD 2010c), *GDPG* are included. Moreover, relative output weighted import intensity (*IVA*) on the industry level *Imports/ValueAdded* as described in (Syverson 2004, Aghion et al. 2009, Buccirosi et al. 2009) is an additional control for the sector's competitive environment. Similar to Buccirosi et al. (2009), the OECD PMR index (OECD 2010b), *PMR*, controls for country specific product regulation. All additional data sources are described in table (2). Given the data structure and availability, we only have three data points such that we linearly interpolate the values in between the different data points. We also use information, as it is done in various studies, on the European Single Market Program (*SMP*) as this has been identified to be an important shock for the competitive environment (Griffith et al. 2010).

For matching the enforcement and productivity/efficiency measure data, we use information on the Nace two digit level. Occasionally, we face the problem when using only 2 nace digits caused by missing matches between an antitrust case and industry information. In these occasions, we allow for aggregations of 2 or 4 Nace 2 digit codes. Hence, we do not have a pure 2 digit level matching. Where there is no aggregation of 2-4 Nace 2 digit codes, the disaggregated level is not considered. Our results for a pure 2 digit level and the results for vertical conducts hold in general, but standard errors for cartels are inflated.

Only industries are taken into account in which there has been any anticompetitive conduct; if in a particular industry in a given year, there is an anticompetitive business

⁶For a critical discussion of the PCM, see Boone (2008a) and Boone (2008b).

practice taking place, the country and industry is included in the analysis. If this is not the case, the observation is excluded from the estimation, ensuring that industries are "observed" to be potentially anticompetitive. When the industries are considered the results are similar for vertical conducts, but less clear for cartels. In industries, that are never subject to any anticompetitive conduct leading to an official antitrust decision by the Commission, there might still be special exemptions or structural settings that are not covered by our research setting.

3 Results

First, we are interested how anticompetitive conduct affects competition intensity. Table (3) shows the results for cartels and vertical conduct. The first column suggests that the competition intensity is less intense if a cartel is in place as one might expect. The detection variable is insignificant. The second column analyses the same considering vertical restraints. Anticompetitive vertical agreements seem to have no impact on competition intensity, suggesting that their consequences do not seem to be too large. This result might be subject to some kind of measurement error. It might be that those vertical conducts are partially in those industries where there is also collusion. Therefore, the third column controls for both conduct simultaneously. Collusion as well as vertical agreements show that the effects found in the first column hold and that also some information on vertical conduct is revealed. Competition intensity is higher (PCM is lower) when there is a vertical conduct in the industries. Given that we do not have proper instruments, we cannot perfectly rule out that those industries affected are more competitive or whether competition intensity increases in those conducts. The detection variable is also negative and significant.

The second measure of industry performance is firms' labor productivity presented in column (1) - (3). Column (1) shows for the typical controls (Capital, Labor, Intermediate Inputs) in the Cobb-Douglas framework that the estimation provides consistent results. The control for the cartel duration is positive and statistically different from zero, indicating that cartelized industries are more productive. However, we cannot state whether this effect is due a kind of joint profit maximizing effect or efficiency related. If a cartel is detected and prosecuted the efficiency is not statistically different from zero, which is

shown by the insignificance of the detection effect.

The second column presents the results for the vertical conduct and its detection. While the coefficient for the conduct time is statistically not different from zero, the coefficient of detection is negative and significant at the 5% level. After detection and prosecution of an anticompetitive vertical agreement the productivity is reduced. This is in line with standard textbook insights of vertical conduct (Motta 2004), stating that there might be significant productivity enhancing effects. The third column controls for vertical and horizontal conducts jointly, indicating that the previously found results still hold. In addition, also the coefficient of the vertical conduct time is negative and significant. This coefficient, although only significant at the 10% level, speaks against the efficiency argument of vertical conduct. This may indicate that there may also be significant profit enhancing effects that may play a role, or just some kind of selection into groups of profitable and non-profitable industries that are more likely to be subject of these practices.

To rule out that there are industry selection issues driving the results, column (4) uses the distance to the frontier measure. Cartelized industries are farer away from the technological frontier. Differently, if a vertical conduct is detected this pushes the industry farer away from the technological frontier, i.e. reducing its efficiency. Detection and prosecution of cartels is supposedly working as desired. Competition intensity is increased and efficiency enhanced. The impact of vertical restraints is more difficult, puzzling for competition intensity and negative for efficiency, with prosecution leading to significant decreased productivity. These results have to be interpreted cautiously as there are still robustness checks necessary. Instruments testing for possible two way causality have to be found and implemented.

4 Conclusions

The analysis uncovers some interesting results on the antitrust enforcement in the European Union. As one can imagine and as it is common knowledge, cartels in place reduce the competitive intensity significantly. Moreover, detection increases efficiency and reduces the distance to the technological frontier.

The picture is different and more interesting for uncovered vertical conducts. The impact

on the competition intensity seem to be positive, indicating that exclusive dealing actually lowers industry profits, the measure we use for competition intensity. However, the impact on productivity seems to be different. Vertical conducts seem to have a positive impact on efficiency, or more precisely, after the detection the industries are pushed farther away from the technological frontier.

These results seem to indicate that despite the clear effect of cartels and the efficiency of the treatment, the prosecution of vertical conducts is more difficult to judge. The results have to be tested against possible bias, but suggest that the treatment and prosecution of vertical conducts should be used carefully and possible efficiency gains should be taken into account, but certainly this aspect certainly desires more research.

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Appendix

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
VALU (in 10 Millions)	26874	233459	0.4	4879482	2845
EMPE (in 1000')	514	1697	100	16620	2589
INTI (in 10 Millions)	29331	188530	1.8	2714260	2790
Capital (in 10 Millions)	67475	649883	0	15266085	2845
<i>Source: OECD STAN (OECD 2010d), auxiliary sources for own calculations (OECD 2010c, OECD 2010a).</i>					

Table 2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
Average Profitability	1.265	0.303	0.141	2.497	2845
CAR	0.05	0.219	0	1	2959
VC	0.02	0.13	0	1	2959
SMP	0.672	0.47	0	1	2845
GDP	6.472	61.982	0	1358.974	2845
PMR	1.826	0.525	0.824	3.97	2634

Source: OECD STAN (OECD 2010d), auxiliary sources for own calculations (OECD 2010c, OECD 2010a).

Table 3: Impact on Competition Intensity

<i>Dependent Variable:</i> <i>ln(Average Profitability)</i>			
	(1)	(2)	(3)
DEC (2 lags)	0.0371 (0.0337)		0.0496 (0.0352)
CAR (2 lags)	0.0745*** (0.0244)		0.0887*** (0.0256)
VDEC (2 lags)		-0.0055 (0.0317)	-0.0486** (0.0239)
VC (2 lags)		-0.0298 (0.0356)	-0.0767** (0.0343)
SMP (1 lag)	-0.0201 (0.0185)	-0.0212 (0.0186)	-0.0197 (0.0186)
Ln(IVA) (1 lag)	-0.0074 (0.0133)	-0.0029 (0.0131)	-0.0087 (0.0134)
Ln(GDP) (1 lag)	-0.0022 (0.0057)	-0.0027 (0.0057)	-0.0022 (0.0057)
Ln(PMR) (1 lag)	0.3004 (0.1916)	0.3134 (0.1915)	0.3060 (0.1922)
Time Dummies	x	x	x
Constant	-0.1854 (0.4022)	-0.0742 (0.3923)	-0.2137 (0.4059)
R2	0.1461	0.1373	0.1493
Observation	1644	1644	1644

Robust Standard errors are in brackets.

*Significant at 1% ***, significant at 5 % **, significant at 10% **

Table 4: Impact on Productivity

<i>Dependent Variable:</i>	<i>LN(VA/Employees)</i>			<i>Distance to the Frontier</i>
	(1)	(2)	(3)	(4)
DEC (2 lags)	0.0430 (0.0377)		0.0478 (0.0388)	-0.6115** (0.2372)
CAR (2 lags)	0.0692* (0.0370)		0.0724* (0.0378)	0.1726 (0.1326)
VDEC (2 lags)		-0.0417** (0.0202)	-0.0567*** (0.0188)	0.4229** (0.2102)
VC (2 lags)		-0.0445 (0.0323)	-0.0600* (0.0349)	0.1716 (0.1508)
ln(Capital) (1 lag)	0.2802*** (0.1047)	0.2753** (0.1113)	0.2796*** (0.1051)	0.4083 (0.5367)
ln(Employees) (1 lag)	-0.6909*** (0.0699)	-0.6873*** (0.0723)	-0.6902*** (0.0700)	1.1442*** (0.1924)
ln(Int. Inputs) (1 lag)	0.4459*** (0.0565)	0.4524*** (0.0570)	0.4462*** (0.0567)	-0.3897 (0.2684)
SMP (1 lag)	0.0498** (0.0245)	0.0477* (0.0249)	0.0498** (0.0246)	0.1694 (0.1150)
Ln(IVA) (1 lag)	-0.0415* (0.0218)	-0.0366* (0.0218)	-0.0418* (0.0218)	-0.0299 (0.0440)
Ln(GDP) (1 lag)	-0.0076 (0.0079)	-0.0074 (0.0080)	-0.0076 (0.0079)	0.0163 (0.0719)
Ln(PMR) (1 lag)	0.2288 (0.1810)	0.2231 (0.1810)	0.2271 (0.1811)	1.0972 (1.2257)
Year Dummies	x	x	x	x
Constant	1.3803 (2.8002)	1.4232 (2.8784)	1.3784 (2.8143)	-13.9807 (11.8328)
2	0.7676	0.7662	0.7679	0.4157
Observations	1498	1498	1498	1498

Robust Standard errors are in brackets.

*Significant at 1% ***, significant at 5 % **, significant at 10% **