

Welfare Effects of Partial Cartels

Some results from the theoretical literature

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Very preliminary – Comments welcome!

1 Introduction

One of the suggested topics for discussion in the workshop is the question ‘under which circumstances cartels typically do not have any (or particularly high) adverse price effects’. In this context, the problem of partial or incomplete cartels, i.e. cartels that do not include all or almost all firms in a market but are comparatively small relative to the overall market, could be of interest.

Partial cartels are not a mere theoretical possibility but there were several cases in the EU as well as in member states where the joint market share of a cartel was significantly below 100%. Some examples are the Methionin, the Citric Acid or the Vitamin C cartel. Another recent example from a member state is the alleged German clay roofing tile cartel that had a joint market share of about 45%. Since, in practice, partial cartels occur quite frequently, the theoretical contributions to the analysis of partially cartelized markets are remarkably scarce, as compared to e.g. the literature on collusion where all firms in a market reach a collusive outcome in a repeated interaction framework.

Some often heard spontaneous reactions to the problem of partially cartelized markets is that their existence is denied altogether. Instead, it is argued that

the market definition is incorrect, i.e. the product market has been delineated too widely. This could indeed be the case in markets with differentiated products where the products under consideration do not belong to the same market but are actually assigned to distinct markets. However, in the case of a homogeneous commodity as e.g. Citric Acid or Methionin, this argument is not convincing. Indeed, there is a variety of cases where partial cartels exist.

A quite intuitive view of the problem of partial cartels is that the size of the cartel relative to the market is reversely related to the potential damage it may cause. At first glance, this argument seems convincing. However, it is not a priori clear that the effect of a comparatively small cartel is of minor relevance. Due to free-rider effects, even a small cartel may significantly affect the market outcome.

From the theoretical point of view, the impact of a partial cartel on market prices and quantities is well worth analysing. In particular, the extent of the damage caused by a partial cartel is of interest, as well as the way in which the market outcome differs from the effect induced by a comprehensive cartel. The relevant questions are, first, is the degree of market coverage an indication of the size of the damages caused, i.e. is a small cartel ineffective? Second, is there a monotone relationship between the size of the cartel on the one hand, and the damage caused by it on the other? Or could a smaller cartel (with respect to the market size) be even more harmful than a larger one? How does the relationship (if any) depend on market conditions (price or quantity competition, homogeneous or differentiated products etc.)? Does a 'small' cartel have only a minor impact on the market conditions, or could even a small cartel, if it acts as a price leader, have detrimental effects on the market? In what follows, a short survey of the theoretical literature is given that focuses on the welfare effects of partial cartels.

2 The theory of partial cartels

There are basically two different strands of the literature with respect to partial cartels. The first deals with models of explicit collusion. This approach usually employs a static, one-shot game approach and goes back to the contributions of Selten (1973) and d'Aspremont et al. (1985). Today, this approach is rarely used in modern industrial organization theory. The second strand of the literature on partial cartels which is quite recent, considers a repeated interaction framework that is usually employed in the analysis of cartels and coordinated behaviour.

2.1 Static models of partial cartels

The central questions addressed in this literature are whether there exist stable cartels, and if so, which firms will participate in such a cartel. Also, the question of the size of the cartel with respect to the industry is considered. In this context, the questions of internal and external stability of a cartel are analyzed. Internal stability refers to the question whether or not a member of the cartel faces an incentive to stick to the cartel. This will be the case if the profit gained by an additional fringe firm is lower than that of a cartel member. External stability refers to the incentives to join the cartel in the first place, i.e. a cartel will be externally stable if no fringe firm has an incentive to enter the cartel. This condition will be satisfied if the resulting increase in price due to entering the cartel is not sufficient to increase the profit of a cartel member compared to what a fringe firm currently receives. A cartel is stable if it is internally and externally stable.

Several different scenarios have been considered in this literature, e.g. price-leadership with a competitive, price-taking fringe¹. Other models consider quantity-leadership where the fringe firms behave as Cournot-competitors.² This literature has derived several interesting results with respect to partially cartelized markets. It is shown that under rather general conditions stable cartels (sometimes several different cartels) exist. In addition, it is shown that, in the price-competition scenario, the smaller the cartel with respect to the market, the lower will be the impact of the cartel on the market price.

The size of the cartel is determined by the impact of an additional cartel member on the market price. If this impact is small, then the cartel will be small with respect to the industry. Also, the size of the cartel has an impact on the market performance, i.e. the smaller the cartel with respect to the market, the less effective it will be, i.e. in case of a small cartel, the market performance is not significantly different from that of a competitive market.³ A similar result holds in the case of quantity competition. It has been shown that the quantity produced decreases monotonically, starting from the competitive quantity and ending up at the quantity supplied by a monopolist.⁴ Of course, this is not surprising as the external competition either by a larger price-taking fringe or a larger group

¹See e.g. d'Aspremont et al. (1983), Donsimoni (1985), d'Aspremont/Gabszewicz (1986), Donsimoni et al. (1986)

²See e.g. Martin (1990, 2002), Shaffer (1995), Konishi/Lin (1999).

³d'Aspremont et al. (1983).

⁴Donsimoni et al. (1986).

of Cournot–competitors increases when the cartel becomes smaller in relation to the market, i.e. the free–riding fringe becomes larger. Thus, this literature shows that there is a monotone relationship between the relative size of a cartel and the damages caused by its existence. Further, in a model of quantity competition with a Cournot–fringe, Shaffer (1995) shows that consumer and total welfare will reach the competitive level if the number of firms in an industry grows large even if slightly more than half of the firms collude.

Several extensions of this approach haven been considered as e.g. the case of large markets with a continuum of firms, with heterogenous firms (Donsimoni (1985), differentiated products (Posada (2001), asymmetric information between the firms (Crampton/Palfrey (1990), Hviid (1992)), in a dynamic context with market entry (de Roos (2001), with sequential or simultaneous formation of cartels (Thoron (1998)). Also, far–sighted firms have been introduced in the framework of the d’Aspremont et. al. model, i.e firms that take into account that their leaving the cartel might trigger other firms also to leave.⁵ Most of these models focus on the question of the existence and the properties of stable cartels, while the welfare effects are rarely considered.

To summarize, the literature suggests that the size of the cartel relative to the market is an indicator of the damages it causes. This seems to be in line with decisions and legal practice: In German competition law, the market coverage of a cartel is considered as a mitigating factor in the computation of the fines.

However, this static approach relies on the crucial assumption that firms in the cartel do not change their output after a defection by one of the firms, i.e. the loss of profit in the future after the collusive arrangement has been violated is not being considered. This amounts to saying that, once a cartel is formed, the agreement is sustained by a binding or enforceable contract.⁶ In these models, it is assumed that the long–run effects of cheating are not considered, i.e. that firms are able to enter into binding agreements. This approach seems to be more useful for analyzing legal cartels as they existed e.g. in Denmark, Switzerland or West Germany.

⁵Diamantoudi (2005), Kamijo/Muto (2007), Kamijo/Nakanishi (2007), Nakanishi/Muto (2008). A comprehensive and very useful survey of the explicit–collusion literature has recently been provided by Bos (2009).

⁶This literature is thus related to the literature on endogenous coalition formation which usually is considered in cooperative game theory. See e.g. Shenoy (1979), Hart/Kurz (1983), Bloch (1996, 2005), Yi (1997), Ray/Vohra (1999), Arnold/Schwalbe (2002).

2.2 Dynamic models of partial cartels

As compared to the static framework employed in the static, one-shot game approach, were it is assumed that firms can explicitly collude by signing binding agreements, models of implicit collusion seem to be more in line with the legal situation in most countries. Here, the firms can reach an implicit agreement in a repeated interaction framework. The collusive or cartel behaviour is, under certain conditions, a subgame perfect Nash equilibrium of a repeated game. However, most models that use this approach implicitly assume that all firms in the industry participate in the collusive behaviour – as soon as one firm deviates from the collusive behaviour, a complete breakdown of the cartel is invariably assumed.

There are only a few papers that explain the existence of partial cartels in a repeated interaction framework. The first of these, to the best of our knowledge, is Martin (1990). He considers repeated interaction of symmetric firms in a market with quantity competition. Only a subset of firms form a cartel while the remaining firms behave as Cournot-competitors. Here, the participation constraint, i.e. the external stability of the cartel has to be taken into consideration. Martin assumes that the cartel acts as a von Stackelberg leader and the fringe firms behave as von Stackelberg followers. Two different punishment strategies, a grim trigger and a stick-and-carrot strategy, are considered. He shows that, provided that a partial cartel exists and the external stability condition is satisfied, if the cartel becomes small with respect to the market, collusion will be more difficult to sustain. With respect to welfare effects, the size of a partial cartel has no impact on the cartel quantity, since a von Stackelberg leader supplies half the monopoly output. However, if the fringe becomes larger, the total output will increase. This implies that, if the cartel is small with respect to the market, its impact on total output and prices becomes less pronounced, i.e. the result derived by Martin in a repeated interaction framework is in accordance with the results of the static one-shot game approach.

A different approach in the analysis of partial cartels in a repeated interaction framework is employed by Eaton/Eswaran (1998). They assume that after a defection from the collusive behaviour has occurred, collusion does not break down all together, but that only the defector is ejected while the cartel continues to exist with the number of members reduced by one, i.e. as a partial cartel. If another firm defects at a later point in time, it will also be excluded from the cartel. Once a firm has defected, it is unable to rejoin the cartel. While, as has also been shown by Davidson/Denekere (1985), larger cartels are more

profitable due to the strategic complementarity of the firms' pricing strategies, an individual firm might still have an incentive to defect from the cartel since the profit gained by cheating could be larger than the profit received by a member of the cartel. They show that, depending on the discount factor, that in such a market small cartels might exist and continue to operate.⁷ With respect to the welfare effects of partial cartels, they show that equilibrium prices increase with the size of the cartel, i.e. the deviation from the situation without cartels increases monotonically in cartel size.

Eaton/Eswaran also consider the case of quantity competition. In contrast to the results derived for price competition, in the former case partial cartels exist only if they are large with respect to the size of the industry. This result corresponds to the well known Salant/Switzer/Reynolds (1983) result that mergers in a Cournot-market are profitable only if they comprise of almost all firms in the market.

Another model of partial cartels has been proposed by Posada (2001). He considers the problem of partial cartels in a differentiated products market either with quantity or price competition in a static, one-shot game as well as in a repeated-interaction framework. The cartel is assumed to act as a quantity or price leader with respect to the fringe firms. For quantity as well as price competition in a repeated interaction framework, he shows that the size of the stable cartels does not depend monotonically on the discount factor. The degree of homogeneity of the products also has an impact on the size of the stable cartels. However, the results are sensitive with respect to the specific assumptions on the punishment behaviour of cartel members in case of a defection.

Recently, several papers by Escrihuela-Villar have been published that focus on partially cartelized markets (Escrihuela-Villar (2003, 2004, 2008a, 2008b, 2009a, 2009b)). Escrihuela-Villar (2003, 2004, 2008a) show that, in a repeated interaction framework where firms compete in quantities, the sustainability of partial cartels is an increasing function of the discount parameters, i.e. smaller cartels are harder to sustain. This is in accordance with the argument proposed by Salant/Switzer/Reynolds (1983), that the incentive to deviate from a cartel arrangement decreases with the size of the cartel. He compares stable cartels with implicit and explicit agreements, i.e. binding collusion, and shows that in the former case, the size of a cartel is larger than in the case of a binding agreement. He also shows that the price decreases with the discount factor and thus, for both the case of explicit as well as implicit collusion, that the price is decreasing in the

⁷Eaton/Eswaran also consider the interesting question whether there could be several cartels coexisting in the same market.

size of the cartel.

Escriva-Villar (2009a) consider the endogenous determination of whether the assumption of the leader–follower relationship between the cartel and the fringe firms is convincing. It is shown that the timing of decisions crucially depends on the discount factor, i.e. for a sufficiently high discount factor, quantities are chosen simultaneously by the cartel and the fringe firms. The reason is that a stable cartel might be larger if firms choose quantities simultaneously since the incentives to deviate in this case are reduced due to the complete breakdown of collusion. This might indicate that quantity–leadership may serve as an indicator of collusion. The question of the impact of quantity or price leadership on the stability of a cartel is further considered in Escriva-Villar (2009b). It is shown that quantity–leadership in a repeated interaction framework makes a partial cartel more easily sustainable as compared to the case of simultaneous quantity choice. The reverse holds in a price leadership model with differentiated products. Here, a numerical simulation illustrates that sequential price setting by the cartel and the fringe firms renders cartel formation more difficult. Most papers concentrate on the question of the stability of partial cartels, while the implications on welfare are not explicitly addressed.

In a recent thesis, Bos (2009) studies several aspects of partial cartels, including formation, behaviour and industry structures that make partial cartels particularly likely. In his model of cartel formation, Bos considers firms competing in prices which differ with respect to their size, i.e. their capacities. He also takes into account the costs of cartelization. If these costs increase in the number of cartel members, a partial cartel will not include all firms in the industry. The actual size of the partial cartel depends on the cost of cartelization. The market price is shown to be an increasing function of the cartel’s joint capacity. Stated otherwise, the price charged by the cartel is smaller when the market coverage of the cartel decreases. Bos also shows that larger firms have a stronger incentive to join a cartel. Thus, a subgame perfect equilibrium consists of a partial cartel that contains the largest firms in an industry. However, the problem of the non–uniqueness of equilibrium might arise. Finally, he shows that in industries where the size distribution of firms is asymmetric, partial cartels are more likely than in markets where firm size is more evenly distributed.

3 Conclusion

The literature on partial cartels using a static approach suggests that there is a direct relationship between the size of the cartel relative to the market on the one hand, and the effect of the market outcome with respect to prices and quantities on the other. It indicates that cartels that have a joint market share that is significantly below 100% have only a minor impact on the market, i.e. that the overcharge induced by damage caused is lower. This result has been confirmed by several recent studies of partial cartels that employ a repeated interaction framework.

The answer to the first question on the agenda: “Is it possible to define certain conditions which make it more likely that a cartel is not able to affect markets and therefore does not lead to any overcharge?” is – with respect to partial cartels – a qualified ‘no’. Every partial cartel leads to prices above the competitive level. However, the overcharge and thus the damage caused increases in the size of the cartel relative to the market. Of course, this has to be qualified with respect to market conditions. So the impact of a cartel of a given relative size is probably higher in a market with differentiated products than in a market with for homogeneous product. Thus, the joint market share of the cartel might provide a first indication of the damage caused. The damage will be supposedly small if the cartel is small relative to the market.

However, it has to be taken into account that the theory of partially cartelized markets is not particularly well developed. Especially with respect to the welfare analysis, i.e. the damages caused by partial cartels, further work is needed. Thus the relationship between cartel size and market price has – to the best of our knowledge – not been analyzed. It may well be the case that this relationship is nonlinear, where e.g. the impact on market performance is hardly noticeable when cartels are small but increases sharply if a certain threshold is exceeded. However, the reverse is also possible.

To conclude, further research on partial cartels should address more thoroughly the relationship between the size of the cartel and its welfare effects. The question of interest is if smaller cartels have a lesser effect on market performance than larger ones. In addition, more empirical research on the relationship between relative cartel size and market prices would be of major importance.

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