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ECONOMICS OF JOINT DOMINANCE**

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ABSTRACT: Recent court rulings, e.g., in the *Gencor* and *Airtours* cases, seem to indicate that the legal concept of joint dominance in oligopolistic markets is equivalent to the economic concept of collusion. This paper argues that the enlargement of the dominance concept to also include oligopolistic dominance is sensible and based on widely accepted economic theory. I discuss how competitive assessment in case law has taken seriously some economics lessons, but ignored some others. Economists on one hand and lawyers and antitrust authorities on the other hand seem to speak past each other on these issues. This paper attempts to bridge this gap, and to clarify the concept of collective dominance. I also discuss some recent advances in economic theory and empirical economic evidence related to the oligopolistic dominance that is relevant to the competition policy.

JEL: K21, L13, L40, L41

Keywords: oligopoly, dominant position, market power, competition policy, merger

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TIIVISTELMÄ: Viimeaikaiset EU:n tuomioistuinten päätökset esimerkiksi *Gencor*- ja *Airtours*-asiassa indikoivat, että juridiikassa käytetty yhteisen määräävän markkina-aseman käsite oligopolistisilla markkinoilla vastaa taloustieteen kolluusion käsitettä. Tässä tutkimuksessa argumentoidaan, että määräävän markkina-aseman käsitteen laajentaminen koskemaan myös oligopolistista määräävää asemaa on järkevä ja perustuu laajalti hyväksyttyyn talousteoriaan. Vaikka kilpailuoikeudellinen arviointi on tapauskäytännössä ottanut huomioon eräitä taloustieteen oligopoleja koskevia tuloksia, se on näyttänyt olleen välittämättä eräistä muista tuloksista. Lisäksi ekonomistit ja juristit näyttävät toisinaan puhuvan toistensa ohi. Tämä tutkimus pyrkii rakentamaan siltaa ekonomistien ja juristien välille ja selventämään oligopolistisen määräävän markkina-aseman käsitettä. Tutkimuksessa tarkastellaan eräitä taloustieteen uusia teoreettisia ja empiirisiä tuloksia, joilla on merkitystä oligopoleja koskevaan kilpailupolitiikkaan.

Asiasanat: oligopoli, määräävä markkina-asema, markkinavoima, kilpailupolitiikka, yrityskauppa

1. Introduction

"Dominant position" is European legal jargon and is defined along the lines of the firm having the power to behave to an appreciable extent independently of its competitors and customers. In economics jargon, dominant position refers to strong market power, i.e., monopolies and other such firms that do not need to meet intense competition nor the countervailing bargaining power of their customers, due to their strengths relative to actual and potential competitors.

"Collective" or "joint dominance" is also European legal jargon, and refers to the situation in which two or more firms share the dominant position on the same relevant market.[1] Regardless of the fact that the idea of dominance by multiple firms is not even mentioned in the EC Merger Regulation, the concept was introduced by the European Commission in the *Nestlé / Perrier* merger case, and accepted by the Court of Justice (ECJ).[2] Since then, the use of the joint dominance concept has proliferated. With *Nestlé*, *Kali&Salz*, *Gencor* and *Airtours* cases, there is now court confirmation that the concept can be used, e.g., to block mergers.[3] In Finland,[4] the concept has been used in the *Fritidsresor / Finnmatkat*, *Carlsberg / Orkla, Georgia-Pacific / Fort James* and *Lännen Tehtaat / Avena* merger cases, and in *Alfons Håkans / Finntugs* abuse case, and extensively discussed in *Telia / Sonera / Radiolinja* abuse case.[5]

The practical relevance of dominance is that the competition law places special obligations on dominant firms, and that transactions which create or strengthen dominance, are not allowed to proceed as such. Therefore, it is of great interest to firms to know whether they are in dominant position and to understand beforehand whether a planned merger would lead to market dominance. Unfortunately, this seems to be quite hard to achieve, and especially so in the case of joint dominance. In single firm dominance cases, the authorities have to demonstrate that the firm has (likely) significant impacts on the competition to warrant a conclusion that the firm is dominant. This disciplines the analysis and opens it to scrutiny regarding the soundness of the economic arguments underlying the decision. The concept of joint dominance has remained somewhat confused, however, so that there is a danger that ad hoc arguments might replace sound economic analysis in competitive appraisal.

To further motivate the paper, let me briefly discuss a Commission inquiry on roaming and few cases from the telecommunications sector. In its Working Document on roaming markets, the Commission noted that mobile operators may enjoy collective dominance in the market for the provision of wholesale roaming to for-

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1 In some other jurisdictions, e.g., in the U.S., one often uses "coordinated effects" to denote collective dominance.

2 *Nestlé / Perrier*, Official Journal 1992 L 115/19.

3 *Kali & Salz / MDK*, Joined Cases C-68/94 and C-30/95, OJ 1994 L 186/38; *Gencor / Lonrho*, Case T-102/96, OJ 1997, L 11/30; *Airtours*, Case T-342/99, OJ C 191, 10/08/2002.

4 In Finland, there are juridical arguments according to which collective dominance is applicaple only to those cases, where there atually exists an association of firms that is dominant, but that the idea of oligopolistic dominace is not applicable. I shall not discuss these juridical arguments here.

5 Fritidsresor / Finnmatkat, 1076/81/99, 5.4.99; Carlsberg / Orkla, 573/81/01, 2.1.01; Georgia-Pacific / Fort James, 830/80/00, 30.1.01; Lännen Tehtaat / Avena, 389/81/2002, 4.10.2002; Alfons Håkans / Finntugs 23/359/98, 29.6.00; Telia / Sonera / Radiolinja, 11.12.01.

eign mobile operators, due to the economic links between mobile operators through their interconnection agreements, their membership of the GSM Association, the WAP and the UMTS forum, the fact that terms and conditions of roaming agreements were almost standardized, and the existence of high barriers to entry. The Commission also stressed that while the mobile market is technology driven, it did not seem to have affected the conditions of competition prevailing on the wholesale international roaming market.[6] In *Vodafone / Airtouch*, the Commission argued that as entry into the market was highly regulated, and that market conditions were transparent, it could not be ruled out that merger would create a dominant duopoly.[7] In *France Telecom / Orange*, the Commission found that two existing players were jointly dominant, as both operators had almost similar and transparent pricing and their prices followed exactly the same trends. In the same decision, Commission dismissed claims as to the risk of a collective dominant position of Vodafone and France Telecom in the market for the pan-European mobile services to internationally mobile customers, as this market was emerging, characterized by an increasing demand and many types of different services on offer and on price.[8] In *BT / Esat*, the Commission concluded that the merger would not create a dominant duopoly on the Irish market for dial-up Internet access, as market shares were not stable, demand was doubling every six months, internet access products were not considered homogeneous, and technological developments were one of the main characteristics of the market.[9] Why would the market characteristics mentioned above indicate oligopolistic dominance or the lack of thereof? Why did the Commission conclude joint dominance in some markets but not on some others? Given a set of market characteristics, can we predict what decision the competition authorities will take? Can we say anything, what decision they should take?

For competition policy regarding oligopolistic markets, there are some issues that particularly seem to warrant attention. First, there is the question of separating competitive oligopolies from the ones where some of the oligopolists are jointly dominant. Second, the more fundamental question of what joint dominance actually means has not always been clear. For instance, if markets are characterized by less than intensive price competition, is this an indication that the leading firms are jointly dominant? Some have suggested "Yes". In this paper, I argue that the conclusion should be "No". The Court of First Instance (CFI) and the ECJ seem to agree with this conclusion.

Third, competitive assessment in the casework has taken some parts of the theory of collusion seriously. For instance, the "checklist" developed to screen joint dominance is based on some lessons from economic theory of collusion. However, the antitrust analysis has ignored some of the economic lessons. Further, competitive assessment does not seem to take the empirical evidence seriously. Antitrust analysis often seems to believe that collusion emerges automatically, once there exist market conditions that theoretically could allow collusion. However, there is large experimental evidence that points otherwise. In experiments, collusion is rare, unless there are only two firms, communication between players is allowed, or the oligopoly is very symmetrical. There is also some econometric evidence that collusion is rare on markets where collusion could in principle arise, i.e., on markets that satisfy many of the items on the "checklist". This evidence seems not to have influenced competition authorities. For instance, in *Exxon / Mobil* merger case, the

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[6] "On the initial findings of the sector inquiry into mobile roaming charges", available at http://europa.eu.int/comm/competition/antitrust/others/sector_inquiries/roaming/

[7] Case No IV/M.1430 – Vodafone/Airtouch.

[8] Case No COMP/M.2016 – France Telecom/Orange.

[9] Case No COMP/M.1838 – BT/Esat.

Commission found that there was a seven firm dominant oligopoly in the market for retail of gasoline in Luxembourg, and five firm dominant oligopolies in Germany, Netherlands and in the French motorways.[10] In light of the above experimental and empirical results, one can question these conclusions.

In this paper, I argue that there is a sound framework for analysis of joint dominance that is based on generally accepted principles of economic theory. I will argue that joint dominance should be assessed on the basis of the economics concept of collusion, and discuss some recent results of theoretical and empirical economics. The rest of the paper is organized as follows. In section 2, I discuss the legal concept of joint dominance and some of the relevant case law. To understand the policy on and the economics of joint dominance, it is useful to first briefly review the analysis of dominance by a single firm. This is the topic Section 3. Then I discuss the economic theory of collusion and semicollusion in section 4 and the experimental and empirical evidence in section 5. Section 6 concludes.

2. Joint Dominance in European Competition Law

2.1 Articles of Law and Case Law

According to the Article 81 of the EU Treaty, agreements between undertakings, and concerted practices which have as their object the prevention, restriction or distortion of competition are prohibited, and according to the Article 82, abuse by one or more undertakings of a dominant position are prohibited. Further, EU Merger Regulation prohibits any transaction that creates or strengthens a dominant position as a result of which effective competition would be significantly impeded. In the text of Article 82, it is stated that more than one firm can simultaneously be in a dominant position on the same markets, but this lacks from Merger Regulation. The jurisprudence of the CFI has shown that the same idea of multiple firms jointly holding a dominant position also applies to merger review.

It has been argued that a finding of collective dominance should be based on the existence of economic links or other factors, which could give rise to a connection between the firms concerned, such as cross ownership. The question of whether collective dominance could also apply to an oligopolistic market in the absence of any links among the firms was first raised in the *Gencor/Lonrho* case.[11] Before the CFI, the parties argued that the Commission had failed to prove the existence of "links" between the members of the duopoly within the meaning of the existing case law. The CFI dismissed the application by stating, i.a., that there was no legal precedent suggesting that the notion of "economic links" was restricted to the notion of structural links between the undertakings concerned. This is quite sensible, as the alternative would have lead to irrelevant discussions on what are links within the meaning of competition law.

According to the CFI,

> … there is no reason whatsoever in legal or economic terms to exclude from the notion of economic links the relationship of interdependence existing between the parties to a tight oligopoly within which, in a market with the ap-

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[10] Case No IV/M.1383 – Exxon/Mobil, 29.09.1999.

[11] Case No IV/M.619, - Gencor/Lonhro, OJ 1997, L 11, p. 30.

> propriate characteristics, in particular in terms of market concentration, transparency and product homogeneity, those parties are in a position to anticipate one another's behaviour and are therefore strongly encouraged to align their conduct in the market, in particular in such a way as to *maximise their joint profits* by restricting production with a view to increasing prices. In such a context, each trader is aware that highly competitive action on its part designed to increase its market share (for example a price cut) would provoke identical action by the others, so that it would derive no benefit from its initiative. All the traders would thus be affected by the reduction in price levels.[12]

The CFI's ruling in *Gencor* was later endorsed by the ECJ in *Compagnie Maritime Belge* case, where the ECJ gave further guidance as to how the term of collective dominance should be understood and as to which conditions must be fulfilled before such finding can be made.[13] According to the Court, in order to show that two or more firms hold a joint dominant position, it is necessary to consider whether the firms together constitute a collective entity vis-à-vis their competitors, their trading partners and their consumers on a particular market. This will be the case when there is no effective competition among the firms in question, and the firms adopt a uniform conduct or common policy in the relevant market. The Court recognized that an agreement, decision or concerted practice (whether or not covered by an exemption under Article 81(3)) may undoubtedly result in the firms being linked in a such way that their conduct on a particular market results in them being perceived as a collective entity vis-à-vis their competitors, their trading partners and customers.

The mere fact, however, that two or more firms are linked by an agreement, a decision of associations, or a concerted practice within the meaning of Article 81(1) of the Treaty does not itself constitute a necessary basis for such a finding. As the Court stated, "a finding of a collective dominant position may also be based on other connecting factors and would depend on an economic assessment and, in particular, on an assessment of the structure of the market in question". It follows from *Gencor* and *Compagnie Maritime Belge* that the finding of collective dominant position can be made in relation to an oligopolistic or highly concentrated market whose structure alone is conducive to coordinated effects[14] on the relevant market.

In its *Airtours* ruling, the CFI set out a three-step procedure for a finding of collective dominance in a merger case.[15] First, each member of the alleged oligopoly group must be able to observe the behavior of the other members. Second, deviation from the agreed norm of conduct must be discouraged by a credible threat of retaliation. Third, there should not be important constraints such as customers with bargaining power, smaller competitors, or the threat of new entry that would be sufficient to unravel attempts to coordinate market behavior. To an economist, this set of requirements, as well as the reasoning in the other court cases discussed above, translates to the separation of collusive and (imperfectly) competitive oligopolies.

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[12] Case T102/96, Gencor v Commission [1996] ECR II-753, at par 276. Emphasis added.

[13] Joined Cases C-395/96 P and C-396/96 P, [2000] ECR I-1365.

[14] The uses of the term "coordinated effects" is no different from the term "parallel anticompetitive behavior" also used in some of the Commission's decisions applying oligopolistic dominance.

[15] Case T-342/99, OJ C 191, 10/08/2002, at par 62.

The Commission has applied the concept of collective dominance in oligopolistic markets in a number of merger decisions. In doing so, the Commission has relied upon a number of criteria, "the checklist", to try to separate competitive and non-competitive oligopolies. The checklist can be summarized as follows: indications for joint dominance are few market players, mature market, stagnant or moderate growth on the demand side, low elasticity of demand, homogeneous product, similar cost structures, similar market shares, transparent market conditions, lack of technical innovation, mature technology, absence of excess capacity, high barriers to entry, lack of countervailing buying power, lack of threat of entry, informal or other links between the firms, retaliatory mechanisms, and lack or reduced scope for price competition. In principle, the list is not exhaustive, nor are the criteria cumulative; rather, the list is intended to illustrate the sorts of evidence that is used to support assertions concerning the existence of a collective dominance.

The Commission noted in *Price Waterhouse / Coopers & Lybrand* that "collective dominance involving more than three or four suppliers is too complex and unstable to persist over time". In that decision the Commission dismissed the possibility that the so-called Big Six accounting firms be considered collectively dominant. However, such an assessment will depend on each market's particular characteristics and indeed markets with more than three major players may be considered as being conducive to oligopolistic dominance, as was the case, e.g., in *Exxon / Mobil*.

In an oligopolistic market where most, if not all, of the checklist criteria above are met, what should be established is that firms have a strong incentives to converge to a coordinated market outcome and refrain from reliance on competitive conduct, means to enforce the joint market policy, and the lack of other competitive pressures sufficient to destabilize market leaders' attempts to coordinate market conduct.

I would like to summarize the economics of recent legal developments as follows. After the *Gencor* ruling by the CFI, the economic interpretation of collective dominance seems to be quite clear: collective dominance means collusion or the grave danger that a merger leads to more collusive behavior (as economists use this term – see Section 2.2 below). Then the European Commission used joint dominance arguments to block *Airtours / First Choice* merger. In its decision, the Commission seemed to enlarge the concept of joint dominance to also include something else than just basic collusion. The CFI overturned the Commission's decision; the general conclusion to be drawn from this ruling seems to conform that collective dominance is more or less equal to collusion.

2.2 Terminology

The economic and legal concepts underlying the word "collusion" are sometimes quite different, and that can lead to confusion. It is then useful to clarify the language before turning into economics of coordinated market conduct.[16]

In economics, the essential difference between (imperfectly) competitive behavior and collusion is to what extent firms condition their behavior on the past behavior and the future expected behavior of their rivals. Economists say that there exists (*imperfect*) *competition* when each firm ignores rivals' past actions, unless they have a *direct* impact on current profits.[17] Then prices close to the monopoly price cannot be sustained. To see this suppose firms tried to charge the monopoly price.

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[16] See also Neven (2001).

[17] That is, each firm pursues to maximize individual short run profits.

But if prices are above equilibrium prices, by definition, a firm can cut its price, and gain enough market share to outweigh the costs of a small price cut. Hence, there needs to be some other profit loss that restrains that natural incentive to undercut rivals. If rivals do not condition their future behavior on the decisions made today, future profits are independent of current price decisions. But then only profits in a current period matter for incentives, and price cuts cannot be prevented. Only if a firm believes that rivals' future price setting will depend on its current behavior, the short run incentive to undercut prices above the (imperfectly) competitive level can be mitigated. *Collusion* in economics is strategy in which rivals' future behavior matters for current decisions via a strategic link (as discussed in Section 4 below). By colluding, firms try to reach higher profits than obtained under competition, and try to maximize joint rather than individual profits.

Some confusion in competition policy arises from legal analysis differentiating between the two ways in which a non-competitive price norm is established. If firms come to an implicit agreement, lawyers would call this collusion; if there were no explicit agreement, this would be "parallel conduct". Collusion through explicit agreement is a violation of cartel prohibition, while parallel conduct is legal. The argument is that, in parallel conduct, every firm simply does what is best for itself, anticipating what others are doing. Hence, there is no intent in violating any competition rules. However, in any circumstances of collusion in the economic sense, with or without explicit communication, every firm always does what is in its individual best interest, given what it expects others to do. The competition and welfare effects are exactly the same. From an economic perspective, the distinction between explicit collusion and "parallel behavior" is therefore essentially semantic.

The distinction is helpful in enforcement, however. The reason is that, in practice, market evidence cannot be used to prove that prices were raised above the (imperfectly) competitive level, to prove that collusion in the economic sense has taken place. Then it is better to only treat communication about prices as hard evidence for collusion in enforcement (see, e.g., Kühn, 2000). However, this approach leaves "parallel behavior" untouched and it will also not catch collusive behavior in the legal sense, when communication could not be detected.

If we could detect collusive behavior directly and perfectly through a market test, there would be no need for considering the effects of mergers on the potential for collusion. We could simply fine companies that raise their prices above the imperfectly competitive outcomes. The fact that collusive behavior cannot be perfectly controlled in this way means that we should restrict transactions that could considerably increase the potential for collusion. Collusion concerns are therefore legitimate concerns for anti-trust policy. This policy is also preventive against "parallel conduct" as well as explicit cartels that are not detected.

There would be no point in this discussion if these semantic differences would not materially affect competition policy analysis. For example, arguments about joint dominance have been rejected because "punishments" were considered irrelevant for the case of "parallel conduct", implicitly stating that "punishments" could only be imposed under explicit collusion. This position is of course wrong. A "punishment" in terms of the economic theory is only the difference between the profits in the future if firms follow some price norm and the profits induced if someone deviates from that norm. Punishments in this sense are also implicit in "parallel behavior". The moral judgements that are attached to "parallel conduct" on one side and "punishment" and "collusion" on the other are immaterial to the implications of the relevant economic analysis for merger policy or policy against abuse of market power.

Economic theory has predictions about how the incentives for collusion in the economic sense systematically differ between different environments. This occurs due to the impact of the environment on the incentives to deviate from a non-

competitive norm and on the credibility of sustaining large differences in future profits conditional on earlier behavior in the market. The first is called "incentives to cheat" and the second "credibility of punishment".

Further confusion in terminology arises from the fact that sometimes economists use the term "cartel" when they actually mean "collusion", and that lawyers and competition authorities sometimes use the term "oligopoly" when they actually mean "oligopoly suspective to anticompetitive behavior". "Oligopoly" is an economic term that refers to a market structure that has multiple firms that are not price takers and have some power over their price. When economists talk about "competition" in antitrust, they mean oligopoly in this sense. In competition policy, when some say "oligopoly", they often actually mean collusion in the economists' sense. This loose usage of terminology should not have material impact on policy, as long as one pays attention to the framework where the terms are used in.

3. Economics of Single Firm Dominance

To better understand some of the economic arguments on joint dominance below, it is useful to first briefly review the analysis of dominance by a single firm as well as some related economic issues. Traditionally, in European case law, the analysis has focused on the question whether a single firm is in a dominant position, and dominance is usually defined along structural lines. Basically, a firm that consistently has a high market share on a market characterized by significant barriers to entry is dominant. A market share of 35 % might be enough for dominance. Market share alone is rarely enough to warrant the conclusion of dominance, but there must be present some "plus-factors" that support the conclusion that the firm can behave to an appreciable extent independently of its competitors and customers. To have a meaningful measure for market share, one needs to define the relevant markets first. Mistakes in made the market definition stage will be carried on to the stage of competitive appraisal.

There is also a sensible economic definition of dominance that attempts to capture the purpose of the law and that is implementable, at least in principle. This approach can also avoid the problems related to market definition and the general problems with structure-based analysis: significant market power. More precisely, dominance is equal to a position which allows the price to be raised significantly above the (long run) marginal costs toward the monopoly price. This approach allows us to actually measure the degree of market power observed from market data, even without taking strong views on what the relevant market is.

This economic approach faces two problems. First, it *seems* to equate dominance with the act of setting high prices, something which lawyers, regulators and courts are unwilling to do, as they consider the ability to raise prices and the action of price-setting two different things. Second, the significant market power approach faces problems due to the difficulty of measuring market power. In practice, it typically cannot be established whether a price is close to the monopoly price or whether it is close enough to some relevant cost measure. In case law, this is reflected in the fact that virtually no cases with abuse by high prices are ever brought up, and the few that are, do not seem to succeed in courts. This problem is mitigated in merger policy, where one only needs to establish that the merger results in a substantial gain in market power. Here, we need to estimate whether the merged firm has a significant incentive to raise prices, which is much easier task.

Let us consider the impact of a horizontal merger on the incentives to raise prices unilaterally. As the merging firms produce substitutes, a price increase by one firm

will lead to some consumers switching to the other. The closer substitutes the products are, the greater is the shift of customers to the substitute. In this way competition limits the ability of a firm to raise prices profitably. After a horizontal merger, the new entity will not loose as much from a given price increase, as part of the substitution is to its own products. Hence, the incentive to raise prices will be increased. Further, when prices across the product range are raised jointly, there is no substitution induced between these products anymore, as the competitive constraint the merged companies were exercising on each was eliminated.

Baker and Bresnahan (1988) have shown how this change in the incentives to raise prices can be estimated more easily than the overall price-cost margins in the industry. By just looking at the prices and the quantities sold by a single firm, we can estimate the "residual demand elasticity". Residual demand elasticity measures customer substitution in manner such that it also captures the (equilibrium) reactions of all other firms in the market. In merger assessment, we want to know how this residual demand elasticity changes as the firm mergers with a competitor. Since the goods are substitutes, the residual demand elasticity is decreased; thus the demand reaction from a given increase in prices is smaller. The change in the residual elasticity of demand is very small if the rest of the market still imposes a strong competitive constraint on the post-merger company – for instance, if the merged firm is a small part of the market. The change in the elasticity is large if the merger increases market power substantially.

One can also estimate jointly the residual demands for any two products. This exercise will give the desired estimate of the post merger residual demand elasticities. The more the demand elasticities fall, the less is the loss of demand due to price increases, and the more prices will rise as a result of the merger. We can therefore measure the increase in market power from the merger using pre-merger data. The simulation methods are based on this idea, and their use has proliferated in the U.S. during the last ten years.[18] This methodology allows us to measure the market power and the changes in it without first taking strong views regarding relevant markets. This is very useful especially on markets characterized by product differentiation.

A limitation for this methodology is that three important factors for merger analysis remain out of the analysis, as cost structures, competitive behavior, and entry incentives are assumed to remain unchanged. Often, these assumptions are not correct. We can estimate the unilateral price effects due to observed variation of price in the data, so that we can estimate the relationship between movements in price and output of the merging firms. However, behavior under the post-merger cost structure is never observed pre-merger. Similarly, entry incentives post-merger cannot be estimated from pre-merger data. These are purely counterfactuals and we have to rely on theoretical reasoning or other ways of eliciting information to find estimates or "guestimates" for these effects.

In any event, the market power possessed by any firm can be divided into three components, two unilateral and one coordinated effect: market power due to product differentiation, fewness of sellers, and coordination. This paper focuses on the coordinated, not unilateral effects, and therefore we need to evaluate the incentives to collude and the credibility of the threat of punishment. Nevo (2000, 2001) has extended the methodology discussed above and developed econometric methods to empirically decompose the market power possessed by any firm into the three components, and to empirically measure the significance of each of the compo-

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[18] For more on empirical merger simulation and measurement of unilateral effects in case law, see, e.g., Baker and Rubinfeld (1999) and Werden (1997).

nents. Nevo (2000, 2001) used the techniques to evaluate competition and market power on the U.S. breakfast cereal market and Slade (2002) and Pinkse and Slade (2002) used the same techniques to evaluate the U.K. beer market. But before we can discuss empirical issues, we should first discuss the economic theory of collusion, on which the policy regarding coordinated effects and parallel anticompetitive behavior is based on.

Before turning to the analysis of collusion, let me comment briefly on a topic that also seems to cause some confusion. When two or more firms merge, and they gain market power, the post-merger firm will often want to increase its prices. Then, the remaining rivals may want to follow and increase their prices also. This is not coordination of market conduct. Under price competition, for any firm, the profit maximizing reaction to a price increase by one of the rivals is to increase its own prices. This is then a unilateral effect, as here the price increases are unilateral and profit-maximizing acts for each of the firms without any coordination (unless the firms are colluding). In empirical analysis, these price effects are picked up by the measurement of unilateral effects as discussed above.

4. Collusion in Economic Theory

4.1 Basic Theory

Game theoretic models of repeated oligopoly markets – mostly developed between mid 1970s and mid 1980s – support the conclusion that firms interested in both future and current profits may adopt strategies which are more profitable than the equilibrium strategies in single period competition.[19] Virtually all of the models of collusion have following logic: There is some pricing norm, say monopoly price, or some other commonly accepted policy, firms are supposed to follow. If everyone obeys this norm, everyone expects everyone else to stay with the norm in the future. However, if anyone deviates, they all expect everyone else to revert to a more competitive price norm, a price war, say. In economics, this switch is called "punishment". This mechanism does not rely on how the coordinated non-competitive norm came into existence. It may have been through an explicit agreement, explicit communication, the result of learning, or it may have arisen in some other manner.

For instance, the only possible equilibrium in a one-shot price competition with homogeneous products requires each firm to set price equal to marginal cost, which leaves them zero (economic) profits. However, while this is true when the firms meet and compete only once, it need not be true if the firms compete repeatedly. If a sufficiently high valuation is placed on future profits, an equilibrium exists in which all firms adopt a strategy of charging the monopoly price if its rivals charged the monopoly price last period, but revert to marginal cost pricing in all future periods if any rival charges a price below the monopoly level.

In this example, collusion between firms is held together by the threat of punishment to those who defect. All firms abide by the collusive agreement, because each does better than if aggressive competition ensues. What is crucial is that the threat of punishment is credible, i.e., that the firms will actually want to resort to more

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[19] As there already exists some high-quality surveys on basic oliogopoly theory accessible by non-economists (see, e.g., Europe Economics, 2001; NERA, 1999; and Phlips, 1995), I will not discuss basic issues in detail. Rather, I will briefly explain the basic theory, and then discuss some recent advances that seem particularly relevant for policy issues.

aggressive competitive mode, should someone deviate from the non-competitive norm. If the threat of serious enough punishment is not credible, then the firms cannot uphold collusion, as the temptation to deviate outweighs the costs.

The higher the prices are, the harder it is to sustain collusion, as the short run gains from cheating increase with prices more rapidly than does the difference between cooperative and competitive profits. Equally, the closer collusive prices are to competitive levels, the smaller is the value placed on future profits which is necessary to sustain the collusion. Then, when perfect collusion is not possible, e.g., for the reasons discussed below, firms can support collusion by coordinating on prices below the monopoly price but above the (imperfectly) competitive price.

The degree of how much future matters depends on a number of factors. Typically, the longer the reaction lag to a deviation from the norm, the longer the relevant time period, the more heavily future profits are discounted. This is intuitively appealing: the longer it is possible to reap the benefits of cheating before rivals react, the more likely it is that cheating will take place. Firms will also discount the future according to their expectations of the duration of the game. If firms think that the current market conditions are only likely to prevail for a limited period, they are more likely to cheat. This again accords with one's intuition of tacit collusion being more prevalent in stable markets. Conversely, tacit collusion seems highly unlikely to occur in dynamic markets in which the nature of the game being played may change radically from one period to the next.

There are many game theoretic models of dynamic oligopoly that enrich the simple model outlined here. For example, Levy and Reitzes (1992) argue that homogeneity of products is not a key feature of stable collusive arrangements. Instead, they argue that differentiated markets may equally well suffer from collusion. They further arguer that collusion may be facilitated by merger, especially in the case where non-neighboring firms closest (in product space) to a would-be cheater merge, as this enables them to monitor more effectively the actions of the potential maverick firm. Merger between such firms also allows them to share the cost of punishing the cheating firm, eliminating a free-rider based impediment to the enforcement of the collusive agreement.

Green and Porter (1984) and Abreu et al (1986) study collusion when cheating cannot be detected perfectly, as the firm's actions are not observed by the rivals nor detected from observed demand or prices. In these types of situations, firms are faced with an inference problem. For any firm, sales lower than anticipated could be the result of cheating by a competitor or adverse demand conditions. Consequently, price wars may be started either by cheating or by a demand pattern. Green and Porter (1984) argue that periodic reversion to competitive behavior may be a characteristic of stable collusive behavior. In equilibrium, the incentive structure is designed to guarantee that firms do not deviate from agreed-upon prices in collusive periods, yet price wars will still occur, as random demand shocks will occasionally induce large discrepancies between anticipated and actual sales. Industry profits are maximized at price levels between the competitive and the monopoly levels, as setting prices at monopoly levels provides too high incentives to cheat and requires too costly punishments. The greater the level of demand uncertainty, the closer the cooperative price is to competitive level. This is because high levels of demand uncertainty increase the frequency of price wars. Limiting their duration can reduce the costs of these price wars. But, in turn, this reduces the cost to any individual firm of cheating.

Rotemberg and Saloner (1986) present a different explanation of fluctuations in collusive behavior. Even when, as in their model, firms can observe one another's output decisions, so that there is no uncertainty about whether a competitor has

cheated on a collusive agreement, successful collusion still requires that firms have an incentive not to cheat. The ability to raise price over the competitive level depends on the relative size of contemporary competitive profits and future collusive profits. For example, an increase in current period demand increases the incentive to cheat, requiring an adjustment in the collusive price to prevent cheating. Thus, even though firms never cheat and the collusion never breaks down, the collusive price fluctuates in response to shocks to demand, as the degree of collusion fluctuates with the incentives to deviate.

The failure to reach perfectly collusive outcomes has also been explained in the literature as a consequence of incomplete information. Incomplete information problems arise when firms have private information, e.g., about their own costs but do not know some or all of the equivalent information about their rivals. For instance, Cramton and Palfrey (1990) show that only if the industry is sufficiently concentrated, it is possible to construct collusion which is both compatible with individual incentives and individually rational, i.e., gives an incentive to all firms to take part in the cartel agreement.

Overall, the conclusions from the analysis of collusive agreements can be summarized as follows: (i) Collusion is most likely on markets with high degree of concentration. There are basically three reasons: cheating is more easily spotted with few firms; being a part of a competitive fringe which competes with the cartel becomes more attractive the more firms there are in the cartel; and it may not be possible to construct an agreement which induces the revelation of necessary information by the members if there are too many firms involved. (ii) For collusion to be an equilibrium (in dynamic sense), it is essential that a concern over future profits as well as current profits motivate each firm. (iii) It is necessary in any collusive arrangement that each side is able to monitor the actions of others, since secret price cutting must be detectable, even if only imperfectly, for retaliation to be possible. (iv) Collusive schemes work best when there are fewer noisy variables, e.g., when demand patterns are predictable. As a result we would expect greater levels of collusion in industries where institutions allow for precise monitoring of rivals or in mature industries characterized by low demand variability.

The results above form a theoretical base for the analysis of joint dominance, and especially for the Commission's "checklist" mentioned above. However, these conclusions were drawn from studies focused on competition between symmetric firms on stable markets, and thus have limited scope of application. Introducing market dynamics and firm heterogeneity can dramatically alter the nature of collusion. Assuming symmetric firms allows one to study the impact of a uniform change in all firms' capacities, but does not allow the analysis of individual changes in capacity. Similarly, changing the number of symmetric firms hardly provides helpful guidance for merger appraisal.

4.2 Recent Developments

Let me then turn to some recent analysis of collusion that provides some light on the operation of collusion in more realistic settings. More recent analysis has looked at how firm heterogeneity (e.g., differences in cost structures), capacity constraints, and market dynamics affect the possibilities to sustain collusion. Analyzing collusion with asymmetric capacity constraints is unfortunately quite difficult. Few earlier studies have suggested that asymmetry in firms' capacities hurt possibilities for collusion. But also asymmetric firms can maintain collusion if they believe that undercutting their rivals would trigger a price war and thus harm future profits, as the potential short-term gain from a deviation is then outweighed by the long-run losses from the price war. Bernheim and Whinston (1990) show that tacit collusion is easier when firms have symmetric costs and market shares.

Vasconcelos (2001) investigates how asymmetry in costs across firms affects the scope for collusion. He assumes that firms have different shares of a specific asset (say, capital) which affects marginal costs. He shows that joint profit maximization implies that output is shifted away from small (inefficient) firms towards large (efficient) firms. This implies that the smallest firm in the industry is the one that has the highest potential to steal the business of its rivals and, hence, has the highest incentives to disrupt the collusive agreement. In addition, he also shows that the incentives to deviate are exactly reversed when the equilibrium calls for punishments. Since the largest firm is the one that proportionally loses more at the one period severe punishment, it will have the highest incentives to deviate from the punishment strategy.

In spite of the simplifying assumptions on the demand and cost functions used, Vasconcelos' results offer interesting implications for merger policy. The analysis suggests that whether the structural change implied by a merger creates more favorable conditions for tacit collusion depends on which firms the merger involve. It is shown that two different effects arise: If firms were already colluding before the merger takes place, then the merger will only have effects on the scope for collusion if it affects the size of the largest firm in the industry. A merger increasing the size of the largest firm gives rise to a more asymmetric distribution of assets and this offsets the increased risk of anticompetitive behavior due to higher concentration. If, instead, firms were not colluding before the merger, then a merger might make collusion enforceable afterwards. This will occur when the merger involves very small (and, hence, inefficient) firms, which turn out to have very high incentives to disrupt the collusive agreement.

Capacity constraints affect the basic insight in two ways: they reduce both the incentives to deviate and the severity of price wars. Davidson and Deneckere (1990) and Lambson (1996) show that asymmetric capacities make collusion more difficult. Compte et al. (2002) explore asymmetry of capacities in further detail, and show that the introduction of asymmetric capacities indeed hurts collusion when the aggregate capacity is limited. However, asymmetry may help collusion when the aggregate capacity is much larger than the market size. It turns out that the largest firm has the highest incentives to disrupt the collusive agreement. Compte et al. show that to facilitate collusion when the total capacity is small relative to market demand, the retaliation possibilities of the smallest firms should be maximized. That is, if the aggregate capacity of the smallest firms is increased, possibilities to collude are increased. Starting from any asymmetric situation, a merger transferring some capacity from the largest firm to a small one then both enhances the small firms' retaliation power and limits the large firm's incentives to deviate, and thus increases possibilities for collusion.

The logic in Compte et al. is similar to that of Vasconcelos discussed above, although some of the conclusions are the opposite. In the absence of any capacity constraint, the standard result applies: any merger facilitates collusion because it reduces the number of competitors, whereas any divestiture makes collusion more difficult to sustain. In contrast, when capacity constraints are more severe, or when their distribution is very asymmetric, any merger involving the largest firm hurts collusion. The reason is that the largest firm now has the highest incentive to deviate and the least incentive to take part in punishment, and such a merger precisely reduces small firms' ability to retaliate by transferring some of their capacity to the largest firm, and may moreover exacerbate the large firm's gains from deviation if it was initially capacity-constrained. Forcing the large firm to divest part of its capacity might facilitate collusion.

Intuitively, the incentives to stay in a collusive equilibrium are very different for large and small firms. A small firm will have some incentive to cheat in the short

run, as it can only increase its sales marginally up to the capacity level. A large firm, in contrast, has a lot more capacity available and can gain more customers with the same price deviation from the collusive norm. Hence, large firms tend to have a greater incentive to deviate from the collusive price. On the other hand, the asymmetry in capacities will also have an important effect on the effective punishments that can be imposed on the different firms. In particular, the worst punishment a firm can impose on its competitors is to produce up to full capacity. However, if a small firm is already producing at almost full capacity, it only has low possibilities to punish rivals that do not follow the collusive norm. Hence a large firm competing with a small firm will have large incentives to deviate from any collusive norm, without this being disciplined by much of a threat of lower prices or output in the future. In this sense increases in asymmetries in the capacities make collusion more difficult.

These two analyses suggest merger guidelines that differ from traditional wisdom. In particular, for a given number of firms, the Herfindahl or other standard concentration tests tend to predict that a more symmetric industry is more likely to be more competitive. Vasconcelos and Compte et al. instead suggest that asymmetry may be pro-competitive. A sufficiently asymmetric industry may even more than compensate for a reduction in the number of firms in a merger involving a large firm: increased asymmetry hurts collusion and may thus benefit competition.

De Roos (2000) and Fershtman and Pakes (2000) develop models of collusion with heterogeneous firms operating in a changing environment. In these models, firms explicitly consider the entry, exit, and investment decisions of incumbents and potential competitors. In de Roos (2000), the collusive agreement specifies that, for the life of the agreement, firms receive shares in the cartel profits based on their market shares at the time of the agreement. This reflects the inability of competing firms, and a recent entrant in particular, to credibly convey key information that would determine its market share under collusion. The implication is that a prospective entrant must establish itself through a price war before it can receive favorable terms from a collusive agreement. In contrast, in the model of Fershtman and Pakes, an entrant will often anticipate entering a comparatively benign industry in which collusion is maintained despite entry. Fershtman and Pakes find that collusion is particularly hard to sustain if one of the firms is likely to exit in the near future.

In most of the literature on collusion, punishment is intended to deter deviation from the collusive agreement by any firm attempting to skim additional profits in the short term before its competitors can detect its deviant behavior and coordinate a response. In de Roos (2000) the flavor of punishment is quite different. The punishment is more characteristic of a general deterioration of the agreement. That is, a firm will willingly invoke the punishment regime if it no longer believes the collusive agreement is in its interests. De Roos argues that the nature of the most severe price wars is more consistent with a bargaining and renegotiation process than with problems of imperfect monitoring and demand uncertainty. The crucial trade off for the entrant (or for a firm with a small capacity relative to its competitors) can then be summarized as follows. Should the entrant agree to collude today, it can enjoy collusive payoffs immediately, but will have a minor share in the collusive agreement for its working life. If the entrant waits, it obtains the reduced profits arising from the non-cooperative regime, but has the prospect of a potentially much larger share of the collusive regime in the future. The results suggest that if incumbent firms permit entry and investment in an industry with collusive possibilities, we might expect to see a rich set of firm behavior: in equilibrium, we will observe periods of successful collusion, price wars due to entry and punishment, and entry deterrence.

4.3 Semicollusion

Often firms have many instruments to use in competition: price, capacity, product quality, marketing expenses, etc. The analysis above implicitly assumes that firms are equally able to collude on all these instruments. Since prices are more flexible than most other choice variables, it follows from the theory of repeated games that it is easier to collude on prices than on other variables. What then happens when collusion is successful only on some, say price, but not on other instruments, say capacity? This type of scenario is called semicollusion.

Suppose then that firms are able to collude on prices but not on capacities, and that originally firms have enough capacity to just fulfil demand at the monopoly price. Then each firm has an incentive to increase its capacity and try to steal market share from its rivals. Firms could even install more capacity under semicollusion than under (imperfect) competition, which then leads to prices below competitive prices.[20] This is exactly what happened in the Norwegian cement cartel, as argued by Steen and Sørgard (1999), and in the Norwegian airline markets as argued by Salvanes et al. (2000). Thus, partially collusive market might be more competitive than the same market without any coordination -- competition in capacity can more than outweigh the lack of price competition. However, note first, that building capacity takes time, so even in quite long run, collusive effect can dominate the overinvestment effect. Second, once the firms understand the adverse effects, they might be able to mitigate the problem of too much competition by renegotiating the collusive "agreement". In any event, under partial collusion, firms have an incentive to overinvest in or overuse those instruments of competition that they are not colluding with. This is something competitive appraisal should take into account when analyzing joint dominance.

Now, let us look at the opposing situation: firms are able to collude on capacities but not on prices, e.g., because they cannot detect secret price-cuts. This is not unlike the reasoning European Commission seemed to have in mind in the *Airtours / First Choice* case.[21] Now, price competition does not undermine capacity collusion. Firms have less incentive to offer secret discounts or revert to competitive conduct, knowing that the rivals are unlikely to steal market share, as they are restricted by their capacities. Then semicollusion would lead to equally bad outcome as full collusion. But this conclusion in not necessarily true, if there are externalities present in the colluding instruments, and when non-cooperative behavior leads to over- or underuse in these instruments relative to social optima that cooperation can mitigate.

Prices are more flexible than most other choice variables, and so it is easier to collude on prices than on other variables. This casts some doubt that allowing *Airtours* merger would have lead to collusive behavior. Most theoretical studies of semicollusion assume collusion in the product market (either on prices or quantity) and competition along other dimensions such as capacity, R&D, advertising, or location.[22] This is not to say that the other alternative is impossible. For instance, Foros et al. (2001) argue that in the mobile communication market, there seems to be collusion on the investment stage (network infrastructure to increase geographical

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[20] This conclusion depends crucially on the details of the collusive "agreement" between firms. Firms might be able to understand how to design "an agreement" or find some other means that take care of this problem.

[21] See also Motta (2000).

[22] For a survey of the literature, see Fershtman and Gandal (1994) or Phlips (1995), Chapters 9 and 10.

coverage, capacity in a given area, and functionality) and competition on the market stage (pricing).

Should semicollusion also be interpreted as joint dominance? The CFI ruling in the *Airtours* seems to indicate the affirmative, although the CFI overturned the Commission's decision in this particular case. According to the CFI, the failure of the Commission's case lay in its treatment of the facts, not in the theory. The CFI has not rejected the theory of joint dominance by collusion in the setting of capacity followed by price competition put forward by the Commission. On the contrary, the CFI has implicitly accepted that this collusive mechanism is based on some potentially plausible economic models of tacit collusion, and re-affirmed that the Merger Regulation can be used to deal with collective dominance concerns. This is sensible, as also partial collusion can lead to market problems similar to those in traditional unilateral dominance.

5. Empirical Evidence

If collusion is very rare, the theory discussed above is not much more than curiosity, and collusion is then not a policy problem we should expect to meet in many markets. But if collusion is widely observed in experiments and in real markets, we need to understand how it is sustained and how to shape policy to deal with the problem. Second, one would want to use empirical evidence in case law to conform the conclusion of joint dominance or the lack of thereof.

As discussed above, the collective exercise of market power is not compatible with the short-term profit incentives, so that firms need some mechanism to enforce collusion, and repeated interaction provides such a mechanism. However, many collusive outcomes can be supported by repeated interactions. Firms need not only to establish adequate incentives (or ensure equilibrium conditions) but also to coordinate on a particular collusive outcome (or solve a problem of equilibrium selection). Whether firms can obtain some basic understanding with each other's, or some form of reassurance, is likely to matter. For instance, firms need some reassurance about the fact that competitors understand the logic of their interaction, or about the fact that competitors also take a long-term view of the market. It would seem in principle that communication between firms might help in achieving this.

Empirical evidence on whether collusion is "easy" with or without communication, whether communication helps, or what type of communication is necessary or useful is hard to come by because outcomes in real market circumstances are complex and hard to evaluate. There is however one alternative methodology in economics which can shed some light on the issue, namely controlled experiments. The idea is to create situations in the laboratory that resemble real life, and to study how agents behave in this artificial market. The basic set up involves financially motivated subjects who take typical business decisions and compete against one another in specified market environments. This method allows for a precise control of particular market characteristics so that the effect of these characteristics can be isolated, and experiments (unlike real live) can be replicated. Let me first review some of the experimental evidence we have on collusion. I will look at econometric evidence and analysis below in Section 5.2.

5.1 Experimental Evidence

Many experiments have studied repeated market games where firms set prices or quantities in laboratory environments. Very simple laboratory environments are es-

pecially useful for isolating the effects of communication, repetition, payoff symmetry, and other factors that may enhance or retard cooperation.

In one of the early studies, Fouraker and Siegel (1963) matched subjects in groups of two or three for a sequence of identical market periods. In the duopoly markets, industry outputs were often below the static equilibrium levels, which indicates that some tacit collusion developed in these repeated games. In the three-seller markets, about two-thirds of the industry outputs were above the one-shot profit-maximizing output, i.e., most of the triopoly participants exhibited rivalry rather than tacit collusion. About half of the triopoly outcomes were very close to the perfectly competitive output prediction, despite the fact that this yielded almost zero profits. With incomplete information about others' profits and only information about the sum of others' quantity decisions, triopoly outcomes were closer to the static non-cooperative equilibrium.

In his survey of laboratory research, Holt (1993) concludes that repetition has been observed to increase cooperation. However, even very long sequences do not necessarily generate perfect collusion. Moreover, there is no direct evidence to support the view that threat of punishment will result in cooperative outcomes in multi-stage games without any communication. Typically, an increase in the numbers of sellers results in more competitive behavior. But with more than three participants, there seems to be little or no evidence for a "pure numbers effect" that is measured by changing the number of sellers in a way that does not alter the incentive structure. With two sellers, a defector can be punished directly without harming a cooperative third party, and there is some evidence that the possibility of direct punishment enhances cooperation.

Holt (1993) also concludes that the effectiveness of non-binding communication in inducing cooperation seems to be sensitive to the trading institutions used in the experiment and the incentives to defect at the margin; the effect is greatest with posted prices and differentiated products, and the effect is less in double auctions (i.e., on markets where both buyers and sellers post bids, e.g., as in stock exchanges). Other factors, such as decreasing costs and the nature and timing of messages, are probably also important. Future work on communication could be usefully focused on designs that parallel specific environments that may come up in antitrust cases, e.g., the trade press announcements of price changes, posting of future prices in computerized listings, and sellers' ability to confirm buyer-specific price quotes with each other.

Huck et al (2000) also report experiments with four players who decide either on prices or quantities. They find that when firms are only informed about the aggregate output and aggregate profits after each round, the outcome is not significantly different from the (imperfectly) competitive equilibrium. They also consider an environment where firms have disaggregated information about their competitors' strategy and profits. Remarkably, they find that behavior is no more co-operative than in the environment where only aggregate information is available. In the case of quantity competition, observed quantities and profits are then even lower than in the static equilibrium. The authors interpret these observations by suggesting that firms follow an "imitation" strategy. Indeed, when firms tend to follow the strategy of competitors who are relatively more successful, the market converges to the competitive outcome. Consistent findings are reported in Harstad et al (1998). These authors consider a repeated pricing game in which firms are informed about the price of their competitors after each period. In most of their experiments prices remain around the static equilibrium level, which indicates that there is no collusion. In remaining experiments prices are more variable but margins remain low on average.

This evidence tends to cast some doubt on the conventional wisdom that the dissemination of individual firm data should be much more of a concern from a public policy perspective than the dissemination of aggregate information. One possible interpretation of this evidence is that disaggregate firm data, which is arguably essential to detect potential deviation by competitors, is irrelevant as long as firms have not established some sort of focal point. To the extent that such focal point can be established by pre-play communication, there may be a complementarity between ex post information exchanges and ex ante communication.

As discussed above, pre-play communication presumably helps both to establish some basic trust or reassurance among players and to select a particular outcome. In principle, pre-play communication does not carry any commitment value, as it is "cheap talk". However, "cheap talk" can perform a useful function. It can be used in order to signal private information (with the constraint that the sender of a message cannot be punished for lying and hence commit not to lie, if it is advantageous for him to do so). Such a form of communication will be useless when the interests of the players are perfectly opposed. However, in markets, there is some commonality in players' interests and communication via cheap talk can be informative. Harstad et al. (1998) consider an environment where four players set prices in a repeated market game in which actual prices, sales and payoffs are communicated after each stage. They compare a situation without prior communication with one in which players can make repeated multilateral announcements at each stage. When communication is allowed, prices are in general no longer set below the imperfectly competitive level. In half of the experiments, prices hover around the imperfectly competitive level. In the others, some attempt to co-ordinate is observed, to the extent that some firms try to set relatively high prices early on in the game. However, prices tend to decline over time and to converge to the imperfectly competitive level. Overall conclusion drawn from experiments supports the view that the complexity of the environment is a significant impediment to coordination and that communication is of limited help in overcoming the difficulty.

The experiment in Muren and Pyddoke (1999) tests the hypothesis that the real difficulty for the tacit collusion lies in how to reach an agreement on price and output. To remove the need for communication, they suggested to the prospective cartel members how to coordinate their actions. In addition, the formation of a cartel was encouraged by the experimental design in that all sellers had identical costs, which was common knowledge, and in that they interacted for at least nine periods with the same subjects. The subjects were not able to communicate or to identify one another at any point in the experiment. Consistent with the findings above, also Muren and Pyddoke (1999) found that with three firms per market, no collusion arose.

With two firms, there were instances of collusion where sellers took turns at a price well above cost. Collusive prices built up gradually but none of the cases achieved the monopoly price. These results are in accordance with the "numbers effect" identified by Holt discussed above. Muren and Pyddoke (1999) also ran an entry "disturbed" two-seller markets, where a third, simulated player entered with a known probability. In this market collusive prices were below the undisturbed two-seller case. Comparing the two, they found that collusive prices did not build up gradually in the disturbed treatment. On the basis of these experimental results, Muren and Pyddoke suggest that collusion operates as follows. Market cooperation is dependent on firms being able to trust one another, in the sense that the seller whose turn it is to win can trust that the other seller(s) will offer support and charge high prices. In the absence of communication, cartel members will offer support reciprocally to one another, if they know that they alone are responsible for the gains or losses of their co-conspirators. In the two-seller treatment one seller is always completely responsible for the other seller's gain, which facilitates the work-

ing of the collusion. In the disturbed two-seller markets and, even more, in the three-seller market, the presence of another potential defector reduces or removes personal responsibility and induces lack of support.

To summarize, communication seems to help in sustaining collusion. The effect seems to be large and significant in simple environments. However communication does not appear to be very effective in overcoming difficulties of co-ordination in more complex settings. In typical market games, the effect of communication on the price-cost margins is modest and not very significant. The literature on economic experiments thus does not seem to support the presumption that collusion is "easy" without communication.[23]

5.2 Econometric Analysis

Despite the substantial theoretical literature on the factors facilitating or hindering collusion, empirical studies of the formation and sustainability of collusion using direct evidence are rare. Moreover, these studies have produced somewhat mixed results. While some findings suggest that product differentiation hinders collusion, this is not confirmed by others. Collusion is more likely in concentrated industries according to some studies, but not according to others. And while some find a positive link between capital intensity and the incidence of collusion, some find no link between the ratio of fixed to total costs and collusive conduct. A possible shortcoming of these studies is that the data either originate from antitrust cases and may therefore be subject to selection bias, or relate to export cartels, which cover only a very small fraction of total economic activity. Also, some of the earlier studies rely on correlations rather than regression analysis for their results, so they may not adequately control for links between the various factors examined. There is also an empirical literature on the issue of cartel duration. These studies have focused on the impact on cartel stability of various organizational features of cartels, demand uncertainty, and the business cycle, in addition to structural industry characteristics such as concentration. Probably the most robust prediction from this line of research is the negative effect of demand uncertainty on cartel stability.

In a recent study, Symeonidis (2002) examines the impact of several structural industry characteristics on pricing conduct using an unusually comprehensive data set on the incidence of collusion across British manufacturing industries in the 1950s. By examining the agreements registered under the 1956 Restrictive Trade Practices Act, as well as several other sources on competition in British industry in the 1950s, he is able to identify those industries that were subject to restrictive agreements at the time the Act was introduced. His sample contains some 150 four-digit industries, nearly half of which were subject to collusive pricing agreements in the mid- and late 1950s. The econometric results, based on a comparison of industries with and without cartels, suggest the following. Collusion is more likely the higher the degree of capital intensity. It is less likely in advertising-intensive industries than in low-advertising industries. There is some evidence that collusion is more likely under moderate market growth than in a market with declining or stagnant demand, but less likely under fast growth than under moderate growth. In Symeonidis' data, there is no clear link between concentration and the likelihood of collusion once one controls for capital intensity, although an inverted-U relationship is present when no account is taken of the potential endogeneity of concentration. Finally, he finds weak evidence that collusion may be less likely in R&D-intensive industries than in low-R&D industries.

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[23] See also Neven (2001) and Davis and Holt (1998).

Porter (1985) tests the theoretical predictions of collusion models using data on the behavior of the US Joint Executive Committee railroad cartel between 1880 and 1886. This cartel satisfied the assumption of a homogeneous good and took the form of market share allotments. Total demand was quite variable and the actual market share of any particular firm depended on both the prices charged by all the firms and on unpredictable market forces. Porter finds that the operation of the JEC conforms to the theoretical collusion model of Green and Porter (1984) discussed above (Section 4.1). In particular, he finds that as the number of active firms increased from four to five, collusion became more difficult to enforce. He also found that, when the average duration of price wars decreased, there was a dramatic increase in the frequency of their incidence. Ellison (1994) reexamines the experience of the JEC to assess the applicability of the Green and Porter (1984) and Rotemberg and Saloner (1986) theories of price wars. He estimate a number of dynamic models to explore the causes of price wars, the cyclical nature of pricing, and the possibility that secret price cuts may have been given, and provides some support for the predictions of the first theory.

Symeonidis (2002) and Porter (1985) were an analysis of an explicit cartels. The question of whether there is competition or coordination was solved at the outset. From the policy perspective, more interesting questions are, From the data available, can we draw conclusions whether firms on some particular market are colluding or competing? Can we empirically measure and decompose observed market power to unilateral and coordinated effects?

New developments have made it possible to do just this. The idea is the following. Assume three industry structures, two hypothetical and one actual: single-brand or single-product firms; the observed structure, i.e., few firms with many brands each; and a multi-brand monopolist producing all brands on the market. The markup (relative difference of price and a relevant cost measure) in the first structure is due only to product differentiation. In the second case the markup also includes the multi-product firm's portfolio effects. Finally, the last structure produces the markups based on full collusion (or joint ownership). Then one can compare the predicted and observed price-cost margins, and choose among the three conduct models. For instance, if all the observed markups are explained by the single-brand model, then all the market power is due to product differentiation, and the number of firms on the market is basically irrelevant; if the observed markups are not explained by the first two models, then market power is basically due to collusion only. The method obviously requires that one can estimate demand and cost parameters, basically own price and cross-price elasticities and marginal costs. Sometimes one can also have engineering and other direct cost data. This obviously helps in the analysis.

Nevo (2000, 2001) analyzed the competition on ready-to-eat cereal in the U.S. markets using the method described above. He takes demand as a function of product characteristics, heterogeneous consumer preferences, and unknown parameters. He uses a panel of quantities and prices for 25 brands of cereal in up to 65 U.S. cities over a period of 20 quarters, collected using scanning devices in a representative sample of supermarkets. By extending the developments in techniques for estimating demand and supply in industries with closely related products (see the discussion on measuring market power above in Section 3), he is able to estimate demand parameters such as own price and cross-price elasticities. These estimates are then used to compute the price-cost margins implied by three hypothetical industry structures: each brand on its own, current structure of few multi-product firms, and perfect collusion. Despite the fact that he observed only a crude measure of actual price-cost margins, Nevo was able to distinguish between the mark-ups predicted by these models.

High concentration, high price-cost margins, large advertising-to-sales ratios, and numerous introductions of new products characterize the ready-to-eat cereal industry. Earlier commentators have concluded that this is a classic example of an industry with nearly collusive pricing and intense non-price competition. However, Nevo's results suggest that the markups implied by the current industry structure and the assumption of imperfect competition match the observed price-cost margins. Even though price-cost margins were as high as 45 %, the conclusion was that pricing is approximately non-collusive. According to Nevo, high price-cost margins are not due to lack of price competition, but are due to consumers' willingness to pay for their favorite brand, and to the pricing decisions by firms that take into account substitution between their own brands. The market power in this industry is entirely due to the firms' ability to maintain a portfolio of differentiated products and influence perceived product quality through advertising. It is these two factors that lead to high price-cost margins in this industry, not collusion.

Also Pinkse and Slade (2002) and Slade (2002) used similar techniques to analyze market power in U.K. brewing industry. Their demand data are a panel of brands of draft beers that have at least one half of one percent market share on a regional market. The panel includes 63 brands that are sold in two regions of the country (Greater London and Anglia) in two bimonthly time periods (Aug/Sept and Oct/Nov 1995) and in two types of pubs (so-called multiples and independents). Cost data came from the UK Monopolies and Mergers Commission, who had performed a detailed study of brewing, wholesaling, and retailing costs. The industry at the U.K. level is characterized by moderately high margins (approximately 30 %), a relatively large number of producers (about 60), a much larger number of brands (many hundreds), and moderate to high concentration (Herfindahl-Hirshman index is approximately 1 800). Furthermore, the product — beer — is differentiated along several dimensions. For example, brands can be grouped into discrete classes, such as lagers, ales, and stouts, and they can be measured along continuous dimensions, such as alcohol content. Finally, in recent years, both the structure of the industry and consumers' demand for product characteristics have witnessed dramatic changes.

Pinkse and Slade were able to empirically decompose the observed price-cost margins into the three factors. The differentiation effect is due to the fact that brands of beer are not identical and consumers differ in their tastes for beer characteristics. This effect accounts for about three quarters of the total margin. The concentration effect is due to the fact that there are 10 rather than 63 brewers present on the geographic market. This effect accounts for the remaining quarter, which means that there is nothing left over to be explained by collusion. In other words, whereas substantial market power is uncovered, all of it is due to unilateral effects, and no evidence of coordinated effects was found. In particular, there is no evidence of a dominant group. In addition, whereas brand characteristics appear to be important determinants of margins, firm characteristics do not.

This methodology is not only for academic research, but should also turn out useful in actual case analysis, as simulation methods measuring unilateral effects have turned out to be.

6. Concluding Remarks

Above I have argued that single-firm dominance is equal to strong market power and the ability to increase price above competitive level. Consistent with this idea we should think that joint dominance is the ability of firms to jointly exercise market power and possess the ability to jointly raise the price significantly by coordi-

nating their market behavior. Further, one needs to answer whether the potentially jointly dominant firms are able to act if a single entity. This is nothing else but asking the question to what extent collusion in the market is feasible.

In simple-minded economic models of collusion the answer to these questions is simple. Eliminating one firm from the market always makes it easier for the remaining firms to collude. However, things are not that simple on actual markets. Mergers generally do not lead to the elimination of some firm from the market but they consolidate the assets owned by two firms under control of a single firm. In a real sense, any merger increases the size of the merged entity relative to its competitors in the market. Mergers will combine the productive capacities of firms and will bring their product lines together. In addition, assets like patent holdings or cash flows are combined and can change the competitive position of the firms. Much of the potential efficiency gains from mergers will also come from the recombination of assets that a merger makes possible. These are issues economic analysis has not taken seriously so far.

There are two main reasons why a merger might favor collusion. First, a merger reduces the number of firms, as the lower the number of firms, the higher the scope for collusion in the industry. Second, a merger can lead to a more symmetric firms (distribution of assets, costs, capacities, etc.), and theory predicts that increased symmetry facilitates collusion. The likelihood of joint dominance depends on a series of factors such as market transparency, information exchange among rivals, and the frequency of market interactions. The more an industry is already characterized by the factors that favor collusion, the higher the likelihood of collusion. The analysis of joint dominance will therefore have to take into account all such factors.

Sometimes there are also arguments that joint dominance concerns price reactions of other non-colluding firms to the unilateral price increases induced by a merger. This argument confuses the issues. The analysis of unilateral effects already includes these effects. While it may be sensible to look at the market structure of the remaining market when two firms merger to assess the likely magnitude of price reactions, this is part of unilateral effects analysis, not of the analysis of joint dominance.

Despite the fact that economic analysis of collusion is far from complete, some policy relevant conclusions can be drawn. First, collusion leads to market power and other problems comparable to those created by a single dominant firm. Then it is reasonable to expand the meaning of dominance to also include joint dominance.

Second, we have noted that market power in general arises from three sources: product differentiation, fewness of sellers, and coordination. Product differentiation does not usually arise as something competition policy should worry about. Market power due to product differentiation results from the facts that goods are not identical and consumers differ in their tastes, and from firms' ability to maintain differentiated products and influence perceived product quality through strategies such as marketing. This could be a cause for concern for competition policy if there are strong firms that are able to restrict the marketing and other efforts of actual and potential rivals to launch or reposition their goods. This problem should be picked up by taking care of such anticompetitive actions. Fewness of sellers is an issue for competition policy, especially for merger control. The problem is, this effect might not be dominance, as the concept is currently understood. In the U.S., for instance, the criteria to interfere on a merger is "significant lessening of competition". European Commission has tried to enlarge the meaning of dominance, e.g., by introducing concepts such as portfolio power and joint dominance to the direction of signifi-

cant lessening of competition, with varying degree of success. Coordination is a genuine problem for competition policy, and especially for merger review.

Third, a large firm with a strong market power cannot credibly participate in a low price phase that would be necessary to discipline the incentives to deviate of smaller firms. Then, intuitively, a large firm can have strong market power either because it can operate without the competitive constraints posed by rivals, or because it has colluded with them. But it is not possible for firms other than the strongest to have dominance unless they collude. Therefore, unilateral and joint exercise of market power are mutually exclusive phenomena, and hence, the finding of single firm and joint dominance should also be mutually exclusive. This is a sensible, as policy responses could be the opposite depending on whether one finds unilateral or joint dominance.

Fourth, we now know that firms might be able to collude when they are fairly symmetric, but face increasingly stronger problems colluding as they get more asymmetric, up to a point where collusion is effectively not an issue anymore. Hence, joint dominance should only be an issue between firms that are fairly similar among themselves and quite different from other firms in the industry. The application of this idea may lead to a surprising conclusion that a merger should be allowed if the market is concentrated but not if the market is less concentrated. This is paradoxical only if one forgets both the impact of heterogeneity and that the analysis of mergers is about changes in market structure.

Fifth, collusion may not occur as often as competition authorities seem to believe or what one is lead to conclude if based on the "checklist" analysis. There is some experimental evidence that leads us believe that coordination is not easy, unless there are only two firms on the relevant market, communication between firms is easy or the oligopoly is very symmetrical. There is also some market evidence that firms in even quite concentrated markets do not seem to be able to coordinate their behavior.

Last, there are now empirical methods that can be used to observe and measure the degree of collusion in the markets under appraisal. The competitive assessment in case law need not be based on purely theoretical discussions, or limited to purely structural analysis or mechanistic application of the "checklist", but hard data and market evidence can be used to corroborate the conclusions regarding the presence and degree of collusion. This methodology should prove itself useful in future case law, exactly as simulation methods have already proved themselves in the analysis of unilateral effects.

References

Abreu, D., D. Pearce, and E. Stacchetti (1986), "Optimal Cartel Equilibria with Imperfect Monitoring", *Journal of Economic Theory*, 39, pp. 251-269.

Baker, J.B. and T.F. Breshanan (1988), "Estimating the Residual Demand Curve facing a Single Firm", *International Journal of Industrial Organization* 6:427-44.

Baker, J.B. and D.L. Rubinfeld (1999), "Empirical Methods in Antitrust Litigation: Review and Critique," *American Law and Economics Review*, 1: 386-435.

Bernheim, D.B. and M.D. Whinston (1990), "Multimarket Contact and Collusive Behavior", *Rand Journal of Economics* 21(1), 1-26.

Compte, O., F. Jenny, and P. Rey (2002), "Capacity Constraints, Mergers, and Collusion", *European Economic Review*, 46: 1-29

Cramton, P. and T.R. Palfrey (1990), "Cartel Enforcement with Uncertainty About Costs," *International Economic Review*, 31, 17–47.

Davis, D.D. and C.A. Holt (1993), *Experimental Economics*, Princeton University Press, Princeton.

Davis, D.D. and C.A. Holt (1998), "The Effects of Collusion in Laboratory Experiments", mimeo, University of Virginia.

de Roos, N. (2000) "A Model of Collusion Timing", mimeo, Yale University.

Ellison, G. (1994), "Theories of Cartel Stability and the Joint Executive Committee", *Rand Journal of Economics*, 25, pp. 37-57.

Europe Economics (2001), *Study on Assessment Criteria for Distinguishing between Competitive and Dominant Oligopolies in Merger Control*, Final Report for the European Commission Enterprise Directorate General.

Fershtman, C. and N. Gandal (1994), "Disadvantageous Semicollusion", *International Journal of Industrial Organization*, 12, 141-54.

Fershtman, C. and A. Pakes (2000), "A Dynamic Oligopoly with Collusion and Price Wars", *Rand Journal of Economics*, pp. 207-236.

Foros, Ø., B. Hansen and J.Y. Sand, (2001), "Demand-side Spillovers and Semicollusion in the Mobile Communications Market", mimeo, NHH, Norway.

Fouraker, L.E. and S. Siegel, (1963), *Bargaining Behavior*, New York: McGraw Hill.

Green, E.J. and R.H. Porter (1984), "Noncooperative Collusion Under Imperfect Competition", *Econometrica*, Vol. 52, pp. 87-100

Harstad, R., S. Martin and H.T. Norman (1998), "Experimental Tests of Consciously Parallel behaviour in Oligopoly", in L. Phlips (ed), *Applied Industrial Organisation*, Cambridge University Press, Cambridge.

Holt, C.A. (1993) "Industrial Organization: A Survey of Laboratory Research", in J. Kagel and A. Roth (eds.), *The Handbook of Experimental Economics*, Princeton University Press.

Huck, S., H.T. Norman and J. Oechssler (2000), "Does Information about Competitors' Actions Increase or Decrease Competition in Experimental Duopoly Markets?", *The International Journal of Industrial Organisation*, 18 (1), 39-58.

Kühn, K.-U. (2001), "Fighting Collusion by Regulating Communication between Firms", *Economic Policy* 32: 169-204.

Motta, M. (2000), "EC Merger Policy, and the Airtours Case", *European Competition Law Review*, 21/4 (April 2000), 199-207.

Muren, A. and R. Pyddoke (1999), "Does Collusion without Communication Exist? Some Experimental Evidence", mimeo, Stockholm University.

National Economics Research Associates, (1999), *Merger Appraisal in Oligopolistic Markets*, Report prepared for the Office of Fair Trading, UK.

Neven, D.J. (2001) "Collusion under Article 81 and the Merger Regulation" in *Fighting Cartels – Why and How?*, Konkurrensverket, Sweden.

Nevo, A. (2000) "Mergers with Differentiated Products: The Case of the Ready-to-Eat Cereal Industry", *Rand Journal of Economics*, 31: 395-421.

Nevo, A. (2001) "Measuring Market Power in the Ready-to-Eat Cereal Industry", *Econometrica*, 69:

Phlips, L. (1995) *Competition Policy: A Game-Theoretic Perspective*, Cambridge University Press.

Pinkse, J. and M.E. Slade (2002), "Mergers, Brand Competition, and the Price of a Pint", mimeo, University of British Columbia.

Porter, R. (1985), "On the Incidence and Duration of Price Wars", *Journal of Industrial Economics*, 23 (June), 415-28.

Rotemberg, J.J. and Saloner, G. (1986), "A Supergame-Theoretic Model of Price Wars During Booms", *American Economic Review*, Vol. 76, pp. 390-407.

Rothschild, R. (1999), "Cartel Stability When Costs Are Heterogeneous", *International Journal of Industrial Organization* 17, 717-734.

Salvanes, K.G., F. Steen and L. Sørgard (2000) "Collude, Compete, or Both? Deregulation in the Norwegian Airline Industry", mimeo, NHH, Norway.

Slade, M.E. (2002), "Market Power and Joint Dominance in UK Brewing", mimeo, University of British Columbia

Steen, F. and L. Sørgard, (1999), "Semicollusion in the Norwegian Cement Market", *European Economic Review*, 43, 1775-96.

Symeonidis, G. (2002), "In Which Industries Is Collusion More Likely? Evidence From The U.K.", mimeo, University of Essex and CEPR.

Vasconcelos, H. (2001), "Tacit Collusion, Cost Asymmetries and Mergers", mimeo, European University Institute.

Werden, G.J. (1997), "Simulating the Effects of Differentiated Products Mergers: A Practical Alternative to Structural Merger Policy", *George Mason Law Review* 5: 363-86.

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