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Trucks, triangles and a quiet life: Welfare implications of the European trucks cartel

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Trucks, Triangles and a Quiet Life: Welfare Implications of the European Trucks Cartel

Christian Beyer*, Elke Kottmann, Korbinian von Blanckenburg

Abstract

We present a pragmatic approach to calculating the total economic loss induced by a cartel, focusing on the European trucks cartel (1997-2011). Overall, we estimate a net welfare loss of approximately €0.7 bn. and an overcharge below 1% (€1.8 bn.). The cartel overcharge is surprisingly low. We explain this by (1) the existence of a reference market with an already elevated price level and (2) by other industry-specific factors that encourage cartel arrangements. In the case of the trucks cartel, the companies involved have apparently preferred the Hicksian "quiet life" of the monopolist to a further maximization of profits.

Keywords

Cartel, Welfare, Efficiency, Overcharge, Trucks

JEL Classification
D43, D61, L62

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I Introduction

With the enforcement of directive 2014/104/EU, the facilitation of private damage claims against cartels has spread throughout the European Economic Area. Cartel overcharge, the basis for private damage claims, is highly topical.[1] In fact, the number of cartel damage claims at European courts rose from a mere 18 in January 2009 to at least 70 in October 2016 (Laborde 2017). From a legal perspective, private damage claims are – second only to public damage claims (fines) - the second pillar for calling competition law offenders to account. While fines primarily aim to deter undertakings from future violations of antitrust law, private damage claims enforce the redistribution of cartel profits back to the customer. Cartel profit is the excess profit (cartel overcharge x total quantity sold) that the cartel was able to reap during the period of infringement. In short, public claims aim at deterrence, while private claims aim at compensation (corrective justice).

However, the economic loss induced by a cartel is more than just the redistribution of rent from consumers to producers.[2] Economists have long agreed that cartels induce an additional, allocative, deadweight loss to society, that is, "a loss to the consumer which is not balanced by any gain reaped by the monopolist" (Lerner 1934). The allocative damage refers to the misallocation of resources and originates from potential transactions. This is the overall net loss of the cartel. The magnitude of the deadweight loss is particularly relevant for governments (re-)considering their antitrust policies and for societal perceptions of cartels and public antitrust enforcement. We provide a pragmatic approach to calculating the total loss caused by a cartel, focusing on the prominent case of the trucks cartel. The results should enable us to (1) adopt a societal perspective, i.e. to compare total damage (deadweight loss and overcharge) to total fines (public and private) and (2) adopt the cartel perspective, i.e. to assess potential gains from forming a cartel (overcharge) to what is at stake (total fines).

The paper is organized as follows. In the next section, we review the trucks cartel and the resulting investigations (Section 2). The methodology and data sources for calculating the cartel-induced damage are described in Section 3, accompanied by the results. Section 4 contextualizes the results in the relevant historical and empirical framework. An overall conclusion is provided in Section 5.

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[1] The EU defines cartel overcharge as "the difference between the price actually paid and the price that would otherwise have prevailed in the absence of an infringement of competition law" (EU directive 2014/104 p. 11).
[2] From the viewpoint of the society as a whole, this redistribution is not a real loss, since wealth is merely shifted between different agents and not "lost". Nevertheless, from a normative point of view it is a *distributive* loss.

II Background: The Trucks Cartel

On January 17th 1997, a meeting of senior-level managers of the six European truck producers, namely DAF, Daimler, Iveco, MAN, Scania and Volvo, marked the starting point of the trucks cartel. In that meeting, the defendants exchanged information on gross list prices for medium and heavy trucks in the European Economic Area.[3] This practice continued, in varying degrees, for 14 years, until the cartel was finally dissolved after MAN had applied for immunity under the European Commission (henceforth the Commission) leniency program. Specifically, the price collusion included the coordination of gross list prices for medium and heavy trucks and coordination of the pricing and timing of technologies, so as to comply with the impending emission standards Euro III-VI. Further attempts to limit competition by increasing market transparency included the exchange of truck configurators (a sales software to customize firm-specific truck offers) and the exchange of information on delivery times.

After the commission had opened the inspections, Daimler, Iveco and Volvo/Renault applied for immunity from fines in accordance with point 14 of the Leniency Notice.[4] Scania did not settle with the Commission and was fined €880 million in September 2017. Table 1 lists the total fines imposed on the defendants:

	Reduction under the Leniency Notice	Reduction under the Settlement Notice	Fine (€)
MAN	100%	10%	0
Volvo/Renault	40%	10%	670 448 000
Daimler	30%	10%	1 008 766 000
Iveco	10%	10%	494 606 000
DAF	0%	10%	752 679 000
Scania	0%	0%	880 523 000
Total			**3 807 022 000**

Table 1: Summary of fines imposed on the trucks cartel.[5]

In the relevant product market, Segments II and III of the trucks market in the EEA from 1997-2011, the six defendants are the only suppliers. Within this group, Daimler is the clear market leader, followed by Volvo and MAN.[6] At the end of the cartel phase, the European

[3] The truck market consists of three segments, defined according to the gross vehicle weight measured in tons: I Lights Trucks (< 6t); II Medium Trucks (6-16t); III Heavy Trucks (>16t).
[4] Commission Notice on Immunity from fines and reduction of fines in cartel cases (Official Journal of the European Union C298, 8.12.2006, p. 17).
[5] Commission Decision C(2016) 4673, 19.7.2016, CASE AT.39824 –Trucks; European Commission Press Release IP/17/3502 and European Commission Statement/17/3509.
[6] Our data for the year 2016 imply the following market shares: Daimler (26.1%), Volvo (23.8%), MAN (19.4%), Scania (11.6%), DAF (10.6%), Iveco (8.5%).

truck producers directly controlled more than 20% of the global production of medium and heavy trucks. Thus, besides their sole dominance in Europe, the European truck producers' competitive conduct is of considerable international relevance.

The global truck industry can be divided into four regions, namely Europe, North America, Japan (together referred to as *the triad*) and China. Regions outside these four major markets have only limited influence on the structure of competition in the global truck industry (Nilsson, Dernroth 1995). Even within the triad, the Japanese market differs significantly from those of Europe and North America. Japanese legislation concerning the size and capacity of trucks is different from standards in Europe and North America, such that Japanese producers have historically refrained from building and exporting (heavy) trucks aligned to the standards in other markets. In both North America and China, the European truck producers have acquired substantial production capacities, or formed strategic alliances with foreign producers, with whom they together control more than 50% of global production.[7]

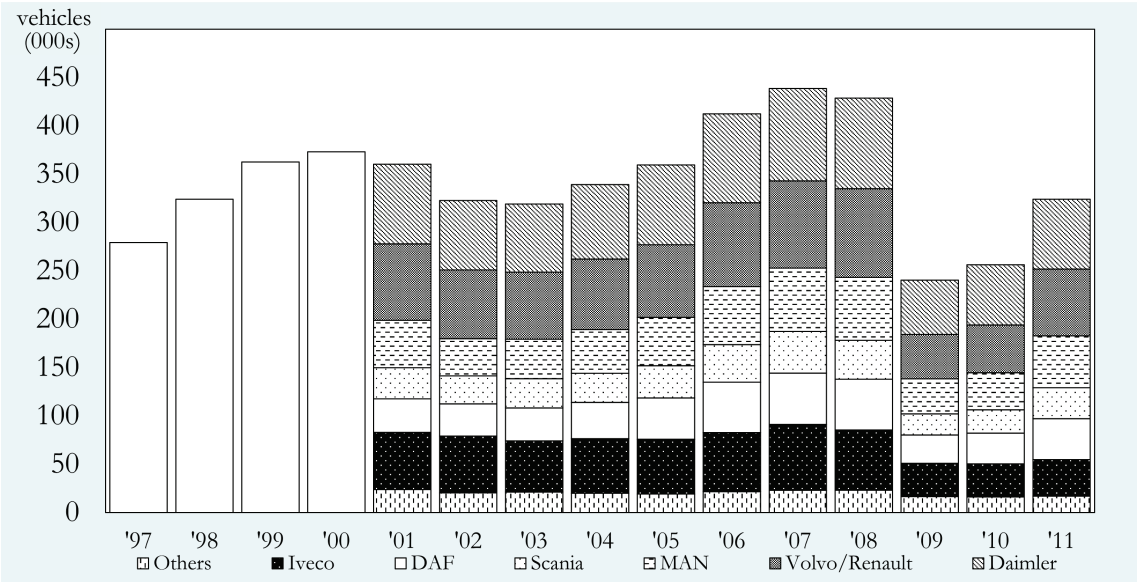

Figure 1: Registrations of trucks (> 3.5t) in the EEA; Source: European Automobile Manufacturers' Association.[8]

The structure of the global truck industry has two main implications for the political and economic analysis of the trucks cartel. First, unfair competitive conduct in Europe might

[7] For example, Daimler acquired Freightliner, Volvo acquired Mack Trucks and Volkswagen (MAN, Scania) cooperates with Navistar. That is, the main producers in Europe and the United States collaborate very closely. In China, the European producers operate joint ventures with local partners, e.g. Sinotruck (MAN), BFDA (Daimler) or Dongfeng (Volvo).

[8] Company-level data for the years prior to 2001 is not available; since trucks with a GVW between 3.5t and 6t are included, the figures slightly overstate the cartel quantity.

well spill over to other regions, since the decisive companies are more or less the same. Second, the European producers have the market power to prevent foreign competition in their home market. In addition, truck production abroad generally requires substantial FDI, and imports/exports of trucks induce considerable shipment and homologation costs. These represent effective entrance barriers to producers outside Europe (Popper et al. 2004 p.61f). Foreign competition in the EEA is thus unlikely.

The sales process in the truck market is based on individual transactions. Gross list prices (GLP) for each truck model are the starting point of truck pricing. Reductions of the GLPs are then usually negotiated with individual customers, either by independent dealers or by the producer's sales personnel. Truck offers are thus specific to customer specifications of the vehicle and to the individual net price negotiations (rebates). The high degree of customization is an obstacle to price collusion, which is why the trucks cartel was able to coordinate prices at the GLP-level only.[9]

III The Economic Damage

The economic damage linked to the existence of a cartel is usually expressed in terms of inefficiencies. The economic literature identifies three types of inefficiency, allocative, productive and dynamic. We focus on allocative inefficiency, i.e. the misallocation of resources resulting from distorted prices. We discuss other inefficiencies very briefly at the end of the section. The concept of allocative inefficiency goes extends to work on the theory of monopoly and welfare, starting with Cournot (1838) and (Dupuit 1844), complemented by Pigou (1910), Lerner (1934) and Harberger (1954). The latter himself estimated the deadweight loss to be less than 0.1% of gross national product in the United States. Subsequent empirical studies on monopolies based on Harberger's model largely confirm this result.[10] The (at the time of publication) surprising result that the deadweight loss of a monopoly is almost negligible still prevails among economists.[11] Even though Harberger's methodology has triggered criticism regarding its assumptions, it remains the "work-horse model" in partial equilibrium analysis of monopolies.[12]

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[9] However, the defendants discussed net prices occasionally (Commission Decision C(2016) 4673, 19.7.2016, CASE AT.39824 –Trucks p. 14).

[10] Prominent exceptions are Cowling, Mueller 1978) or Jenny, Weber 1983), who estimated values of around 10%.

[11] McCloskey (2011) even uses the dictum "shades of Harberger" for factors explaining only small fractions of an overall phenomenon.

[12] See the general critique of Stigler (1956) and Bergson (1973) on unitary price elasticity.

Due to their collective action, cartels enable monopolistic pricing. Their welfare implications are thus analyzed similar to those of a monopoly. Since all six European truck producers have participated actively in the trucks cartel, the entire European truck production in its respective segments has been under the supervision of the cartel between 1997 and 2011. We therefore treat the six truck manufacturers as one monopolist and apply the methodology used to calculate the welfare loss of a monopoly. To the best of our knowledge, this is the first time that deadweight losses á la Harberger are calculated for a real-world cartel case.

Methodology

The methodology we apply builds upon the very simple and familiar model shown in Figure 2. The underlying assumptions of this textbook-model include a linear demand curve and constant average (marginal) cost. The cartel is able to establish a market price P^M above the competitive price and thus realizes cartel-induced profits amounting to the rectangle P^MABP^C (cartel overcharge x total quantity). In addition, triangle ABC captures the "deadweight welfare loss", referred to as allocative loss (AL).

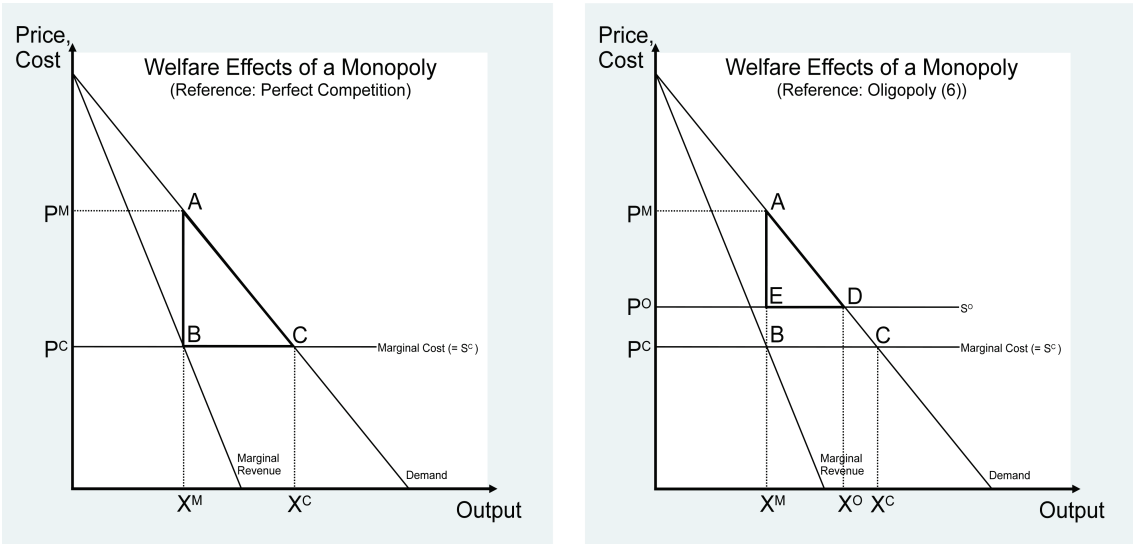

Figure 2: Welfare damages in a cartelized market.

We estimate this social damage, following the approach of (Shinjo, Doi 1989). The area of triangle ABC, henceforth ΔAL, is represented by

$$\Delta AL = \tfrac{1}{2}*(AB)*(BC) = \tfrac{1}{2}*(P^M-P^C)*(X^C-X^M).$$

Since P^C and X^C are counterfactuals by nature and thus unobservable, we reformulate ΔAL as follows: $\Delta AL = \tfrac{1}{2}\,\Delta P*\Delta X = \tfrac{1}{2}et^2S$, where t is the profit margin ($t = \Delta P/P^M$), S is sales

and e is the price elasticity of demand $e = (\Delta X/X^M)*(P^M/\Delta P)$.[13] Since by assumption e = 1, we do not need to calculate the counterfactual quantity X^C. Thus, we have rewritten ΔAL in terms of observable variables. S, the current sales figure, is observable in the annual reports of the cartel-members. The cartel profit margin t, defined as the rate of cartel profits ($\prod^M$) on sales (S), where the latter is observed as before and $\prod^M$ is calculated by subtracting a counterfactual, competitive, profit from observed profits in the annual reports ($\prod^O$). Counterfactual profits are approximated by r*A, r being the competitive profit rate and A being total assets, altogether, $t = (\prod^O - rA)/S$.[14]

The time series for the competitive profit rate r originates from the Bank for the Accounts of Companies Harmonized (BACH) database, maintained by the Bank of France.[15] It represents the ratio of net operating profit on total assets for large companies in the automotive industry of the participating European countries. We collected the data on the trucks market from the annual reports of the affected companies. Appendix I gives a detailed overview about the variables used, Appendix II provides a graphical representation of the main variables (Sales, EBIT and total assets), supplemented by summary statistics.

We collected data for the entire duration of the infringement (1997 - 2011). However, these data are not directly available in an ideal fashion for economic analysis, i.e. we do not observe perfectly disaggregated data, neither at the product, nor at the regional level. Some practical difficulties and specifics associated with our dataset prevail. Firstly, participants in the trucks cartel are multiproduct firms. Data representation at the segment or business-unit level is state of the art in the latest annual reports, but not for the entire period under consideration. That is, for some years, there is data at a higher level of aggregation only. This can introduce (i) a product-mix bias and (ii) a geographical bias, since some levels of aggregation cover operations in a larger region than the cartel`s area of influence.[16] Moreover, firms have adjusted their group structure from time to time. The most prominent example during the infringement period is the merger of Daimler-Benz and Chrysler in 1998 and their dissolution in 2007. Beyond the structural challenges, firms have an incentive not to report disaggregated data (due to competitive intelligence considerations) and to disguise the reported data wherever possible. We provide firm-level details on these caveats in Appendix I. However,

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[13] Substituting $t = \Delta P/P^M$ and $\Delta X = eX^M t$ into ΔAL yields $\Delta AL = ½ P^M e X^M t^2$, from which follows $\Delta AL = ½ e t^2 S$.

[14] The data at hand provide us the variable S on a disaggregated level; t is calculated with data at the business unit level.

[15] As of 2018, the participating countries are: Austria, Belgium, Czech Republic, France, Germany, Italy, Poland, Portugal, Slovakia and Spain. See https://www.bach.banque-france.fr/?lang=fr

[16] Even within a single segment reported, product-mix bias can occur if accounting data from value-added services are pooled with those of manufacturing.

the data available are, to a large extent, satisfactory with regard to our methodological approach and in the end, they are the only data available to the public. We believe that – under the guideline of Article 17 of the damages directive ("pragmatism") – the published accounting data provide a promising basis for cartel damage calculation.

Results

We estimate the deadweight welfare loss attributable to the trucks cartel at approximately €0.65 bn. If the counterfactual market is perfectly competitive, ΔAL comprises 50% of cartel-induced profits.[17] By contrast, in the absence of a cartel, the trucks market can be best characterized as a Cournot-type oligopoly with six firms. In this scenario, it can be shown that ΔAL, comprises 35.7% of cartel-induced profits (i.e. of rectangle $P^{M}AEP^{O}$; right side of Figure 2).[18] Taking this into account, Figure 3 represents the total economic damage and compares it to the fines imposed on the infringing companies. From a deadweight welfare loss of €0.65 bn., we derive an overcharge amounting to €1.88 bn. The total economic loss is thus €2.54 bn. Taking into account the limitations of static welfare calculation and further inefficiencies as described below, the relation between total damage and fines set by the commission seems to be balanced.

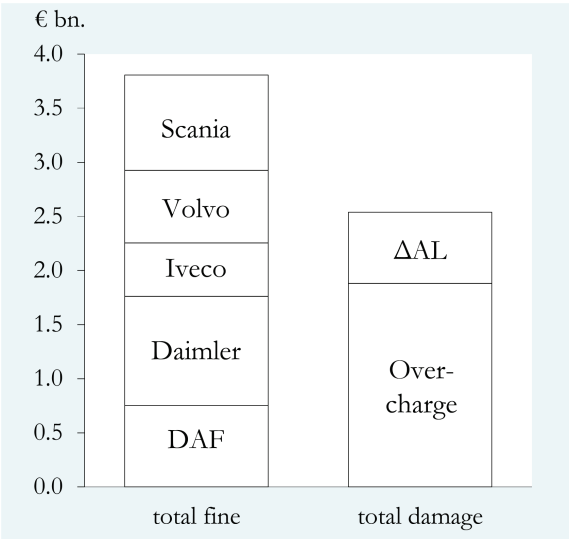

Figure 3: Fines and Damages in the Trucks Cartel.

The welfare-analytical treatment of cartels as monopolies relies on the assumptions mentioned above and is, by definition, a static model. In that sense, it disregards two other types of damage. First, the cost of maintaining the cartel and coordinating its organization adds to the deadweight-loss. These costs represent wasted resources that would otherwise

[17] Because, with linear demand and symmetric, constant marginal cost, marginal revenue has the same intercept, but twice the slope of the demand curve.
[18] See Appendix II.

have been used efficiently. In the trucks cartel, for example resources were shifted to the collection, aggregation and communication of planned list-price increases.[19] These resources could have been used efficiently. Harvey Leibenstein (1966) introduced this kind of deviation from optimal behaviour and labeled it "X-inefficiency". Empirical evidence confirms a robust impact of competition on productivity (e.g. (Schiffbauer, Ospina 2010); Okada (2005)). However, to the best of our knowledge, there is no empirical evidence originating specifically from cartel cases.

Secondly, the dynamic efficiency of the cartelized industry is affected. Dynamic inefficiencies are deviations from the "optimal" path of future innovations, caused by the elimination of competitive pressure. The dynamic damage is difficult to measure. Moreover, the relation between competition and innovation is vague. Theoretical arguments vary from clearly negative relations (profitability-driven; (Schumpeter 1912)) to clearly positive ones (incentive-driven: (Arrow 1962)). In recent empirical work, an inverted-U relationship between competition and innovation prevails (Aghion et al. (2005), Peneder (2012), Lambertini et al. (2017)). That is, comparing the oligopoly to a quasi-monopoly (cartel) there is a clear positive relationship between competition and innovation. In our case, the reduced incentives for the cartel members to innovate are accompanied by explicit collusion on the pricing of future innovations.

IV Discussion

To contextualize our results, we use two points of reference, namely the overcharge observed in past cartel cases, and the welfare loss calculated for other monopolized markets. Compared to the welfare losses estimated by Harberger and others (0.1% of GNP; see Section 3), the loss caused by the trucks cartel is, relative to GNP in the EEA, almost negligible. In terms of welfare, the trucks cartel has obviously been less destructive than the aforementioned monopolies.

The magnitude of overcharges in cartel cases has been examined in a number of meta-studies. The hypothetical overcharge for EU-wide cartels is commonly assumed to be 20%.[20] This benchmark is, however, a comparison to the competitive price. Instead, our point of reference is the equilibrium price in a six-firm oligopoly. Theoretically, the overcharge in this

[19] "At the end of 2004, an employee of DAF Trucks Deutschland GmbH sent an email to, amongst others, the representatives of the German Subsidiaries requesting that they communicate their planned gross price increases for 2005. The summarised and compiled price increase information was sent back to all of the participants, including all of the Addressees, a few days later containing information on intended gross price increases." (Commission Decision on CASE AT.39824 – Trucks p.15).

[20] See Renda et al. 2007 p. 99. In addition, the authors provide a survey of empirical studies on cartel overcharges.

setting should be smaller. Our calculations suggest an overcharge of below 1%. Expressed per vehicle (heavy trucks, produced between 1997 and 2011), the total damage amounts to ≈ €700, the overcharge alone is ≈ €520. However, due to the extent of product variation, the overcharge may vary with regard to specific vehicle types. In light of the tremendous efforts that the defendants devoted to coordinating the cartel, this result is surprising. If the objective of the cartel was on profit maximization, it has operated way beyond its capabilities. As indicated, one explanation for this is the focus of the cartel. Potentially, the truck producers focused more on coordination and facilitating transparency as to enjoy the "quiet life of the monopolist" (Hicks 1935). The exchange of truck configurators, delivery-time data and the exchange (rather than mutual elevation) of gross list prices provide circumstantial evidence. If profit maximization was not the primary reason to establish the cartel, what then are the potential socio-economic drivers behind the trucks cartel?

Two factors seem to be important in this regard, namely the timing and spatial organization of the cartel. First, looking at the date of its formation, the cartel seems to be a response to the liberalization efforts in the EEAs transport sector. With the completion of the internal market and the harmonization of technical standards concerning utility vehicle registration, the European Commission has fostered competition between the truck producers. In Germany, the formation of the cartel coincides with enacting the new transport law (Transportrechtsreformgesetz), which abolished all forms of quotas and cabotage-regulations in road-freight transport. Establishing a cartel seems to be the obvious answer to this competition shock. This is anecdotal evidence by nature, but the "coincidence" explains why the producers collaborated to preserve the former competitive order, rather than to maximize profits.

To assess the question of spatial organization, a closer look at the structure of the cartel is useful. In total, 17 legal entities were involved in the trucks cartel. They are charged with different degrees of collusion and varying periods of infringement (Fig. 4). Three layers of collusion can be identified, the "Parent-level", comprising the parent companies of the respective group, the "Headquarter-level", national headquarter of the groups' truck division, and the "German-level", the latter comprising the groups German subsidiaries. The parent companies have been involved in the cartel only in an indirect manner via their subsidiaries.[21] The "Headquarter-level" held collusive talks beginning on January 17, 1997. Until 2004, these

[21] The only exception in this regard is Daimler, for which, due to the legal structure of the group, Daimler AG is responsible for infringements in all three layers of the cartel.

where gradually replaced by agreements at the "German-level". That is, at least since 2004, the cartel used the German subsidiaries as its vehicle of operation.

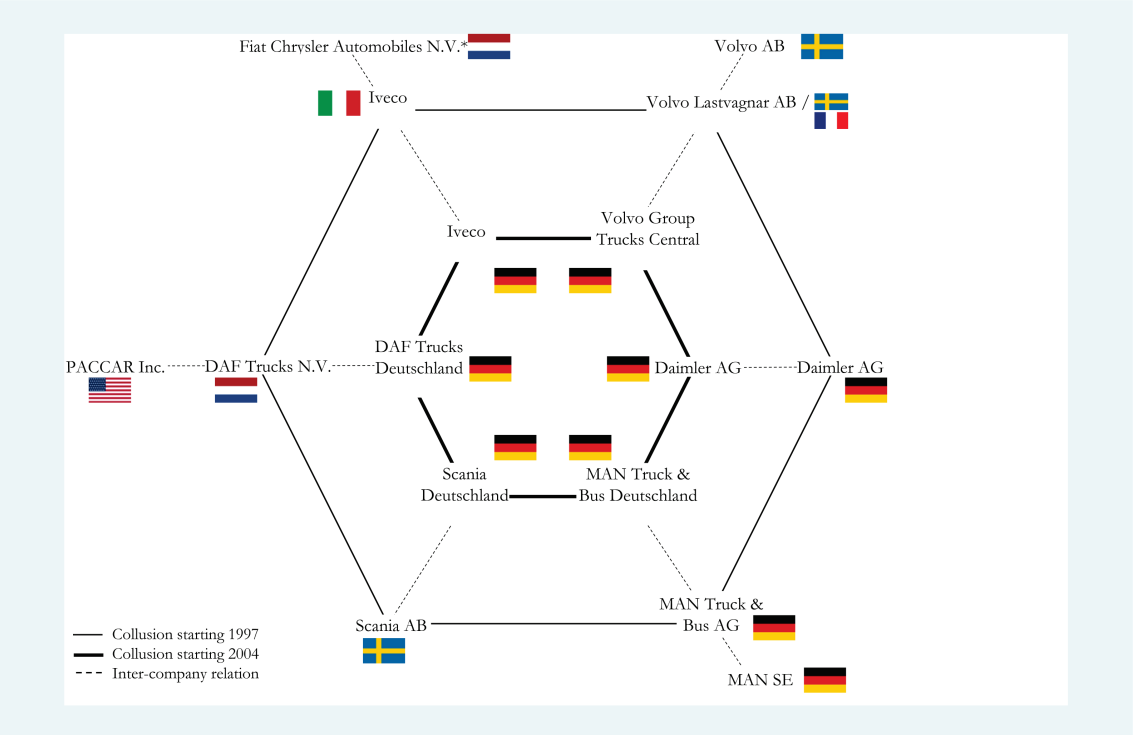

Figure 4: Structure of the European trucks cartel.

It is striking that the German companies play this prominent role in the cartel, since the German truck producers have been historically "spoiled", by having a relatively protective industrial environment. For example, quantity restrictions on truck registrations were a very common policy tool in post-war Germany until the 1990s. Traditionally, the German automotive industry has collaborated very closely via their inter-industry organization, the German Association of the Automotive Industry (VDA).[22] In this regard, the German companies provided the ideal infrastructure for collusion, focusing on the exchange of information and reduction of competitive pressure, but not profit maximization per se.

[22] For Example until 2010, Daimler, MAN and Iveco-Magirus exchanged detailed information (for example, production quantities by GVW and manufacturer) openly via the VDAs annual report; see Verband der Automobilindustrie various years (various years).

V Summary and Conclusion

Following Harberger (1954) and Shinjo/Doi (1989), we have estimated cartel overcharges and deadweight losses for the European trucks cartel (1997-2011). Time series for the competitive profit rate available to the public and annual reports of the companies in question were used as source of data. The main outcomes can be summarized as follows:

(1) We estimate € 0.65 bn. of deadweight welfare losses

The deadweight welfare loss is lower than in other scenarios of monopolistic market power, and substantially lower than the fines imposed on the trucks cartel of around € 3.8 bn. This welfare loss, however, is accompanied by further indirect distortions, and productive or dynamic inefficiencies. The trucks market is, in the absence of a cartel, best characterized as a Cournot-type oligopoly with six firms. In this scenario, it can be shown that the deadweight welfare loss is 35.7% of cartel-induced profits. This enables the estimation of cartel overcharge on the same basis.

(2) We estimate 1.8 bn cartel overcharges in total,
(3) That is, we find a below-1% mark-up on the reference price.

The cartel overcharge is surprisingly low, compared to the 20% assumed by the European Commission. This might be explained, on the one hand, by the fact that the reference market was an oligopoly with an already elevated price level. Nonetheless – especially in light of the efforts the defendants devoted to coordinating the cartel - this result is surprising.

Expressed per vehicle, the cartel overcharge is ≈ €520. This below-1% mark-up provides only a weak incentive for the observed (illegal) behavior. If the focus of the cartel was on profit maximization, it operated way beyond its capabilities, even if we take into account the fact that the price level without a cartel should already have been quite high. However, a closer look at this case reveals that there may be some "deeper causes" of cartels. If the participating companies realized even small advantages in terms of their profits, they have were able to influence the market for a long time and fundamentally shape it in terms of a "quiet life". In the case of the trucks cartel, the companies involved apparently preferred the "quiet life" to further profit maximization.

An analysis of the evolution of the trucks cartel suggests the general importance of historical experience and regional conditions for entrepreneurial behavior in an industry. These factors shape long-term behavior, the specific "spirit of competition", and can therefore provide additional information on the causes of cartel development.

Appendix I

Defendant	Company reporting	Unit of Account	Calculation of t	Calculation of S
Daimler	Daimler AG (2006-2011)	Daimler Trucks incl. medium and heavy trucks, specialty vehicles (global)	BU-level: Net Assets, EBIT and Sales	European truck sales are reported directly (disaggregated reporting)
	DaimlerChrysler AG (1997-2005)	Nutzfahrzeuge incl. trucks, buses and vans (global)	BU-level: Net Assets, EBIT and Sales	Sales in Europe, adjusted for vans and buses, using annual data on the composition of sales quantities.
DAF	Paccar Inc. (1997-2011)	Trucks incl. trucks of all segments (global)	BU-level: Total Assets, EBIT and Sales	European truck sales are reported directly (disaggregated reporting)
Iveco	Fiat Industrial S.p.A. (2011)	Commercial Vehicles (Iveco) incl. trucks of all segments, buses and specialty vehicles (mostly Europe)	BU-level: Operating Assets**, EBIT and Sales	Truck sales in Europe, debugged from operations outside Europe (≈30%) and vehicles type other than medium and heavy trucks (≈50%)
	Fiat Group (1997-2010)	Commercial Vehicles (Iveco) incl. trucks of all segments, buses and specialty vehicles (mostly Europe)	BU-level: Operating Assets*, EBIT and Sales	Truck sales in Europe, debugged from operations outside Europe (≈30%) and vehicles type other than medium and heavy trucks (≈50%)
MAN	MAN SE (2009-2011)	MAN Truck & Bus incl. medium and heavy trucks, buses (mostly Europe)	BU-level: Total Assets, EBIT and Sales	European truck sales are reported directly (disaggregated reporting); data for 1997-2000 estimated
	MAN AG (1997-2008)	MAN Nutzfahrzeuge incl. medium and heavy trucks, buses (mostly Europe)	BU-level: Total Assets, EBIT and Sales	European truck sales are reported directly (disaggregated reporting); data for 1997-2000 estimated
Scania	Scania AB (1997-2011)	Vehicles and Services incl. heavy trucks, buses and services (global)	BU-level: Total Assets**, EBIT and Sales	European truck sales are calculated by adjusting the reported global truck sales for the share of units sold in Europe
Volvo	AB Volvo (1997-2011)***	Volvo Trucks incl. trucks of all segments and buses (global)	BU-level: Total Assets****, EBIT and Sales	European truck sales are reported directly (disaggregated reporting)

Table 2: Firm-level details on data availability

*Data prior to 2004 had to be calculated using group-level data.
**Data for the years 1997-2000 are missing. We inserted the value for 2001 instead.
***From 2001 onwards: incl. Renault V.I.; older data have been adjusted so as to implicitly include RVI.
****Total assets of Volvo Trucks are estimated using the reported total assets of Volvo Lastvagnar AB and Renault Trucks SAS. Since data prior to 2007 are missing, we calculated the missing values based on the aforementioned, combined with group-level data.

Appendix II

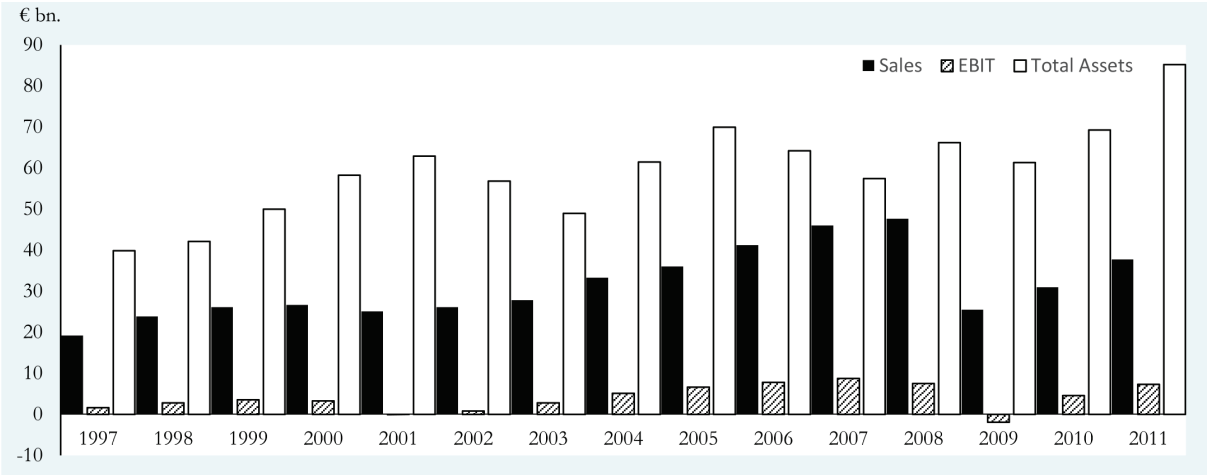

Figure 5: Combined (industry-wide) balance sheet data of European truck producers.

	Sales (mean)	Sales (sd)	EBIT (mean)	EBIT (sd)	Total Assets (mean)
Total Industry	**31.56**	**8.22**	**4.03**	**3.04**	**59.60**
DAF	3.82	2.31	0.96	0.70	6.06
Daimler	8.17	2.25	0.98	0.94	26.90
MAN	5.94	1.66	0.40	0.32	6.03
Iveco	2.86	0.46	0.34	0.24	10.50
Scania	2.61	0.58	0.70	0.39	5.51
Volvo	8.16	1.50	0.66	0.77	4.69

Table 3: Summary statistics of main variables in the data set (values in bn. €)

Appendix III

Consider a market with constant marginal cost c and linear demand given by p = a – b(x). From the optimality conditions in a monopoly and a Cournot-oligopoly with six identical firms, it follows:

$x^{*M} = \frac{a-c}{2b}$ $\quad p^{*M} = a-b(\frac{a-c}{2b})$ for the monopoly case (M) and

$x^{*C} = \frac{6(a-c)}{(6+1)b}$ $\quad p^{*C} = c+\frac{a-c}{6+1}$ for the six-firm-oligopoly case (C).

The overcharge-rectangle ($P^M AEP^O$, compare with Figure 2) is given by:

$$\frac{a-c}{2b} * \left(a-b\left(\frac{a-c}{2b}\right) - \left(c+\frac{a-c}{6+1}\right)\right)$$

The Harberger triangle (ADE) is given by:

$$\frac{1}{2}\left(\frac{6(a-c)}{(6+1)b} - \frac{a-c}{2b}\right) * \left(a-b\left(\frac{a-c}{2b}\right) - \left(c+\frac{a-c}{6+1}\right)\right)$$

The share of ADE on $P^M AEP^O$ is thus given by:

$$\frac{\frac{1}{2}\left(\frac{6(a-c)}{(6+1)b} - \frac{a-c}{2b}\right) * \left(a-b\left(\frac{a-c}{2b}\right) - \left(c+\frac{a-c}{6+1}\right)\right)}{\frac{a-c}{2b} * \left(a-b\left(\frac{a-c}{2b}\right) - \left(c+\frac{a-c}{6+1}\right)\right)} = \frac{\frac{6(a-c)}{14b} - \frac{a-c}{4b}}{\frac{a-c}{2b}} = \frac{5(a-c)}{28b} * \frac{2b}{a-c} = \frac{10b(a-c)}{28b(a-c)} = \mathbf{0{,}3571}$$

Literature

Aghion, Philippe; Bloom, Nick; Blundell, Richard; Griffith, Rachel; Howitt, Peter (2005): Competition and Innovation: An Inverted-U Relationship. In *The Quaterly Journal of Economics* 120 (2), pp. 701–728. Available online at http://www.jstor.org/stable/25098750.

Arrow, Kenneth J. (1962): Economic Welfare and the Allocation of Resources for Invention. In R. R. Nelson (Ed.): The Rate of Incentive Activity, pp. 609–626. Available online at http://www.nber.org/chapters/c2144.

Bergson, Abram (1973): On Monopoly Welfare Losses. In *The American Economic Review* 65 (5), pp. 853–870. Available online at http://www.jstor.org/stable/1806639.

Cournot, Antoine-Augustin (1838): Recherches sur les principes mathématiques de la théorie des richesses.

Cowling, Keith; Mueller, Dennis C. (1978): The Social Costs of Monopoly Power. In *The Economic Journal* 88 (88), pp. 727–748. Available online at http://www.jstor.org/stable/2231975.

Dupuit, Jules (1844): On the Measurement of the Utility of Public Works*. *English translation from "De la Mesure de l'Utilité des Travaux Publics", Annales des Ponts er Chaussées, 2bd series, Vol. 8, 1844. In *International Economic Papers* 2, pp. 83–110.

Harberger, Arnold C. (1954): Monopoly and Resource Allocation. In *The American Economic Review* 44 (2), pp. 77–87. Available online at http://www.jstor.org/stable/1818325.

Hicks, John Richard (1935): The Theory of Monopoly. In *Econometrica* 3 (1), pp. 1–20. DOI: 10.2307/1907343.

Jenny, Frédéric; Weber, André-Paul (1983): Aggregate Welfare Loss Due to Monopoly Power in the French Economy: Some Tentative Estimates. In *The Journal of Industrial Economics* 32 (2), pp. 113–130. DOI: 10.2307/2098043.

Laborde, Jean-Francois (2017): Cartel damages claims in Europe: How courts have assessed overcharges. In *Concurrences (Competition Law Review)* (1), pp. 36–42. Available online at https://www.concurrences.com/en/review/issues/no-1-2017/law-economics/cartel-damages-claims-in-europe-how-courts-have-assessed-overcharges.

Lambertini, Luca; Oyago-Theotoky, Joanna; Tampieri, Alessandro (2017): Cournot competition and "green" innovation: An inverted-U relationship. In *Energy Economics* 68, pp. 116–123. DOI: 10.1016/j.eneco.2017.09.022.

Leibenstein, Harvey (1966): Allocative Efficiency vs. "X-Efficiency". In *The American Economic Review* 56 (3), pp. 392–415. Available online at http://www.jstor.org/stable/1823775.

Lerner, Abba Ptachya (1934): The Concept of Monopoly and the Measurement of Monopoly Power. In *The Review of Economic Studies* 1 (3), pp. 157–175. DOI: 10.2307/2967480.

McCloskey, Deirdre N. (2011): Bourgeois dignity. Why economics can't explain the modern world. Chicago, London: University of Chicago Press.

Nilsson, Carl-Henric; Dernroth, Jörgen (1995): The strategic grounding of competitive advantage — The case of Scania. In *International Journal of Production Economics* 41 (1-3), pp. 281–296. DOI: 10.1016/0925-5273(95)00035-6.

Okada, Yosuke (2005): Competition and productivity in Japanese manufacturing industries. In *Journal of the Japanese and International Economies* 19 (4), pp. 586–616. DOI: 10.1016/j.jjie.2005.10.003.

Peneder, Michael (2012): Competition and Innovation. Revisiting the Inverted-U Relationship. In *Journal of Industry, Competition and Trade* 12 (1), pp. 1–5. DOI: 10.1007/s10842-011-0123-4.

Pigou, Arthur Cecil (1910): Producers´ and Consumers´ Surplus. In *The Economic Journal* 20 (79), pp. 358–370.

Popper, Steven W.; Greenfield, Victoria; Crane, Keith; Malik, Rehan (2004): Measuring Economic Effects of Technical Barriers to Trade on U.S. Exporters. Planning Report Prepared for: National Institute of Standards and Technology.

Renda, Andrea; Peysner, John; Riley, Alan J.; Rodger, Barry J.; Van den Bergh, Roger J.; Keske, Sonja et al. (2007): Making antitrus damages actions more effective in the EU: welfare impact and potential scenarios. Report for the European Commission DG COMP/2006/A3/012. Available online at http://ec.europa.eu/competition/antitrust/actionsdamages/files_white_paper/impact_study.pdf.

Schiffbauer, Marc; Ospina, Sandra (2010): Competition and Firm Productivity. Washington: International Monetary Fund (IMF Working Papers). Available online at http://gbv.eblib.com/patron/FullRecord.aspx?p=1586824.

Schumpeter, Joseph Alois (1912): Theorie der wirtschaftlichen Entwicklung.

Shinjo, Koji; Doi, Noriyuki (1989): Welfare loss calculation for Japanese industries. In *International Journal of Industrial Organization* 7 (2), pp. 243–256. DOI: 10.1016/0167-7187(89)90021-0.

Stigler, Georg J. (1956): The Statistics of Monopoly and Merger. In *Journal of Political Economy* 64 (1), pp. 33–40. Available online at http://www.jstor.org/stable/1825858.

Verband der Automobilindustrie (various years): Tatsachen und Zahlen. Berlin.