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Collusion with costly consumer search☆

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ABSTRACT

I use standard consumer search models to study how an increase in market transparency (lower search costs or higher share of fully informed consumers) affects cartel stability. When firms sell horizontally differentiated products, cartels become more stable as the search cost increases; with homogeneous products, by contrast, the opposite holds. A higher share of fully informed consumers makes collusion less stable when the market is initially sufficiently transparent, whereas it happens otherwise if the market is originally little transparent.

1. Introduction

Market transparency affects many decisions of market participants, including the choice of sellers whether to collude or not. The economics literature has shown that in markets where firms observe each other actions imperfectly collusion is less likely (e.g. Abreu et al., 1985; Compte, 2002; Green and Porter, 1984; Kandori and Matsushima, 1998; Stigler, 1964). What happens is that as the market becomes less transparent, the punishment that follows a deviation from collusion is softer.

The aforementioned studies focused on market transparency on the supply side of the market. In this paper I study a different notion of market transparency. In particular, I ask how the stability of collusion relates to market transparency from the point of view of the consumers. To the best of my knowledge, much less is known about how transparency on the demand side of the market affects the choice of sellers whether to collude or not. This paper contributes to filling this gap by studying cartel stability in consumer search markets.

I start by looking at collusion in the Wolinsky (1986) sequential search framework with horizontally differentiated products. The model features a finite number of symmetric firms, playing a repeated price-setting game with an infinite horizon. Consumers engage in costly sequential search to observe the characteristics of products. I relate the notion of market transparency to the search cost: a market where search costs are higher is said to be less transparent. I consider the stability of collusion when firms play grim-trigger strategies. Higher search costs affect the short-run gains from deviation and the long-run punishment. When search costs increase, a consumer on average chooses to compare fewer alternatives. This gives market power to the sellers and so they earn more in a static Nash equilibrium. From the point of view of colluding firms, this implies that the incentives to deviate increase as search costs go up because the punishment that follows a deviation becomes softer. However, it turns out that the gain from deviating from collusion decreases with search costs. This occurs because as search costs increase, fewer consumers happen to visit a deviating firm. Thus, the increase in profits that is obtained by undercutting the rival firms goes down as search costs increase. I show that the increase in search costs usually makes cartels more stable. What happens is that the deviation profit typically decreases with the search costs

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more than the competitive profit increases. The same qualitative result holds if firms apply stick-and-carrot strategies as in Häckner (1996).[1]

I then move to examine how market transparency affects collusion in Stahl's (1989) consumer search market with homogeneous products. This model has a finite number of symmetric firms that repeatedly compete in prices over an infinite number of periods. All consumers have the same valuation for the product. A fraction of them (shoppers) are fully informed, while the rest of the consumers engage in costly search to learn the prices that are actually charged by the firms. This shopper/non-shopper feature of demand results in a static Nash equilibrium in mixed strategies. As in the case with differentiated products, an increase in search costs gives market power to the firms. Thus, the firms' profits go up in the static Nash equilibrium. This makes the punishment that follows a deviation milder, which tends to strengthen the incentives to deviate from collusion. Differently from the differentiated products case, it turns out that search costs have no influence on the deviation profit and therefore the gains from defecting from the collusive equilibrium are independent of the search costs. Hence, with homogeneous products higher search costs make collusion less easy to sustain.

The model of Stahl (1989) lends itself to model transparency in a different way. Because of the shopper/non-shopper feature of demand, we can alternatively relate market transparency to the share of shoppers. I then regard a market with more shoppers as more transparent and study how cartel stability is related to the share of shoppers in the market. I show that both the deviation gain and the deviation loss increase with the share of shoppers. The net influence of these effects depends on which of these forces is dominant. It turns out that it depends on the initial level of market transparency. Specifically, the critical discount factor above which collusion is stable decreases with the share of shoppers when the share of shoppers is initially small and increases with the share of shoppers when this is initially high.

To the best of my knowledge, only Nilson (1999) and Schultz (2005) study how market transparency on the demand side affects collusive outcomes. Nilson (1999) analyses how the magnitude of consumer search costs affect collusion in a duopoly version of the non-sequential consumer search model of Burdett and Judd (1983). In his set-up, firms sell homogeneous products, some consumers observe the prices of both firms, whereas others have to pay a positive search cost per firm to learn the offers of the sellers. Nilson (1999) shows that cartel become less stable as the search cost increases. This finding is similar to what I find in the Stahl's setting, which suggests that the search protocol does not influence the relation between stability of collusion and search costs.[2]

Schultz (2005) also analyses how market transparency on the demand side affects collusion. He studies this question in a Hotelling market with shoppers and non-shoppers. In his model, there are no search costs. The shoppers are fully informed and the non-shoppers are assumed to visit only one seller. Schultz (2005) finds that when products are almost homogeneous, the share of fully informed consumers does not have any effect on cartel stability. This finding differs from my result in the Stahl setting and it is due to the restriction that non-shoppers are not allowed to search. When products are differentiated, though, Schultz (2005) shows that cartels are more stable in less transparent settings, which is in line with what I find in the Wolinsky's framework.

To the extent that an increase in search costs weakens competition in the marketplace, my findings are also related to those from the literature on cartel stability in horizontally differentiated product settings. In my paper, higher search costs lead to more stable cartels whereas in the papers of Deneckere (1983), Rothschild (1997) and Ross (1992) the degree to which collusion is stable turns out to be non-monotonic in the degree of product differentiation. The key difference between my work and that on product differentiation is that changes in search costs do not affect willingness to pay whereas changes in product differentiation do.

In order to deter collusion, competition authorities try to identify structural factors that influence the likelihood of collusion. Much is known about how e.g. the number of competitors, product differentiation and the nature of competition affect the stability of collusion. My paper indicates that significant consumer search frictions should be regarded as a sign of risk in environments where products are horizontally differentiated, but not in homogeneous product settings. As a matter of fact, there are instances of detected or suspected cartels in markets where consumer search and product differentiation are prominent features. An example is the market for laundry detergents (The EC, 2011); this is a market where products differ from one another in for example their content of fabric softeners and perfumes and, as shown by Pinna and Seiler (2014), consumers incur non-negligible search costs while shopping. The Danish competition authorities (Borum, 2014) fined several driving schools for coordinating their pricing in 2014; according (Muir et al., 2013) this is a market where search frictions also seem to be important. Finally, collusion has also been detected in the automobile market, which is a market where consumers also experience significant search costs and products are highly differentiated (see Moraga-González et al., 2015; Meikle, 1999; Foggo, 2005 for more details).

The rest of the paper is organized as follows. In Section 2, I analyse collusion in the Wolinsky's consumer search market with differentiated products. Collusion in the Stahl's consumer search market for homogeneous products is studied in Section 3. Some concluding remarks can be found in Section 4. The proofs of the propositions are placed in the Appendix of the paper.

2. Differentiated products

2.1. Model

On the demand side, there is a unit mass of consumers. A consumer wants to buy one unit of a product and she can buy it from $n \geq 2$ sellers. Every firm offers one variety, and products are horizontally differentiated. All the firms have the same constant unit production cost that is normalized to zero. Consumer i who buys product j gets utility u_{ij}:

$$u_{ij} = \varepsilon_{ij} - p_j \tag{1}$$

where ε_{ij} is the match value between consumer i and product j, and p_j stands for the price of the product. A consumer prefers to buy the product that gives her the highest utility. However, she has to pay a positive search cost s per firm to observe the price and the match value. The consumer visits firms sequentially with costless recall and can terminate her search after sampling any number of firms.

The firms never observe individual match values, and consumers do not know how much they like the products without searching them. However, it is common knowledge that the match value ε is distributed identically and independently across consumers, products and time according to a continuous and differentiable distribution function $F(\varepsilon)$ in the interval between zero and $\overline{\varepsilon}$.[3] The density function of ε is denoted by $f(\varepsilon)$, it is positive and log-concave. Additionally, I require that $f(y) + pf'(y) > 0$, $\forall p \leq y$.[4]

In symmetric equilibrium consumers expect all n sellers to charge the same price p^*. Thus, the distribution of utilities across the firms is

[1] The details are in the working paper version of this paper.

[2] This fact also holds in the model with differentiated products. In the working paper version of this paper I show that the critical discount factor above which collusion is sustainable also decreases with search costs when consumers search non-sequentially.

[3] The assumption about the independent distribution of ε over time is reasonable while analysing the markets where the assortment in shops changes between the purchases of a consumer. The examples of such markets can be the markets where consumers shop rather infrequently, and products change rapidly because of technological progress, e.g. home appliances, computers, phones, and cars.

[4] This assumption ensures concavity of pay-off functions.