1   Resume

In the public opinion and among consumer councils, the traditional view has been that increased transparency promotes competition, since more informed consumers make it more attractive for firms to set low prices. Economists and competition authorities, however, have been concerned that increased transparency not only helps consumers in their search for the lowest price, but also provides a foundation for information sharing between firms, making collusion easier to sustain. The idea that access to information about competitors' prices can promote anti-competitive behavior originates from Stigler (1964), who argues that increased information on the producer side may serve as an instrument for firms to detect 'undercutters', thus facilitating cartels. Over the years this conception has developed into a profound knowledge of how information affects firms' ability to collude. The general learning from the vast number of articles on this topic is that more transparency on the producer side is usually anti-competitive, e.g. Kühn & Vives (1995).

Hence, the traditional policy recommendations on transparency issues have balanced the perceived positive effects of increased price information among consumers against the negative effects of more information among firms. This trade-off is reflected in the Series Roundtables on Competition Policy, OECD (2001) p. 9: "*As a general rule, increased price transparency will benefit buyers unless it results in considerably increased risks of collusion among sellers.*" Moreover, OECD states that "*measures extending to consumer transparency which already exist among businesses should generally be pro-competitive.*" This illustrates clearly that the perceived downside to more transparency is usually more information among firms. The validity of such statements is the key topic in our thesis. As the effects of increased producer side information are well understood, we assume that firms are perfectly informed. While this is obviously a simplification of reality, it enables us to distinguish how changes in transparency on the consumer side alter competition.

While there seems to be general agreement that more information among consumers will lower prices and make the single shot market outcome more competitive, the story is less clear-cut if repeated competition is taken into consideration. More informed consumers do not only increase firms' incentive to undercut competitors - they also enhance firms'

ability to punish a potential undercutter. A priori, it is not possible to determine which of these two countervailing effects is dominating. Hence, the policy implications concerning transparency are mixed, even if producer side information is unaffected.

Although transparency is an often-used term in the policy debate, the definition of the term may sometimes be unclear. In our thesis we use the term transparency to describe the degree of consumer side information in the market. More precisely, we use the term in two slightly different ways. First, as a measure of how easy consumers can become informed about prices. The lower the cost in time and money required to discover prices, the more transparent is the market.[1] However, in a large part of the literature, search is not modeled explicitly, and hence, we also interpret transparency as the share of consumers who are informed about prices. In our thesis, there is no conflict between these two definitions of transparency.

1.1   Transparency and competition in static games

An obvious requirement when studying the effects of changes in transparency is a setup where some consumers are imperfectly informed about prices. Traditional workhorse models, such as the Bertrand model, are not directly suited for this purpose, since they implicitly assume that all consumers are informed about prices. A few modifications may however turn the Bertrand model into a satisfactory starting point for studying how competition is affected by changes in transparency. This is exactly the procedure followed in Salop & Stiglitz (1977) and Varian (1980). Here firms compete in prices in a market where some consumers are informed and some are uninformed about the prices offered by firms. Informed consumers shop at the store offering the lowest price, while the uninformed consumers choose a store at random. Since firms are not able to price discriminate, they face the following problem: By pricing low, firms can hope to win the informed consumers, but by doing so, they forgo the possibility of charging a high price and exploit the uninformed consumers. There are two effects in play. If all firms charge a high price, a firm can reduce the price slightly and win all informed consumers, with only a marginal loss on existing customers. This puts a downward pressure on prices similarly to traditional price competition. However, since firms can always charge the monopoly

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[1]This is the definition of transparency used by OECD, see OECD (2001)

price and serve their share of the uninformed consumers, there is a limit to how low firms are willing to price. Instead of tying at this low price, a firm is better off abandoning informed consumers and charging a high price to exploit uninformed consumers. This simple argument reveals that no single price can be the market outcome when there are both informed and uninformed consumers. In Varian (1980), firms avoid this catch 22 by setting unpredictable prices. Instead of offering a fixed price, firms randomize prices, making it impossible for competitors to systematically offer a slightly lower price.

A natural extension to this stylized model is to endogenize consumers' decision to become informed. This is done in Burdett & Judd (1983) among others. Rather than assuming differences in consumer information *ex ante*, they use the idea that consumers' willingness to search is determined by the expected gain from being informed about prices. The main finding is that differences in consumer information *ex post* can arise even if all consumers are alike.

The general findings in static game models with imperfectly informed consumers are that differences in information usually generate market outcomes where prices are dispersed. The learnings from this literature seems to be that more transparency promotes competition.

1.2   Transparency and competition in dynamic games

The research on how consumer side information affects firms' ability to collude is more limited. This topic has primarily received attention from Scandinavian researchers. One plausible explanation is that the Scandinavian competition authorities have been some of the strongest advocates for promoting transparency, see Nilsson (1999). Nilsson (1999) considers firms' ability to collude in the Burdett & Judd (1983) framework. He finds that collusion may be easier to sustain when search costs are lower and more consumers are informed. Schultz (2005) analyzes how product differentiation affects collusion when some consumers are imperfectly informed about prices. He finds that when products are differentiated, collusion becomes harder to sustain when more consumers are informed. Møllgaard & Overgaard (2000) interpret the degree of product differentiation as transparency and reuse the results from the literature on collusion with heterogeneous products.

They find that full transparency is not optimal. To summarize, the literature does not give any conclusive policy recommendations if there is a potential risk that firms are able to collude.

1.3 Our contributions

1.3.1 Theory

In our thesis, we analyze Varian (1980) in a more general setup where firms face a downward sloping demand curve and have different marginal costs. We show that when few consumers are informed, there exists a pure strategy Nash equilibrium where firms set their monopoly prices. When the share of informed consumers is sufficiently high, firms are tempted to lower prices to capture the informed consumers, and end up in a mixed strategy equilibrium similar to the one seen in Varian (1980). However, contrary to Varian (1980), they set their monopoly price with positive probability and randomize in a continuum of prices otherwise. Firms set lower average prices as more consumers are informed, leading the high-cost firm's profit to decrease, whereas the effect on the low-cost firm's profit is ambiguous. If the cost difference is large, the low cost firm's profit increases, but when the cost difference is small and competition from the high-cost firm is tough, profit decreases along with more informed consumers. Finally, we consider how transparency affects firms' ability to collude in the presence of asymmetric costs. We show that collusion is easier to sustain when prices are more transparent. Hence, more consumer information is not always pro-competitive.

1.3.2 Empirics

Using data from the Danish gasoline market we investigate whether the predictions delivered by the literature on competition under imperfect consumer information are supported empirically.

We analyze which kind of price dispersion prevails on the gasoline market by ranking firms by their prices. With spatial price dispersion as seen in Salop & Stiglitz (1977), we would expect the same firm to offer the lowest – or the highest – price over time. On the

contrary, the temporal price dispersion from Varian (1980) predicts significant changes in ranking over time. If firms have different costs, our extension to Varian's model supports temporal price dispersion, but with low cost firms offering lower prices on average.

Our data from the Danish gasoline market clearly indicates that prices are dispersed, and supports that this dispersion is temporal rather than spatial. But although the identity of the cheapest firm varies greatly over time, unstaffed stations, which presumably have lower costs, are cheaper more often than staffed stations, and their average prices are significantly lower. This is in line with the predictions in our extension, but can also be a result of differences in services.

In order to be able to measure the effect of changes in transparency we study a "natural experiment" in Helsingør, where there is an abrupt change in the share of uninformed consumers . We find that during the tourist season – when there are more uninformed consumers – prices are generally higher and less dispersed. One explanation offered by our extension is that firms do not find it worthwhile to compete for the informed consumers but prefer to set a high price to exploit tourists. Another explanation is that firms are able to collude during the summer, since the temptation to deviate is lower. The literature on collusion and consumer side transparency is for the most part ambiguous, but this "case study" indicates that increased transparency can make it more difficult for firms to sustain collusion. This story, however, is not in line with the prediction of our extension to Varian (1980).