THE ECONOMIC OF CARTELS

Cento Veljanovski[*]

Abstract: This paper sets out the basic economics of cartel formation and stability, methods of estimating overcharges and but for prices, and concludes with a brief discussion of multiple damage claims for price-fixing. It draws on some evidence of cartel prosecutions in the Europe.

Keywords: price-fixing, cartel, overcharges, cartel damages

JEL Code: L4

Date: 21 March 2007

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Forthcoming *Finnish Competition Law Year Book, 2006*

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The Economics of Cartels

Cento Veljanovski*

Price-fixing is said to be the most 'evil' anti-competitive abuse. It is an agreement (explicit collusion) or other cooperation ('tacit collusion') between firms that restricts output, overcharges customers and generates excess profits for its members. In recent years competition authorities across the world have waged war against cartels. This is certainly true of the EC Commission, which has intensified its prosecution of cartels, raised the fines[1] and reformed the law to make it more effective. In this chapter I review the economics of cartels, and the issues surrounding the quantification of damages in private actions.

THE ECONOMIC THEORY

The theory of cartels is simple to state. A group of firms supplying similar products or services come to an agreement or understanding to fix prices and to share the market in order to overcharge their customers. As long as the firms adhere to the agreement or understanding they can profitably raise their prices above current levels and earn greater profits. This harms their consumers who now pay more and consume less, because in order for the cartel to raise prices its members must restrict output.

In most jurisdictions price-fixing and market-sharing are for all intents and purposes *per se* infringements. This is not to say that price-fixing has not been defended from time to time. It is well known that price and market sharing arrangements were until recently seen as the usual way of doing business. Others have claimed that price-fixing is sometimes necessary to prevent 'ruinous' or 'destructive' competition in oligopolistic industries with high fixed costs subject to frequent 'price wars'. This was the defence in the celebrated US *Trans-Missouri*[2] case where 18 railroad companies formed an association to set their rates, arguing that absent their agreement there would be ruinous

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[1] EC Commission, *Guidelines on the method of setting fines imposed pursuant to Article 23(2) of Regulation No 1/2003*, 28 June 2006.

[2] 166 U.S. 290 (1897).

competition, and eventual monopoly and even higher prices. The Court rejected their justification. Some recent literature suggests that competition in high fixed cost industries can lead to an inefficient market structure and that there may be social gains from price-fixing arrangements[3]. However, these are likely to be special cases.

A different tack supporting lax enforcement is that cartels are inherently unstable and short-lived, and therefore not a real problem. This instability is easy to describe. Each member of a cartel faces a conflict of interest when agreeing to increase its prices. At first the arrangement is attractive because the higher cartel price increases the firm's expected profits. However, once the cartel is formed each firm has an incentive to cheat on the agreement or understanding by undercutting the cartel price, since by doing so while others adhere to the common position it can further increase its market share and profits. As a result (or so it is argued) where members of a cartel mistrust each other, or more practically do not have an effective mechanism for monitoring and disciplining their members, a cartel is inherently unstable and short-lived. This problem is exacerbated in cases of implicit collusion because the cartel members will have no effective arrangement for communicating with one another.

Merely identifying the incentives to cheat is insufficient to conclude that all or many cartels are unstable and hence prone to collapse. Rather the economic approach suggests that while there is this tension, the stability or otherwise will be based on a rational calculation of the gains and losses from cheating. The gains to an individual firm from reneging on the cartel arrangement are made up of the profit from 'stealing' a greater market share less the expected losses due to punishment and retaliation should the cartel discover that the firm has cheated. Thus the likelihood of cheating, and hence instability depends on the first term being greater than the second term – that is a cost-benefit assessment of the expected profits exceeding the expected losses.

The above theory of cartelisation has been used in two other ways – first to identify industries susceptible (or not susceptible) to effective cartelisation; second to devise remedies that increase the instability and detection of cartels, and hence reduce their incidence.

The first approach, developed by George Stigler[4] and refined by others[5], sets out a list of conditions favourable to the cartelisation of an industry. Among the factors identified as making cartelisation more likely are:

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[3] N. G. Mankiw and M. D. Whinston, 'Free Entry and Social Inefficiency' RAND Journal of Economics, Vol. 17, 1986, pp. 48-58.

[4] G. J. Stigler, 'A Theory of Oligopoly', Journal of Political Economy, Vol. 72 , 1964, pp 44-61; reprinted in his The Organization of Industry (University of Chicago Press, 1968) Chap. 5.

[5] R. A. Posner, Antitrust Law, 2nd edn. (University of Chicago Press, 2001) Chap. 3; D. W. Carlton and J. M. Perloff, Modern Industrial Organization, 4th edn (Pearson Addison Wesley, 2005) Chap. 5; P. A. Grout & S. Sonderegger, Predicting Cartels, Office of Fair Trading, Economics Discussion Paper, OFT 773, March 2005.

- **Elasticity of demand**: The gains from fixing higher prices will be greater the more inelastic market demand. This is because the contraction in output necessary to achieve the higher collusive price will be less, and the profits correspondingly higher. Although a low market elasticity of demand increases the likelihood of a cartel, it should not be assumed that a high elasticity of market demand does not mean that cartelisation will not occur or does not exist. The market elasticity we are talking about is the pre-cartel elasticity, assuming that the firms do not have significant market power. If they do, or, if the elasticity during the cartelised period is used, then a high elasticity may be consistent with the existence and persistence of a cartel because it has managed to raise prices to near the monopoly price. That is a high elasticity may be evidence of successful collusion. One way of testing whether this is the case is to examine whether those products regarded as substitutes for the cartelised product at prevailing prices cost more to produce than the cartelised product, and therefore would not be produced under more competitive conditions.

- **Seller concentration**: Cartels and cooperative behaviour are more likely in industries where there are a few firms. This is because the costs of forming a cartel and coordinating and monitoring its members' actions, are lower the fewer the number of firms. Also, if the firms have similar market shares and/or cost structures it is less likely their interests and incentives will diverge, and hence a reduced risk that some firms will defect.

- **Barriers to entry**: Barriers to entry increase the likelihood of collusion since there is a low prospect that firms will enter the market to undercut the cartel price and other arrangements. However, not all firms in the industry need join for a cartel to succeed. The larger firms may coordinate their prices leaving an inefficient fringe of competitors to shelter under the 'umbrella' of the cartel arrangements and barriers to entry.

- **Buyer concentration**: A small number of large buyers tend to reduce the likelihood of a cartel. This is because it is difficult for members of the cartel to determine whether one of its members has cheated when a major buyer has switched to another seller. The switch may be due to a number of specific factors related to service levels or legitimate discount policies, or under the table deals. Further, large buyers are more likely to detect and react to collusive arrangements.

- **Absence of non-price competition**: Cartels are more likely in industries producing standardised products and otherwise subject to price competition. In markets where products are differentiated and non-price competition prominent, the organisational and monitoring costs of coordinating actions are larger, and hence the likely incidence of cartelisation lower. That is it is much harder for the members to police non-price competition, and the gains and losses from cartelisation will differ the more differentiated the product and firms creating a greater risk of defection.

- **Exchange of information**: There must be some mechanism for participants to signal price and output intentions to one another. Such signalling is facilitated by the presence of an industry group or trade association that disseminates information on prices, market conditions and, where a significant proportion of goods are traded across national borders, data on imports and exports to enforce geographical market sharing. Information on key variables can also be exchanged by press releases. However, caution must be exercised when examining the exchange of information since 'talk is cheap'. That is, it costs nothing for a firm to say (for example) in a press release that it is capacity constrained and will increase prices. What matters to the effective functioning of the cartel and to any claims for damages is whether the firm follows suit and actually increases prices.

- **High risk of bankruptcy**: Cartelisation is more likely in industries with a high ratio of fixed to variable costs. This is because price competition, especially the eruption of 'price wars', pose a real threat to the survival of individual firms. Where there is such a high risk of bankruptcy, firms are more likely to be attracted to collusive arrangements that minimise price competition, and hence the possibility of significant losses.

- **Static or declining demand**: In industries where demand is stable or declining it is easier to detect those firms cheating on the collusive agreement since changes in market shares cannot be masked by temporary or cyclical demand fluctuations. Conversely, a cartel is unlikely to form where demand is increasing significantly because of the difficulties of disentangling those sales due to greater demand from those induced by a firm undercutting the cartel price.

- **Multi-market contact**: The likelihood of reneging on the collusive outcome is diminished when firms compete with one another in a number of markets because cheaters can be punished not only in the cartelised market but also the other markets where the firms operate. This increases the expected losses to the cheating firm, and deters defection.

- **History of collusion**: Cartels are more likely in industries which have a history of cartelisation since the factors that make cartel formation likely are present, and the firms tend to be more 'experienced' in operating cartels.

Whether these and other conditions cumulatively or in some combination explain the incidence of cartelisation, and more usefully are able to predict whether collusion is likely to take place, has not yet been adequately confirmed. However, there is evidence (see below) that many of these factors are present in industries where cartels have been detected[6].

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[6] M. C. Levenstein and V. Y. Suslow, 'What Determines Cartel Success?', University of Michigan Business School Working Paper No. 02-001(January 31, 2002). Available at SSRN http://ssrn.com/abstract=299415

At the other end of the spectrum antitrust authorities have developed leniency or immunity programmes which seek to shift the payoff matrix of individual cartelists in favour of whistle blowing, thereby making cartels much less stable[7]. These offer full immunity from prosecution to the first member of a cartel to report the existence of the cartel and assist in its successful prosecution. Often these programmes also discount fines to those who reveal 'value added' information that further assists the competition authority and courts to gain a successful prosecution.

Evidence on cartelisation

Cartels have been around for a long time. Yet little is known about their effects and longevity[8]. This is not surprising since the *modus operandi* of successful cartels is their secrecy.

Some evidence can be gleaned from the cartels prosecuted by competition authorities[9]; although caution must be exercised because such samples are likely to be the tip of the iceberg and biased. Notwithstanding this, many of the factors discussed above appear in the details of the 43 reported cartels prosecutions by the EC Commission (Table 1) since 1999. This shows that cartels detected and prosecuted by the EC Commission:

- had an average duration of 7.1 years with a range of 2.6 months (*French Beef*) to more than a quarter of a century (29 years for *Organic Peroxides*), with a median and mode duration of 5.5 years and 4.0 years respectively.

- had 5.2 members on average with a range of 2 members in 7 cartels (*Belgian Brewers, Beta carotene, Carotinoids, Extruded Speciality Graphite, Fine Arts Auction, French Brewers* and *SAS/Maresk Air*) to 16 members in one cartel (*FETTCSA*), and a median and mode of 4 and 9 members respectively.

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[7] EC Commission Notice on Immunity from fines and the reduction of prices in cartel cases, 2006/C 298/11, 8 December 2006.

[8] For a comprehensive review of existing studies of cartel overcharging see J. M. Connor, *Price-Fixing Overcharges: Legal and Economic Evidence,* Purdue University, Staff Paper No. 04-16, Nov 2004 http://www.antitrustinstitute.org/recent2/355.pdf

[9] G. A. Hay and D. Kelley, 'An Empirical Survey of Price Fixing Conspiracies', Journal of Law and Economics, Vol. 17, 1974, pp. 13-38 and evidence and references cited in Carlton and Perloff, Chap. 5; J. Connor, Global Price Fixing, (Kluwer Academic Press, 2001)

Table 1: EU Commission reported cartel prosecutions 1999-2006

Cartel/Date	no. firms	Duration	Fine € million	Leniency € million
1999				
Seamless Steel Tubes	8	5.0	107.1	99.0
2000				
Lysine	5	4.0	163.2	110.0
FETTCSA	16	-	6.9	6.9
2001				
Vitamin A	3	9.0	331.7	131.7
Vitamin E	4	9.0	438.0	202.8
Vitamin B2	3	4.0	135.3	69.7
Vitamin B5	3	8.0	212.0	111.4
Vitamin C	4	4.5	214.8	117.5
Vitamin D3	4	4.0	76.7	42.7
Beta carotene	2	6.0	182.4	91.2
Carotinoids	2	5.5	176.7	88.4
Carbonless Paper	11	3.5	452.7	313.7
Graphite Electrodes	8	5.5	338.4	218.9
Citric Acid	5	4.0	315.2	135.2
German Banks	5	4.0	100.8	100.8
Belgian Brewers	2	4.5	114.1	89.7
Private Label (Belgian Brewers)	4	0.8	2.9	1.9
Lux Brewers	4	10.0	2.8	0.4
SAS/Maersk Air	2	2.5	61.3	52.5
Zinc Phosphate	6	4.0	14.7	12.0
2002				
Plasterboard	4	6.5	540.6	478.0
Methionine	3	12.5	333.0	127.0
Austrian Banks	8	3.5	138.0	124.3
Concrete Reinforcing Bars	8	10.5	86.0	85.0
Isostatic Speciality Graphite	8	4.5	84.5	51.8
Extruded Speciality Graphite	2	3.5	33.8	8.8
Dutch Indus & Medical Gases	7	4.0	29.5	25.7
Food Flavour Enhancers	4	9.5	40.7	20.6
Fine Arts Auction	2	6.5	75.6	20.4
2003				
French Beef	6	0.2	16.7	16.7
Sorbates	5	17.5	276.0	141.5
Organic Peroxides	6	29.0	363.1	69.5
Carbon & Graphite products	6	11.0	238.6	101.4
Industrial Copper Tubes	3	12.5	113.9	78.7
2004				
Choline Chloride	3	5.5	88.5	66.3
Copper Plumbing Tubes	12	12.5	362.5	222.3
French Brewers	2	-	2.5	2.5
Spanish raw tobacco	9	5.0	23.9	20.0
Needles & Harberdashery	3	5.0	67.5	60.0
2005				
Italian raw tobacco	6	6.0	72.0	56.0
Rubber Chemicals	4	6.0	147.0	75.9
MCCA Chemicals	4	15.0	302.9	216.9
2006				
Hydrogen Peroxide	9	6.5	587.1	388.1
Totals	**225**	**290.5**	**7,471.8**	**4,453.7**
Average per cartel	**5.2**	**7.1**	**173.8**	**103.6**
Average per cartelist	**n/a**		**33.2**	**19.8**

Table 2: EU Commission reported cartel prosecutions by industry, 1999-2006

Industry	Cartels	%	Commission Decisions
Chemicals	20	45	Lysine, Vitamins A, E, B2, C and D3, Beta Carotene Carotinoids; Citric Acid, Zinc Phosphate, Methionine, Dutch Indus. Medical Gases, Food Flavour Enhancers, Sorbates, Organic Peroxides, Chloine Chloride, Rubber Chemicals, MCCA Chemicals, Hydrogen Peroxide
Industrial inputs	10	23	Seamless Steel Tubes, Carbonless Paper, Copper Plumbing Tubes, Concrete Reinforcing Bars, Graphite Electrodes, Isostatic Speciality Graphite, Extruded Speciality Graphite, Plasterboard, Industrial Copper Tubes, Carbon & Graphite Products
Food	7	16	Belgian Brewers, Private Label (Belgian Brewers), Luxembourg Brewers, French Brewers, French Beef, Spanish Raw Tobacco, Italian Raw Tobacco
Banks	2	5	German Banks, Austrian Banks
Transport	2	5	FETTCSA, SAS/Maersk
Games consoles	1	2	Nintendo
Needles & Haberdashery	1	2	Needles & Haberdashery
Fine Arts Auctions	1	2	Fine Arts Auctions

- involved products that were homogeneous such as vitamins, chemicals, tubing etc.

- were concentrated in the chemicals (47%) and industrial raw materials (23%) sectors (Table 2).

- involved 21 firms who were multiple offenders (Table 3)

  - 2 firms (Roche and BASF) participated in 9 separate cartels each;

  - 4 firms (Akzo, Aventis, SGL, Nippon) participated in 4 separate cartels each;

  - 2 firms (Graf Technical International, Takeda) participated in 3 separate cartels each.

  - 13 firms (Hoechst, ADM, Ajinmento, Chiel, Degussa, Solvay, Atofina, Deltafina, KME Group, Wieland Werke, Outokumpu, Interbrew and Maersk) participated in 2 cartels each.

Table 3: Multiple offenders in European cartels, 1999-2006

Cartelist	No. cartels	Cartel
Roche	9	Vitamins A, E, B2, B5, C and D3, Beta Carotene, Carotinoids; Citric Acid
BASF	9	Vitamins A, E, B2, B5, C and D3, Beta Carotene, Carotinoids; Chloine Chloride
Akzo	4	Organic Peroxides, Chloine Chloride, MCCA Chemicals, Hydrogen Peroxide
SGL	4	Graphite Electrodes, Isostatic Speciality Graphite, Extruded Speciality Graphite, Carbon & Graphite Products
Nippon**	4	Seamless Steel Tubes, Graphite Electrodes, Methionine, Sorbates
Aventis	4	Vitamins A, E and D3; Methionine
Takeda	3	Vitamins B2, C; Food Flavour Enhancers
Graf Tech Int'l	3	Isostatic Speciality Graphite, Extruded Speciality Graphite
Hoechist	2	Sorbates, MCCA Chemicals
ADM	2	Lysine, Citric Acid
Ajinmento	2	Lysine, Food Flavour Enhancers
Chiel	2	Lysine, Food Flavour Enhancers
Degussa	2	Methionine, Hydrogen Peroxide
Solvay	2	Vitamin D3, Hydrogen Peroxide
Atofina	2	MCCA Chemicals, Hydrogen Peroxide
Deltafina	2	Spanish Raw Tobacco, Italian Raw Tobacco
KME Group*	2	Industrial Copper Tubes, Copper Plumbing Tubes
Wieland Werke	2	Industrial Copper Tubes, Copper Plumbing Tubes
Outokumpu	2	Industrial Copper Tubes, Copper Plumbing Tubes
Interbrew	2	Private Label, Belgian Brewers
Maersk	2	FETTCSA, SAS/Maersk Air

*   *The KME Group is made up of KME Group, KME AG and EM and TMX; all these firms were fined in both the Industrial Copper Tubes and Copper Plumbing Tubes cartels.*
** *Nippon Steel and Nippon Soda were the cartelists in Seamless Steel Tubes and Methionine respectively.*

PRIVATE DAMAGE ACTIONS

In Europe the routine sanction has been monetary fines that have increased significantly in recent years[10]. Private enforcement of antitrust is now much discussed in Europe but it is an area that is 'wholly underdeveloped' and with significant differences in procedures among the Member States[11]. The EC Commission has become an enthusiastic advocate of private enforcement and is intent on increasing its role as part of its modernisation of EC competition law[12].

Estimating Damages in Practice

One practical concern is how to estimate the damages in cartel cases. This requires first a theory of cartel harm which posits a practical counterfactual and a method of quantifying the difference between non-cartel prices and cartel prices and other losses.

Estimating damages is difficult for a number of reasons.

The first is the absence of data and the complexity of the calculations involved which rely on the claimant investigating broad market conditions both during the period of cartelisation, and the hypothetical (counterfactual) benchmark of what would have happened in the absence of the alleged cartel. This type of analysis is many orders of complexity greater than that encountered in most civil litigation, and requires specialist economic and data analysis skills which have an impact on the credibility of the case, and the costs to the claimant and defendant.

Second, while most damage claims are likely to be 'follow-on actions' from a competition authority's successful prosecution, the reported decisions are generally of little help in estimating damages. This is because liability is founded on evidence of a conspiracy to raise prices, or more specifically the 'object' provision of Article 81(1). This consists of documentary and oral evidence that meetings and discussions took place which sought to set quotas, raise prices etc. without establishing that these arrangements did significant harm to consumers. In nearly all the EC Commission's reported cartel decisions since

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[10] C. Veljanovski, 'Penalties for Price-Fixers - An analysis of fines imposed on 39 cartels by the EU Commission', European Competition Law Review, 2006, Vol. 27, pp. 510-513; C. Veljanovski, 'Cartel Fines in Europe - Law, practice and deterrence', World Competition, 2007, Vol. 30, pp. 65-86 (available at http://ssrn.com/abstract=920786)

[11] D. Waelbroeck, D. Slater and G. Even-Shoshan, *Study of the conditions of claims for damages in case of infringement of EC competition rules*, Ashurst for the EC Commission, August 2004. www.europa.eu.int/comm/competition/antitrust/others/private_enforcement/comparative_report_clean_en. pdf. For a practical attempt in a judicial proceeding to provide workable guidance on quantification of 'harm' by the Norwegian courts in *Corrugated Cardboard – see* report prepared for the Supreme Court by O. Magnussen & V. D. Norman, submitted 10 June 1995. An English version summary appears in Norwegian Competition Authority, *Sanctions Pursuant to the Norwegian Competition Act,* 25 March 2001. http://www.konkurransetilsynet.no/archive/Internett/publikasjoner/Skriftserien/01_01_Sanctioning.pdf.

[12] EC Commission, *Green Paper – Damage Actions for Breach of the EC Antitrust Rules*, COM(2005) 672 final, December 2005; and EC *Commission Staff Working Paper*, Annex to Green Paper, 2005.

1999 no attempt has been made to estimate the extent of the overcharge let alone quantify the losses. This contrasts sharply with the claimant's burden in litigation where he must establish effect, causation and quantify the losses. Thus the private litigant has a more onerous burden of proof than the EC Commission.

Thirdly, although the position is unsettled and uncertain, unlike (some jurisdictions) damage claims are not restricted to direct purchasers. This raises an additional complication arising from the passing-on of overcharges along the supply chain, or the so-called 'passing-on defence'. This limits the claim to only that proportion of the overcharge which the claimants can establish was borne by them and excludes that passed-on to their customers[13]. To take a concrete example, if vitamins are first purchased from manufacturers by pre-mixers, who then supply this to chicken producers, who then sell their chickens fed on the vitamins contained in the pre-mixes to supermarkets, in a jurisdiction with a passing on defence the compensation to each claimant would be limited to the proportion of the overcharge passed on to them minus the proportion of the overcharge they passed-on to customers. It is easy to see that this is a complex calculation.

The simplest and most frequently used measure of damages is the price overcharge. That is the damages are confined to the difference between the 'but for' or non-cartel price and the cartel price. The steps necessary to quantify the aggregate overcharge damages assuming a pass-on defence (but ignoring quantification difficulties) are for each claimant:

1. Determine or estimate the actual cartel prices for each period (P_c);

2. determine or estimate the quantity purchased by each claimant (Q);

3. estimate the price for each period in the absence of the illegal cartel, known as the but for or counterfactual price (P_b);

4. calculate the overcharge (OC) in each year by subtracting the estimated but for price from the actual price for each year period (i.e. $OC = P_c - P_b$);

5. estimate the proportion of the overcharge absorbed by upstream supplier (u);

6. estimate any downstream pass-on of the overcharge (d);

7. multiply the net annual overcharge absorbed by the claimant – given as ($1-u)dOC$ - by quantity (Q) purchased in each year to arrive at the annual net overcharge absorbed by the claimant;

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[13] Example based on facts UK damage actions in the Competition Appeals Tribunal (which were settled out of court) - CAT, Case No. 1028/5/7/04, *BCL Old Co Limited, DFL Old Co Limited, PFF Old Co Limited v. Aventis SA, Rhodia Limited, F Hoffman-La Roche AG and Roche Products Limited;* CAT, Case No. 1029/5/7/04, *Deans Food Limited v. Roche Products Limited, F Hoffman-La Roche AG and Aventis SA.*

8. apply the statutory simple pre-judgment interest rate;

9. take account of other factors required by law, such as taxation; and

10. aggregate annual net losses to arrive at a compensable amount.

These steps are more easily identified than implemented given the extent and duration of cartels, their secretive nature, and the complexity of the calculations.

There is limited evidence on the size of overcharges and losses imposed by cartels. Recent empirical research shows that the overcharges (again based on a biased sample of prosecuted cartels) can be large. The OECD[14] has estimated that cartel overcharges average 15%-20%. A more recent survey[15] of over 200 'social science studies' suggest higher estimates – an average overcharge of 40% positively skewed with the median of 25%, and one-fifth at 10% or less. International cartels have a larger median overcharge of 30%-33% compared to 17%-19% for domestic cartels. Estimates of the losses imposed by cartels suggest these can be significant also[16]. However most of this evidence is drawn from rather crude methods of estimating overcharges, although it appears that whether the method is crude or sophisticated has relatively little impact on the estimated average overcharge.[17]

Methods of Calculating 'But for' Prices

One area which is problematic for claimants is the calculation of the price that would have been charged in the absence of the cartel. The but for or 'counterfactual' price cannot be directly established from historical or existing prices. Economists (and others) have therefore proposed a number of methods to estimate but for prices[18]. These range in sophistication, and all have advantages and drawbacks. In practice the choice of these methods depends on the industry and data to hand, and the degree to which some techniques can be comprehended or related to the legal principles.
Among the methods used to estimate but for prices and overcharges are:
- 'before-and-after' approach;

- 'yardstick' approach;

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[14] *OECD Report on the Nature and Effect of Cartels*, 2002.

[15] J. M. Connor and Y. Bolotova, 'Cartel Overcharges: Survey and meta-analysis', *International Journal of Industrial Organization,* 2006, Vol. 24, pp. 1109-1137.

[16] Estimated in Posner *op. cit.* pp. 304-305.

[17] Connor and Bolotova, op. cit.

[18] Ashursts, *Analysis of Economic Models for Calculation of Damages*, Report to EC Commission, 31 August 2004.

- cost-based approach;

- econometric approach;

- simulation models.

1. **Before-and-After Approach** The simplest and most frequently used method for estimating cartel overcharges is the 'before-and-after' method. This consists of the following steps:

   - Select a beginning and end price for the cartelised product that reflects the best estimate drawn from actual prices of the non-cartelised prices.

   - Take the period of the cartel as stated in the competition authority's decision as a basis for projections except where it is evident that the cartel was not effective during that period. This means that the period over which the overcharge is calculated is never longer than the period determined by the EC Commission (as a matter of law), but may be shorter if the cartel is found to have been ineffective over the legally determined period.

   - As a first approximation the notional but for prices have been assumed to move in a linear progression over the period of the cartel.

   - Adjust these prices for 'market conditions' in each period such as foreign exchange fluctuations, and demand and supply factors on which there is sufficient information.

   This method is simple but crude, and depends often on *ad hoc* but practical assumptions about the influence of other market forces that affect actual and but for prices. Its particular drawback is the assumption that end periods capture non-cartel prices and that there are (initially) linear price movements between these two end points. Obviously, actual and but for prices will be the outcome of a number of factors many unrelated to the cartel. Further, the end periods may not reflect the actual end periods of the cartel and hence the non-cartel price. This is because the competition authority's determination of the period of cartelisation may be inaccurate as it cannot prove the exact duration of the cartel. Also the price immediately before and after the period of alleged cartelisation may not be the but for price because, for example, the firms recognise they may be liable in damages and maintain prices above the true but for price[19] for some period after detection.

2. **Yardstick Approach** The yardstick method compares prices in cartelised market with those in 'similar' uncartelised markets. The benchmark market must be one

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[19] J. E. Harrington, Jr., *Post-Cartel Pricing during Litigation,* John Hopkins University, Revised June 2003. http://www.econ.jhu.edu/pdf/papers/WP488_harrington.pdf

which has similar demand and cost conditions and market structure. Generally, this will be a market for the same or similar products in a different country.

Assuming that data are available for products in 'similar markets', the yardstick method involves:

- Estimating the correlation between the pre-cartel prices in the cartelised market and the similar markets; and the post-cartel prices in these markets. The correlations reveal the extent to which prices in the two markets track each other. If the estimated correlations are positive and high (i.e. close to 1) in both the pre- and post- cartel periods then the yardstick is more likely to be a valid one since the prices in both markets move in the same way.

- Calculating the correlation over the period of cartelisation between the cartel prices and the non-cartel prices in the benchmark market. The correlation should be lower than those calculated in the pre- and post- cartel periods.

- Calculating the overcharge as the difference in prices between the two markets during the cartel period.

There are potential problems with the yardstick method. If the benchmark markets are not sufficiently similar to the cartelised market then the estimated overcharges will be unreliable and either over- or under- estimate but for prices. For example the method assumes that these markets have similar oligopolistic interactions. The approach also imposes a considerable data burden since it requires not only price data for the period and country cartelised, but for a considerable period each end of the period of the cartel for a number of countries. It may be impossible to collect data for the whole period that is reliable especially where the cartel has operated for a number of years, and prices are discounted, or subject to foreign exchange fluctuations e.g. the extent to which exchange rate changes are assumed to be passed on in the benchmark prices.

3. **Cost-based Approach** The cost-based approach seeks to estimate overcharges by comparing the average or marginal unit cost plus a 'reasonable' mark-up with actual prices. That is if the price during a period exceeds the firm's marginal costs of production then this is seen as attributable to collusion, and the difference between the marginal costs plus mark-up and the actual price is used as a measure of the overcharge.

The cost-based approach has a number of drawbacks. The first and principal one is some assumption as to the appropriate counterfactual. The approach assumes that the but for price is that arising from competitive market conditions where price equals marginal costs. However, this is not necessarily the case since in the absence of explicit collusion the competitive interaction may still be oligopolistic and prices substantially above the hypothetical competitive price (see below). Further, there are problems in calculating marginal costs and determining what a 'reasonable' mark-up

is especially when market conditions change over the period of cartelisation e.g. should a fixed mark-up be used or one that varies with market conditions.

4. **Price Prediction Regressions** This is a more sophisticated and statistically robust method of calculating the but for price[20]. Its major attraction is the ability to take into account, estimate and quantify the myriad of other factors which influence prices such as changes in demand and supply side factors. It holds out the possibility of adjusting the but for price for these considerations in a systematic and statistically credible way which is the major drawback of the approaches so far discussed.

There are two basic econometric specifications used in cartel analysis:

- **Dummy Variable Model.** This is a regression model (or estimating equation) which has the price as the dependent variable (the variable to be explained) and the demand and supply factors as the independent variables (the variables which are supposed to determine or influence actual prices) plus a dummy variable (a binary variable equal to either 1 during the period of the cartel and 0 otherwise) which captures the period of alleged cartelisation. If the impact (coefficient estimate) of the dummy is positive and statistically significant, it provides a measure of the average overcharge during the cartel period.

- **Residual Model.** This method first estimates a regression equation using data for the non-cartel to predict prices. It then uses the equation (the estimated coefficients) and the actual values of the explanatory variables during the cartel period to give the but for price. Finally, the overcharge is calculated by subtracting the estimated but for prices from the actual cartel prices, and multiplying these by the quantity sold for each period.

These regression models deal with the major drawback of the preceding approach – the ability to adjust for non-cartel factors which are likely to influence the but for price. However, like all sophisticated techniques they require considerable data to implement and are often open to attack on grounds of mis-specification and more sophisticated, largely technical, criticisms. This can make it difficult for regulators and judges to interpret and risks debates about the techniques and their pros and cons which overtake the primary exercise of providing common sense and reasonable estimates of the claimants' losses.

5. **Simulation Models** Simulation models go one step further by tying estimates of losses to explicit models of oligopolistic behaviour. In oligopolistic markets, which we have seen are those most likely to be cartelised, firms recognise that their pricing and output decisions are interdependent. Thus in these markets uncoordinated non-

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[20] *Quantitative Techniques in Competition Analysis*, UK Office of Fair Trading Research Paper no. 17, 1999; J. B. Baker and D. L. Rubinfeld, 'Empirical Methods in Antitrust Litigation: Review and critique', *American Law and Economics Review*, Vol. 1, 1999, pp. 386–435. For recent examples from US merger decisions see J. E. Kowka, Jr. and L. J. White (eds), *The Antitrust Revolution*, 4th edn, (Oxford University Press, 2004).

collusive behaviour is going to lead to price and output decisions that are not necessarily the same as competitive levels without infringing competition law. That is, the assumed counterfactual is that the but for price is that which would occur in the absence of the alleged collusion but in the presence of actual uncoordinated rivalry between the few firms in the market. This may not necessarily be the competitive price.

Economists use to two standard models of uncoordinated oligopolistic behaviour and pricing in their simulations - the Cournot and Bertrand models.

- **Cournot Model** – The Cournot model assumes that firms produce a single homogeneous product at constant marginal costs and supply the whole market. The firms decide the quantity of a product to produce after taking into account their beliefs about reaction of rival firms to their output decision. The Cournot model predicts that output and prices will fall between the monopoly and competitive prices and output levels, and that the but for price will fall and quantity produced increase toward the competitive levels the greater the number of firms.

- **Bertrand Model** – In a Bertrand model firms set prices rather than output. The assumption that firms are able to supply the entire market implies that firms are not capacity constrained. In a Bertrand model even with two firms the industry outcome is the competitive outcome of price equal to marginal costs.

The choice between Cournot and Bertrand models depends on which best portrays actual market conditions. If it is reasonable to assume that firms cannot rapidly expand output and are capacity constrained the Cournot model is suitable; if not then the Bertrand model may be more appropriate.

These models are static (one period models) and based on constraining assumptions. Economists have other models which allow for dynamic (multi-period) interactions[21] over extended periods. However, as these models increase in sophistication, their predictions and conclusion become less determinate and hence of less practical assistance in estimating damages.

Notwithstanding this, an indication of how the Cournot model can be used to estimate the but for price can be given. In it simplest form the Cournot model needs three pieces of information:

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[21] A simple dynamic version of the Cournot model is the so-called Stakelberg model where one firm is assumed to be the leader in choosing the amount of output to produce in the first period and the rival to choose its output after observing the output decision of the first firm in the second period. The Stakelberg leader chooses to produce more than the follower leaving a smaller residual demand for the follower; consequently the leader has higher profits.

- **Herfindahl-Hirschman Index or HHI ('*HHI*') index** of concentration in the market during the cartel period[22].

- **Estimates of the (absolute) market price elasticity of demand ('*e*')** which is a measure of reaction of the market's quantity demanded to an increase in price. In practice, data may not be available to estimate the price elasticity of demand, in which case estimates of elasticity made by industry experts may have to be used; however, this raises the question of how accurate the estimate is and ultimately on the accuracy of the but for price.

- **Weighted-average marginal cost of production ('*MC*')** using market shares of each firm under the period of cartelisation as weights.

Under the Cournot model each firm's profit margin where they do not collude is given by the formula:

$$(P - MC)/P = HHI / e$$

The left hand term is the price-cost margin or so-called Lerner Index often used as a measure of market power[23]. When the firms in an oligopolistic market do not coordinate their actions the price-cost margin equals the concentration ratio divided by the market elasticity of demand (*HHH/e*). The above expression can be re-arranged to indicate the but for price in the absence collusion as:

$$P = (MC \times e)/(e - HHI)$$

The expression indicates that the but for price in the absence of collusion lies between the monopoly price and the competitive price (*P=MC*), and declines as the number of firms increases. In a competitive industry the but for price would be, as expected, equal to marginal costs (*P = MC*) but higher where the market is more concentrated.

Multiple Damages

For the economist the primary purpose of damages and fines is not to compensate and penalise respectively, but to deter price-fixing. Both damages and fines do this to some extent because they increase the potential costs of price-fixing thereby making it less

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[22] The HHI is the sum of the squares of the individual market shares of all firms in the market; where shares can be measured on sales or volume. The HHI takes account of all firms, and gives greater weight to larger firms, and hence the disparity in firm size. It ranges from 10,000 for a monopolist to lower values for markets with many small firms. In the Cournot model the HHI has a value between 0 and 1 i.e. a HHI of 5,000 would enter the model as 0.50.

[23] W. M. Landes and R. A. Posner, 'Market Power in Antitrust', Harvard Law Review, Vol. 94, 1981, pp. 937-996.

profitable. Here we explore briefly the interaction between damages, deterrence and cost-effectiveness[24].

Ignoring for the moment the incidence and costs of litigation, one would assume that if damages reflect consumers' losses from overcharges they would deter price-fixing. This is because, if accurately measured, the price fixer would make no profits from his illicit activity. This is not correct[25].

First, if consumers know that they are being overcharged and have a claim for (single) damages, then they will factor this into their purchase decisions. Assuming that claiming damages is relatively costless the effective price (equal to the overcharge minus damage claim) will be the same as in the absence of the cartel, and hence they will purchase the same amount. However, this view is predicated on the assumption that consumers know they are being overcharged and that they have ready redress in the courts. Both these assumptions are unreal.

The second reason is that in the real world the detection of cartels is far from certain, perfect or costless. These have an impact on optimal damages and efficient law enforcement (I here ignore the impact of fines). If only a proportion of offenders are caught and prosecuted then single damages will not provide the appropriate level of deterrence. This is because price–fixers know that, say, only one in three of their number will be sued and will discount the damage claims by one-third. That is the *ex ante* measure of damages – the expected damages - which influence actions are far less than the *ex post* damage payments that successfully sued price-fixers pay. The concealability of price-fixing may warrant supra-compensatory damages. Less than full enforcement of the law requires *ex ante* damages or fines to be a multiple of the aggregate overcharges. If not all offenders are prosecuted, an uplift (a 'damage multiplier') must be applied to the *ex post* aggregate overcharge in order to achieve optimal (*ex ante*) deterrence. The deterrence multiplier will be *1/c*, where *c* is the conviction rate. Thus if, to use the figure above, only one-third are sued, the optimal damages is 'triple damages'. This is the partial justification for the triple damage rule in US antitrust law.

The size of the damage multiplier is not for obvious reasons accurately known. There have been some estimates of cartel detection rates. Bryant and Eckard[26], in a now dated study, estimate that about 1 in 7 cartels were detected in the 1980s. Others suggest only 1

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[24] G. S. Becker, 'Crime and Punishment: An Economic Approach', *Journal of Political Economy*, Vol. 76, 1968, pp. 167–217; C. G. Veljanovski, Economics Principles of Law (Cambridge University Press, 2007) Chap 6. W. M. Landes, 'Optimal Sanctions for Antitrust', *University of Chicago Law Review*, Vol. 50, 1983, pp. 652-678. K. N. Hylton, *Antitrust Law – Economic theory and common law evolution* (Cambridge University Press, 2003) Chap. 2 provides and excellent and brief description of optimal enforcement.

[25] S. W. Salant, 'Treble Damage Awards in Private Lawsuits for Price Fixing', *Journal of Political Economy*, Vol. 95, 1987, pp. 1236-1336; J. B. Baker, 'Private Information and the Deterrent Effect of Antitrust Damage Remedies', *Journal of Law, Economics, and Organization*, Vol. 4, 1988, pp. 385-408.

[26] P. G. Bryant and E. W. Eckard, 'Price Fixing: The probability of getting caught', *Review of Economics & Statistics,* Vol. 73, 1991, pp. 531-536.

in 10 cartels[27], and others suggest much lower detection rates. These studies suggest damage multiples of 7, 10 or more times actual damages are needed to fully 'internalise' the cartel's harm and provide adequate deterrence.

However, this is going a bit too far because the costs of litigation and the impact of the damage rule on the litigation rate has been ignored. The likelihood of litigating a claim is a function of the damage award. Thus, for example, if the initial litigation rate is 10% and the optimal damage multiplier set at 10, the prospect of getting ten times your losses will result in more victims suing and the litigation rate rising dramatically at least compared to a single damage rule. Thus damage multiples which adjust for the concealability of cartels can lead to over-deterrence and excessive litigation costs.

Hylton and Micelli[28] have examined this feedback effect. They distinguish between the multiplier which internalises overcharges and leads to optimal deterrence as defined above, and the socially optimal multiplier which takes account of the impact on the litigation rate and litigation costs. These multipliers move in the opposite direction. The deterrence multiplier discussed above increases with litigation costs because the litigation rate declines. The socially optimal multiplier decreases as litigation becomes more expensive because the marginal deterrent effect of increased litigation falls when the costs of litigation are taken into account. Hylton and Micelli suggest that for tort actions the deterrence multiplier using US data is about 1.6 whereas the socially optimal multiplier is closer to one. Thus paradoxically, and somewhat counterintuitively, the presence of significant litigation costs leads to single or compensatory damages as being approximately efficient. Whether this is the case for cartel damages warrants further investigation.

CONCLUSION

This chapter has attempted to highlight some of the economic considerations relevant to cartel policy and enforcement. It shows that economics can make a contribution to the design of the law, its enforcement and the practical prosecution of cartels by competition authorities and private litigants through the courts.

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[27] G. J. Werden and M. J. Simon, 'Why Price Fixers Should Go to Prison', *Antitrust Bulletin*, Vol. 32, 1987, pp. 917-937.

[28] K. N. Hylton and T. J. Miceli, 'Should Tort Damages be Multiplied?', *Journal of Law, Economics & Organisation*, Vol. 21, 2005, pp. 388-416.