

A SURVEY ON THE UNCERTAINTY ABOUT DEMAND IN OLIGOPOLISTIC MARKETS

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ABSTRACT

The purpose of this work is to do a revision about the existing literature on information exchanges about demand in oligopoly models and the derivation of political consequences concerning to the effectivity and boundaries of these agreements. The main problem is to know, how and what these agreements can affect to the producers, consumers and society in general. A first point of view can show us that several factors are involved: The type of competition (price versus quantities), nature of uncertainty (common versus private), nature of goods (substitutes versus complements) and number of firms.

Key words: Demand Uncertainty, information exchange, quantity competition, price competition.

MSC: 91B24

RESUMEN

El propósito de este trabajo es hacer una revisión de la literatura existente sobre el intercambio de información sobre la demanda en modelos oligopólicos y la derivación de las consecuencias políticas concernientes a la efectividad y las fronteras de esos acuerdos. El problema principal es saber, cómo y cuáles de estos acuerdos pueden afectar a los productores, consumidores y la sociedad en general. El primer punto de vista puede mostrarnos que varios factores están envueltos: el tipo de competencia (precios versus cantidades), naturaleza de la incertidumbre (común versus privado), naturaleza de los bienes (sustitutos versus complementos) y el número de firmas.

Palabras clave: incertidumbre en la demanda, intercambio de información, competencia en cantidad, competencia en precio.

1. INTRODUCTION

One hundred and sixty three years have passed since the publication of Augustin A. Cournot's great book "Recherches sur les principes mathématiques de la théorie des richesses" (1838). It is important as well as appropriate to see how and what extend Cournot's pioneering work has contributed to our economics profession.

This paper is focused in the revision of the academic literature of information exchanges agreements about demand in oligopoly models, a line of research¹ that was initiated by Basar and Ho (1974) and Ponsard (1979) and continued by the explosion of works in 1980s including Novshek and Sonnenschein (1982), Clarke (1983), Vives (1984), Gal-Or (1985, 1986), Li (1985), Kirby (1988, 1993), Sakai (1990, 1991) and others, but still today is an important line of research, specially due not only at its theoretical importance but also from the point of view of the consequences for the competition policy.

Generally speaking, all the papers deal with those factors that affect the incentives for firms to share information and the effects of those agreements on consumers and society as a whole (producers and consumers). At a first glance, there appear no definite answers but there are several factors involved (Type of competition, nature of goods, nature of uncertainty, and number of firms). All of this adds complexity for the consequences of the competition policy in relation with the information exchanges agreements in oligopoly models.

In the oligopoly and uncertainty about demand's models there are two main effects of information sharing on firms. One is, the increased precision of information, which benefits the firms. The other is the increased precision of information of the others which might benefit or hurt the firm depending on whether residual demand becomes more or less variable. Hence there is a direct information effect and an indirect

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¹This line of research also includes studies about cost uncertainty in oligopoly models.

informational externality. However, a third effect arises in Oligopoly models because firms have a perceivable effect on their competitors. A firm knows that other firms know when it acquires information and it knows that these firms act according to that knowledge. If a firm knows that another firm has just acquired the information it has itself it will change its behaviour accordingly. Hence, the fact of acquiring information may not only improve the precision of information but at the same time affect the variability of the residual demand function. However, while this may influence the value of information acquired, it does not in any significant way affect the qualitative conclusions from the analysis. The net value of information acquired from other firms through information exchange will still remain positive. We can therefore without loss of insight still analyse information sharing as the combination of two steps: First, all firms except our firm receive the relevant information. Secondly, our firm is given all the information in the market, which produces a net gain. In the following sections we are going to study the existing literature on the subject based on these two effects.

The rest of the paper is divided into 4 sections: In section 2 we study the case of common uncertainty about demand when firms are quantity competitors. In Section 3, we deal with the same type of uncertainty but when firms are price competitors. In section 4, we deal with private uncertainty about demand and we derive the results for price and quantity competition. In section 5, we summarize the results obtained in the previous sections and finally in section 6 we finish given some conclusions on the consequences for the competition policy.

2. COMMON DEMAND UNCERTAINTY AND QUANTITY COMPETITION

In this section we will see the different contributions to the oligopoly models under quantity competition, when we model the uncertainty about demand taking into account that this uncertainty affect to all firms in the same way. (*Common Value Model*)

First of all, we are going to illustrate with an example the main characteristics about competitive externalities from information improvements for competitors. Let consider that the demand function faced by each competitor is affected by a common shock. Let demand for the good of firm i be given by:

$$p_i = a - (1 - d)Q_i - dQ^*$$

where a is the uncertain demand parameter, Q_i is the output of the firm, and Q^* is the average output of all the other firms in the market. Note that, the parameter d is a measure of how differentiated products are in the market. The case of $d = 0$ means that there is a pure monopoly. As d goes towards 1 goods become perfect substitutes and firms are not able to influence the price. The demand intercept is perceived by firm i

as being $a - dQ^*$. If other firms do not have any information about a the only uncertainty in the demand intercept comes from the uncertainty about a .

In Figure 1 we are going to represent the residual demand function for firm i . In the case that other firms does not have any information about demand, the demand intercept take the following values,

$$D_H = a_H - dQ^*$$

when the demand is high

$$\text{and } D_L = a_L - dQ^*$$

when the demand is low.

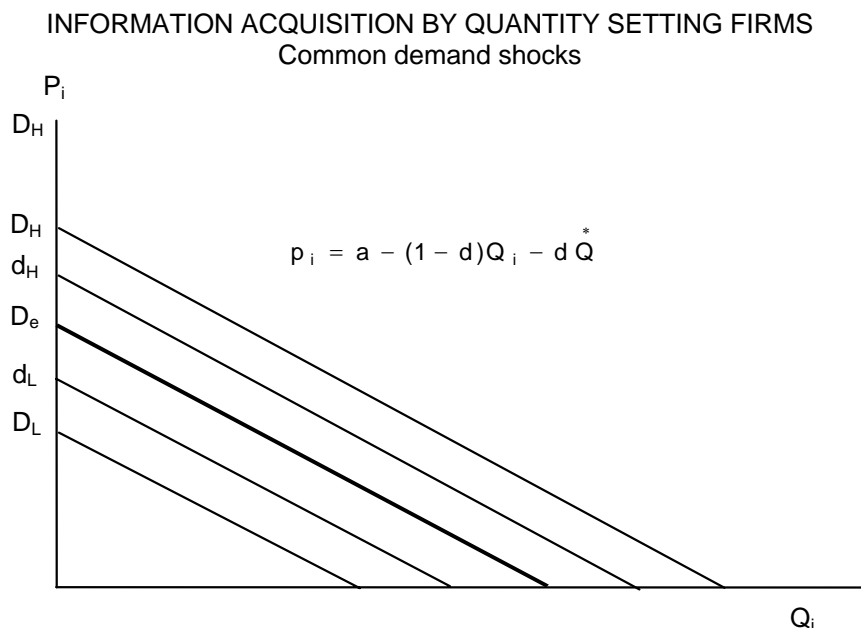


Figure 1. The external effect on residual demand.

The solid line in the middle represents the expected demand curve. Now suppose that other firms can perfectly condition on the state of demand a because they possess this information. Then they will produce more in states with high a and less in states with low a . This means that $Q^*(a_H) > Q^0 > Q^*(a_L)$ and therefore the demand intercept for firm i is reduced in high states and increased in low states. Hence, the demand intercept varies less from the point of view of firm i . In other words, demand for firm i in the high and low state, $d_H = a_H - dQ(a_H)$, and $d_L = a_L - dQ(a_L)$ will lie closer to the expected demand than D_H and D_L . Demand for firm i is less variable if other firms have full information of a . Given that this is the signal received by the firm, the effects will be a decrease in its benefits. Hence, there is a trade-off between the benefits of information precision through information sharing and the losses from giving other firms more precise information.

The first contributions to the information exchange literature in oligopoly (taking into account substitutes) said that information sharing reduces the profits of the firms (Novshek y Sonnenschein (1982), R. Clarke (1982 y 1983), Vives (1984), Gal-Or (1985)). However, if we consider that the goods are poorer substitutes the informational externality gets smaller since adaptation to the demand shock by other firms does not feed through as much into the demand intercept of the remaining firm. Hence, if goods are poorer enough substitutes there will be incentives for information sharing (Vives, 1984). By the same argument, increasing marginal costs of production will reduce the informational externality because it is more costly to react to the information. In particular, exploiting good information about demand is costly if marginal costs are increasing. Hence, the reduction in the variability of residual demand becomes smaller the steeper marginal costs are. If marginal costs are increasing fast enough, the effect of increased precision in information will dominate and there will be an incentive for industry wide information sharing agreements even under Cournot competition. (Kirby 1988)

Although the possibility of profitable exchange through the reduction of the correlation between outputs (i.e taking into account goods poorer enough substitutes in order to make that the precision effect overcomes the correlation effect and in overall the exchange were profitable) other authors expanded the scope of possibilities for profitable information exchanges in oligopoly models with demand uncertainty and quantity competition. (David A. Maleug and Shunichi O. Tsutsui, 1996 y 1998, Dasgupta, S. y Shin, J. 1996 y 1999)

All the models we have studied up to now take into account two possibilities:

1. No firm exchange information
2. All firms exchange information between them.

The possibility of information exchanges among a subset of firms was consider by David A. Maleug and Shunichi O. Tsutsui (1996). These authors built an oligopoly model with three firms, given as a result an increase in the scope of possibilities for profitable information exchanges. Particularly they found that:

3. Although the goods were strong substitutes, there were also possibility for profitable information exchanges, but in this case it was between a subset of firms. (Two firms)
4. They expanded Kirby's results (1988), because they show that with lower increase in marginal costs, information exchanges carried on profitable, but in this case it was again information exchanges between a subset of firms. (Two firms)

Later on, David A. Maleug and Shunichi O. Tsutsui (1998), carried on a complementary research to that developed by Vives (1984) and Kirby (1988). They focused in the precision effect and show the possibility of profitable information exchanges even for homogeneous goods. These authors built a measure² of the extent to which information exchange improves firms' forecasts of demand. Intuitively they expect that if the

²The measure that was built by these authors is defined as $G = \frac{\text{Var}(e_{ns}) - \text{Var}(e_s)}{\text{Var}(e_{ns})}$, where e_{ns} denotes a firm's forecast error when firms do not exchange information and e_s denotes de forecast error when they do. Var is the operator Variance. Index G measures the fraction of mean-squared forecasting error that can be eliminated by exchanging information.

accuracy effect of information exchange is to dominate the negative correlation effect, this should occur when the accuracy gains to information sharing are large, that is, where G is large. In particular, information sharing might be profitable in situations where G is very close to 1, for in these cases the second signal essentially removes all residual uncertainty about demand.

David A. Maleug and Shunichi O. Tsutsui (1998), show that when the firms' signals are accuracy enough (G close to 1), the accuracy effect of information exchange outweighs the correlation effect, and information exchange is profitable, (proposition 1 and proposition 2, David A. Maleug and Shunichi O. Tsutsui (1998). This condition on the signalling technology is analogous to Vives' sufficient condition given by sufficiently weak substitutability in demand of firms's products.

The constant model of demand uncertainty based on intercept uncertainty have had the consequences that the oligopoly models of information exchanges with quantity competition and substitutes goods had been unnecessarily restricted in the sense of underestimates the possibility of profitable information exchanges (sharing information is not an equilibrium strategy, Vives 1984, Gal-Or 1985, Kirby 1988). If we consider the possibility of modelling demand uncertainty as uncertainty based on slope of demand³ (David A. Maleug and Shunichi O. Tsutsui 1996) it has been found examples in which these same oligopoly models with quantity competition and perfectly substitutes goods carried out to opposite conclusions to the former models.

David A. Maleug and Shunichi O. Tsutsui 1996 modeled information exchanges between duopolists facing a common random demand. The slope of the common demand curve facing the firms was assumed unknown, and firms observed private signals about this slope. They showed that, for sufficiently large variation in the demand slope⁴, firms earned strictly higher profit when they shared their information rather than keeping it private⁵ (Theorem 3 and corollary 1). In this case, it is a Nash equilibrium⁶ for the duopolist to share their information in a Quid pro Quo⁷ information exchange.

All contributions in the literature had ignored the firms' capital structure, more precisely we can say that all oligopoly information exchange models had assumed that firms were equity financed. However research made at the end of 90s about capital structure in firms in relation to the incentives to exchange information show that the classic result that firms do not want to share information again can be reversed. (Dasgupta, S. and Shin, J., 1996 y 1999)

These authors showed that the level of leverage affected positively firms' incentives to share information, i.e. once capital structure (the debt-equity ratio) is made an endogenous choice variable, information sharing is optimal. The basic intuition for this result is related to the well-known idea in corporate finance that, in the presence of limited liability, leverage creates incentives for shifting profits from states in which debt holders are residual claimants to states in which equity holders are residual claimants (Jensen and Meckling, 1976). Brander y Lewis (1986), have shown that in the context of oligopolistic product markets, this implies that leverage will make a firm more aggressive, by enabling it to commit to producing more.

Consider the extreme case in which the debt of the firm is large enough that the probability of default in the bad state is very high, we are going to call this firm, firm A. Besides this firm at the beginning is uninformed. Suppose that the other firm has perfect information about demand state, we call this firm, firm B (these assumptions are in the line of the initial specification about the way of implement an information exchange agreement). Under these circumstances if the informed firm, firm A, does not transmit any information to the other firm, firm B, it is generated an "overproduction effect". Since A is uninformed about the demand state, it

³Slope uncertainty could arise in a setting in which consumers are identical and firms are uncertain about the number of consumers in the market.

⁴These authors defined the variation in the demand slope as the rate of two possible values, β_h for high demand and β_l for low demand.

⁵These conclusions were obtained for the case of a duopoly model, but are the same for extensions of the model although there are some restrictions

⁶Unfortunately, there are no a complete understanding of why information sharing is profitable with slope uncertainty, but not with intercept uncertainty, given perfect substitutes and constant marginal cost.

⁷Quid pro Quo agreements refers to a type of agreements where only those firms that contribute their private information will receive the others' contributes information.

is very likely to default in the bad state. It is for this reason that firm A is going to choose an output that is close to what it would produce if the state of demand were known to be high for sure. This is a case where limited liability and debt combine to make the firm extremely aggressive and produce a very high level of output. This is clearly undesirable since the point of view of firm B. Thus, firm B can do better if it transmits all its information about the demand state to firm A. Since firm A knows the state perfectly, if the state is high it will produce the same output as when it is uninformed and highly levered. However, if the state is low, so long as firm A is not going to default⁸ for sure, it has an incentive to produce the lower output, which is optimal when the state is bad. Without any doubt, this is an outcome that is more preferable to firm B. (See proposition 2, Dasgupta, S. and Shin, J. (1999))

As far as welfare effects concern, information exchanges drive firms to a better information, which leads to more quantity adjustments when firms set quantities and lower quantity adjustments when they set prices. It is for this reason that information exchanges lead to a tendency of dead weight loss being decreasing by firms when they set quantities. We will call this the quantity adjustment effect. However we have an additional effect due to product differentiation. Product differentiation in this model is derived from the assumption that consumers have preference for variety. This means that for any given average output across firms consumers prefer consumption bundles that have less variation of consumption across varieties. In other words, uniformity of output across varieties is valued by the consumer when he has preference for variety. Information exchange has the effect of increasing uniformity of outputs across varieties, both when firms set quantities and when they set prices. If the information of firms is more correlated, output will be more uniform across firms. This has a positive welfare impact both under price and under quantity setting. We will call this the preference for variety effect.

As a result, under quantity setting, the quantity adjustment effect and the preference for variety effect go in the same direction. Welfare is increased through information sharing. The same two effects are at work in evaluating the impact of information sharing on consumer surplus. Again, the quantity adjustment effect is dominating with price quantity setting firms. As a result consumer surplus is increased by information sharing when firms are quantity setters. Thus, public and private incentives of information sharing go in the same direction in a more range of assumptions than previously was supposed. (Goods poorer substitutes, i.e quasi monopolistic markets and steep marginal costs).

3. COMMON DEMAND UNCERTAINTY AND PRICE COMPETITION

When firms are price setters, the above arguments are reversed. The increase of information about demand by the competitors leads to a lower output variation. Thus, the intercept demand for firm i will be more variable. The intuitive explanation for this case can be seen in Figure 2. In the case of price competition, when firms do not know the value of demand, they are going to set an expected price P^* in relation to an average expected demand D_e . The quantities that firms are going to sell are the ones that clear the market for the price P^* . Let us represent these quantities by Q_H^* (average quantity that firms are going to sell when the state of demand is high) and Q_L^* (average quantity that firms are going to sell when the state of demand is low). If we now suppose that these firms acquire additional information about demand, they will not set the price P^* , now for high values of demand they are going to set $P_H > P^*$. For this reason the quantity sold at this new price will be lower $Q_H < Q_H^*$. For low demand states, firms are going to set $P_L < P^*$, and the new quantity sold will be $Q_L > Q_L^*$. Thus, the variability of the average quantity sold by the firm i is decreased. For that reason, residual demand for firm i is going to increase. In Figure 2 we denote by D_H and D_L the possible values for firm i demand when competitors have no information about the true state of demand. Once competitors have acquired that information the residual demand for firm i is more variable, as we explain before. In Figure 2 we denote that residual demand by D_H (high demand) and D_L (low demand).

⁸If firm A defaults for sure in the low state and when firm B transmits all its information to firm A, we shall assume that when the low state is realized, the firm will be run in the interest of debtholders, and the profit maximizing output for the low state will be produced.

ACQUISITION OF INFORMATION WHEN FIRMS SET PRICES

Common demand shocks

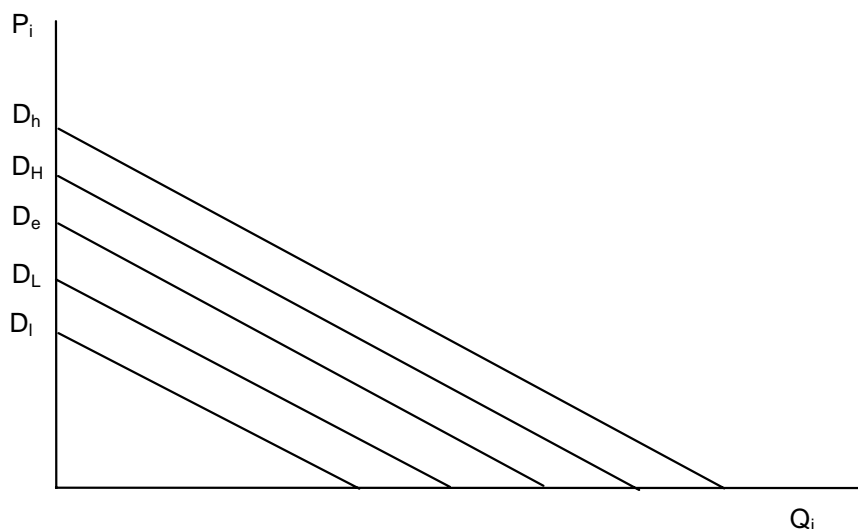


Figure 2.

All mentioned before allow us to say that there are positive externalities for firm i from the acquisition of information by competitors when firms are price setters. Thus, there will be always an incentive for industry wide information exchanges agreements.

In relation to total expected welfare and consumer surplus, we have the same two effects that we mentioned in the last paragraph. On one hand, there is a negative effect from the quantity adjustment output. Increasing information of firms reduces the adjustment of output to the state of demand. On the other hand there is a positive preference for variety effect. Output becomes more uniform across firms. However, the first effect always dominates from the point of view of consumers. Consumer surplus falls. However, welfare may rise if goods are close enough substitutes.

4. PRIVATE SHOCKS TO DEMAND: QUANTITY COMPETITION VERSUS PRICE COMPETITION

To complete the analysis of information exchanges about demand in oligopoly situations, we are going to analyse the case in which the demand for each firm is affected by an individual shock. Mathematically this shock is on the demand intercept.

In this case we can define the demand function for firm i in the following way:

$$p_i = a_i - (1-d)Q_i - dQ^*$$

where the only difference with respect to the case of common demand shocks is that the demand intercept, a_i , is now firm specific. This change, does, however, significantly affect the analysis. Lets suppose that a_i is perfectly known by firm i and the demand intercepts are imperfectly positively correlated across firms. If other firms do not have any information about their competitors a single firm will expect a_i and Q^* to be positively correlated. Observing a high a_i gives firm i the information that other firms, on average, will also have high realizations of their demand intercepts. Now suppose that other firms except for firm i are perfectly informed about the realization of all demand intercepts. How do these firms react? If the average a in the market is higher than expected, firms will decrease output expecting other firms to produce more than anticipated. If the average a in the market is lower than expected, they will increase output expecting other firms to produce less than anticipated. Hence, after information sharing each output produced for every firm j , and therefore average output, will vary less systematically with a given a_j . What are the effects for the variability in the demand intercept that firm i faces? Firm i has full information about a_i , when setting output. Average output

* Q will before information sharing vary positively with a_i because of the correlation between private shocks.

After information sharing Q varies less systematically with a_i , which makes the demand intercept $a_i - dQ$ more variable from the point of view of firm i . Hence, other firms obtaining information has a positive external effect on firm i .

Thus, firms will have an incentive for sharing information in the case of quantity competition, (Fried (1984), Li (1985), Shapiro (1986), Sakai (1991), Raith (1996), A. Creane (1998)⁹ etc.). Hence, information sharing is a dominant strategy for firms and firms will be willing to unilaterally reveal information.

There are two effects on total expected welfare and expected consumer surplus. On one hand there is the output adjustment effect which is positive in the case of quantity setting. Secondly, there is the preference for variety effect, which is negative because of private value uncertainty. Expected welfare will again be increased. However, the preference for variety effect will be larger for smaller number of firms leading to reductions in consumer surplus for duopoly (and more generally for markets with few firms). In this sense markets with a larger number of firms will make information sharing with quantity competition and private demand shocks more likely to lead to welfare improvements. (Sakai (1991), Raith (1996), A. Creane (1998))

The conclusions about the variability in residual demand function is the same in the case of price setting firms. When firms share information and are price setters, they will increase prices if the demand intercept are higher than they expected, because they expect other firms set also higher prices. The opposite will occur in the case that demand intercept are lower than expected. Hence again, the average output produced is going to vary less systematically for an individual demand intercept a_i . The positive external effect of other firms acquiring information persist. However, both output adjustment effect and preference for variety effect are negative, so that expected welfare and expected consumer surplus are reduced.

The former explanations model demand uncertainty taking into account a random specific intercept for each firm. A. Creane (1998), also considers the case of demand functions with random specific slopes for each firm (Maleug and Tsutsui (1996) investigated if a firm would reveal information about a common demand slope when firms are quantity setters), obtaining the conclusion that in both cases, quantity competition and price competition, if the slope (specific for each firm) is unknown, information exchanges will increase firms' expected benefits.

5. SUMMARY

In this section we are going to summarize the results obtained in the former sections in order to derive possible consequences from the point of view of competition policy.

5.1. Incentives to share information

Results on the incentives to share information are contained in Table 1. The table gives information about the sign of the information externality generated by information sharing on firms' expected profits. A positive information externality will yield incentives for a firm to share information in dominant strategies (that is, no matter what rivals do about the pooling of data). A negative externality will not destroy necessarily the incentives to share information in a Quid pro Quo type arrangement provided expected profits increase (due to the increased information that firms have). As is clear from the table, the sign of the externality depends on the particular specifications of the model. A change of strategic variables (price instead of quantities) or of the type of uncertainty (common values versus private value), may yield different incentives to share information.

Table 1 remark that information exchanges, either Quid pro Quo type or Unilateral revelation of information, can appear in a wide set of scopes of competition between firms. The only exceptions would be in specific situations of quantity competition.

⁹A. Creane studies the firms' incentives to exchange information about specific random parameters (costs, demand intercept, slope of demand) using concepts of the risk literature and applying them to the information exchanges literature. Particularly he models information exchange agreements using Blackwell's definition (1951, 1953)

Table 1. Incentives for information exchanges.

DEMAND	COMMON VALUE	PRIVATE VALUE
PRICE COMPETITION	+ YES DOMINANT STRATEGY	+ YES DOMINANT STRATEGY
QUANTITY COMPETITION	- ? ONLY QUID PRO QUO	+ YES DOMINANT STRATEGY

5.2. Welfare impact of information sharing

Table 2 summarizes the welfare effects of information sharing on consumer and total surplus. These results depend on two main features of the market. First, the type of decision variable (price or quantity) matters. If firms are quantity setters increasing information decreases the degree of output adjustment. It is important to note that this is an effect that is independent of the degree of competitiveness of the market. Secondly, the type of uncertainty (common value versus private value) matters. This is true because of a preference for variety effect. Consumer prefers in these models consumption patterns that are uniform across varieties. With common values demand uncertainty production patterns will become more uniform with information sharing and benefit consumers. With private value uncertainty production patterns tend to become less uniform with information sharing, which leads to a reduction in welfare and consumer surplus. These two effects may be reinforcing or countervailing depending on the combination of uncertainty and decision variable. Furthermore, the relative size of the two effects may vary depending on the size of the industry.

Table 2. Effects on the welfare.

DEMAND	COMMON VALUE	PRIVATE VALUE)
PRICE COMPETITION	E.E.C: - E.E.T : - far substitutes E.E.T: + close substitutes (N big: -)	E. E.C: - E.E.T: + N = 2
QUANTITY COMPETITION	E.E.C: + E.E.T: +	E.E.C : - N small E.E.C: ? OTHER CASE E.E.T: +

CONCLUDING REMARKS

While this paper is mainly a theory-oriented piece of work, we believe that the results obtained so far may have some policy implications regarding the effectiveness and limits of information-sharing agreements.

- The most important thing we must bear in mind is that the welfare implications of information transmission are sensitive to many factors. They are: the type of competition (prices versus quantities), the nature of goods (substitutes versus complements), the nature of information (private versus public) and the number of participating firms.
- It goes without saying that policy implications are closely linked to the welfare results, given a certain criterion of social welfare. Even if we regard the expected sum of the producer and consumer surpluses as a good measure of social welfare, we should be very careful of what kind of oligopoly we are discussing and what sort of uncertainty and information we are talking about.
- In order to have a clear-cut conclusion on the merits or demerits of information transmission, it is first necessary to determine whether the uncertainty each firm is confronted with is of a common type or a

firm specific type. Suppose that every Cournot or Bertrand firm belonging to the same industry is subject to the same demand risk. Then, as our welfare analysis can show, information flow from one firm to others results in an increase in expected social surplus, with the exception of the case that firms are Bertrand competitors facing common demand uncertainty and goods are not strong substitutes. Besides, in all those favorable cases, if side payments are permitted between firms and goods are moderately substitutable or complementary, such information transmission is most likely to represent a Pareto improvement in the sense that it makes both producers and consumers better off. Therefore, except the situation of Bertrand oligopoly with common demand uncertainty, the government authority should pursue a policy with encourages the spreading of information among firms. If such policy happens to harm consumers although it does increase total surplus, it appears that we are in a sort of dilemma, since consumer protection is often regarded by antitrust policy makers as their main objective. It follows that public policies for information transmission should be supplemented with income distribution policies so that some of the increased social surplus may be shifted to consumers, for instance, through taxes and subsidies.

- The most troublesome case rests with the situation under which firms are Bertrand competitors facing a common demand risk. Unless goods are strong substitutes, information transmission has a rather negative effect on social welfare. In such a case, the authority should be discouraged from engaging in information transfer.
- Let us turn to the more interesting case where each firm faces its own demand risk. In the case of such private uncertainty, the number of participating firms plays an important role deciding the effect of information sharing on the welfare of consumers. Any information pooling agreement yields an increase in producer surplus and in total surplus. Regarding the effect on consumers, there appears a dividing line between “a few firms” and “many firms”. When the number of firms is “small”, information pooling is always harmful to consumers, showing the need of introduction of supplementary income redistribution policies. If, however, the number of firms is “large”, then the situation changes completely. Then the shared information case is most likely to be Pareto superior to the non-shared information case.
- The above considerations seem to lead to making a case-by-case analysis quite effective if we have to take much care of adopting a Pareto-improving policy. If, however, we allow for a certain kind of side payments among firms, the scheme of welfare-enhancing policy becomes much simpler. This is due to the fact that unless the oligopoly in question is Bertrand oligopoly with common demand uncertainty, any government policy of promoting information flows among firms has an effect of increasing total welfare although it might decrease the welfare of certain members of the society. Since the economic pie per se gets larger by information transmission, it is possible to make every member better off if an information-flow-promoting policy is supplemented by series of income redistribution policies. On the other hand, there is a case in which information transmission or information sharing does indeed hurt total welfare. This case is Bertrand oligopoly with common demand uncertainty. Besides there are more possible cases where information pooling is harmful to consumers as outsiders if the number of producers is rather small. What we have learned from our analysis is that these “bad” cases may clearly be identified and should be distinguished from many other “good” cases. The government agencies should have sharp eyes to select “good” cases only and, if necessary, should supplement policies for information transfer with policies for income redistribution.

In conclusion, we believe that economists should share any kind of information with each other through oral discussions or written papers, with the strong faith that information is power in the academic circle. Laboremus!

REFERENCES

- ALBACH, H.; J.Y JIN and Ch. SCHENK (1996): “Collusion through Information Sharing? New Trends in Competition Policy: Preface”, Albach, Horst Jin, Jim Y. Schenk, Christoph, eds..Collusion through information sharing? New trends in competition policy. Berlin: Edition Sigma, 7-11.
- ARROW, K. (1962): “Economic Welfare and the Allocation of Resources for Invention”, The Rate and Direction of Inventive Activity Nelson R. (eds.) Princeton: University Press Princeton.

- BRANDES, J.A. and T.R LEWIS (1986): "Oligopoly and Financial Structure: The Limited Liability effect", **American Economic Review**, 76, 956-970.
- BROWING, M. (1987): "Prices vs. Quantities vs. Laissez-faire", **Review of Economic Studies**, 54, 691-694.
- CLARKE, R.N. (1983): "Duopolist don't wish to Share Information", **Economics Letters**, 14, 33-36.
- _____ (1983): "Collusion and the Incentives for Information Sharing", **Bell Journal of Economics**, 14, 383-394.
- CREANE, A. (1998): "Risk and Revelation: Changing the Value of Information", **Economica**, 65(258), 247-61.
- D'AMOURS, S. et al. (1999): "Networked Manufacturing: The Impact of Information Sharing", **International Journal of Production Economics**, 58(1), 63-79.
- DOYLE, M.P. and Ch. M. SNYDER (1999): "Information Sharing and Competition in the Motor Vehicle Industry", **Journal of Political Economy**, 107(6), Part 1, 1326-64.
- DRIVER, C. and F. GOFFINET (1998): "Investment under Demand Uncertainty, ex-ante Pricing, and Oligopoly", **Review of Industrial Organization**, 13(4), 409-424.
- DUMEZ, H. and A. JEUNEMAÎTRE (1996): "Information et Décision Stratégique en Situation D'oligopole. L'exemple du Secteur Cimentier", **Revue Economique**, 47(4), 995-1012.
- FARMER, A. (1994): "Information Sharing with Capacity Uncertainty: The Case of Coffee" **Canadian Journal of Economics**, 27(2), 415-32.
- GAL-OR, R. (1985): "Information Sharing in Oligopoly", **Econometrica**, 53, 329-343.
- _____ (1986): "Information transmission-Cournot and Bertrand equilibria", **Review of Economic Studies**, 53, 85-92.
- HUCK, S.; HANS-THEO NORMAN and J. OECHSSLER (2000): "Does Information about Competitors' Actions Increase or Decrease Competition in Experimental Oligopoly Markets", **International Journal of Industrial Organization**, 18, 39-57.
- HUGHES, J.S.; J.L. KAO and A. MUKHERJI (1998): "Oligopoly, Financial Structure, and Resolution of Uncertainty", **Journal of Economics and Management Strategy**, 7(1), Spring, 67-88.
- HWANG, HAE-SHIN (1993): "Optimal Information Acquisition for Heterogenous Duopoly Firms", **Journal of Economic Theory**, 59, 385-402.
- _____ (1995): "Information Acquisition and Relative Efficiency of Competitive, Oligopoly and Monopoly Markets", **International Economic Review**; 36(2), 325-40.
- JENSEN, M. and W. MECKLING: "The Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", **Journal of Financial Economics**, 3, 305-360.
- JIN, J.Y. (1996): "A test for Information Sharing in Cournot oligopoly" **Information Economics and Policy**, 8(1), 75- 86.

- _____ (1998): "Information Sharing about a Demand Shock", **Journal of Economics (Zeitschrift für Nationalökonomie)**, 68(2), 137-52.
- KIRBY, A. (1988): "Trade Associations as Information Exchange Mechanisms", **The RAND Journal of Economics**, 19, 138-146.
- _____ (1993): "Optimal Information Exchange", **Information Economics and Policy**, 5(1), 5-29.
- KULTTI, K. and JUHA-PEKKA NIINIMAKI (1998): "Demand Uncertainty in a Cournot-Duopoly", **Liiketaloudellinen Aikakauskirja**; 47(1), 24-32.
- LELAND, H. (1972): "Theory of the Firm Facing Uncertain Demand", **American Economic Review**, 62, 278-291.
- LI, L. (1985): "Cournot Oligopoly with Information Sharing", **The RAND Journal of Economics**, 16, 521-536.
- MALUEG DA and SO TSUTSUI (1996): "Duopoly Information Exchange: The Case of Unknown Slope", **International Journal of Industrial Organization**, 14, 119-136.
- _____ (1998): "Oligopoly Information Exchange when Non-negative Price and Output Constraints may Bind", **Australian economic papers**, 37(4), 363-371.
- _____ (1998): "Distributional Assumptions in the Theory of Oligopoly Information Exchange", **International Journal of Industrial Organization**, 16, 785-797.
- MAKSIMOVIC, V. "Optimal Capital Structure in Oligopolies" ,PH.D. Dissertation, Harvard University.
- MARTIN, S. (1993): **Advanced Industrial Economics**, Blackwell, Cambridge, MA.
- MASON, C.F. and O.R. PHILLIPS (1997): "Information and Cost Asymmetry in Experimental Duopoly Markets", **Review of Economics and Statistics**, LXXIX (2)2, 290-299.
- NOVSHEK, W. and L. THOMAS (1998): "Information Disaggregation and Incentives for Non-collusive Information Sharing", **Economics Letters**, 61(3), 327-32.
- NOVSHEK, W. (1996): "Directions for Research in Information Sharing" Albach, HorstJin, Jim Y.Schenk, Christoph, eds. Collusion through information sharing? New trends in competition policy. Berlin: Edition Sigma, 13-26.
- OKUNO-FUJIWARA, M.; A. POSTLEWAITE and K. SUZUMURA (1990): "Strategic Information Revelation", **Review of Economic Studies**, 57, 25-47.
- PONSSARD, J.P. (1979): "The Strategic Role of Information on the Demand Function in an Oligopolistic Environment", **Management Science**, 25, 243-250.
- RAITH, M. (1996): "A General Model of Information Sharing in Oligopoly", **Journal of economic theory**, 71(1), 260-288.
- REYNOLDS S.S. and B.J. WILSON (2000): "Bertrand-Edgeworth Competition, Demand Uncertainty, and Asymmetric Outcomes", **Journal of economic theory**, 92(1), 122-141.
- SAKAI, Y. (1990): "Information Sharing in Oligopoly: Overview and Evaluation. Part I. Alternative Models with a Common Risk", **Keio Economic Studies**, 27(2), 17-41.
- _____ (1991): "Information Sharing in Oligopoly: Overview and Evaluation. Part II. Private Risks and Oligopoly Models", **Keio Economic Studies**, 28(1), 51-71.

- SAKAI, Y. and Y. TAKEHIKO (1989): "Oligopoly, Information and Welfare", **Journal of Economics (Zeitschrift für Nationalökonomie)**, 49(1), 3-24.
- _____ (1990): "On the Exchange of Cost Information in a Bertrand-Type Duopoly Model", **Economic Studies Quarterly**, 41(1), 48-64.
- SHAPIRO, C. (1986): "Exchange of cost information in oligopoly", **Review of Economic Studies**, 53, 433-446.
- SHINKAI, T. (2000): "Second Mover Disadvantages in a Three-player Stackelberg Game with Private Information", **Journal of economic theory**, 90(2), 293-304.
- TEECE, D.J. (1996): "Information Sharing, Innovation, and Antitrust" Albach, HorstJin, Jim Y.Schenk, Christoph, eds.. Collusion through information sharing? **New trends in competition policy**, Edition Sigma, Berlin, 51-68.
- TIOLE, J. (1988): **The Theory of Industrial Organization**, The MIT Press, Cambridge, Massachusetts.
- VENAYRE, F. (1999): "Incertitude sur la Demande et Incitations au Partage de L'information dans un Duopole", **Revue Economique**, 50(3), 601-10.
- VIVES, X. (1984): "Duopoly Information Equilibrium: Cournot and Bertrand", **Journal of Economic Theory**, 34, 71-94.
- _____ (1985): "On the efficiency of Bertrand and Cournot Equilibria with Product Differentiation", **Journal of Economic Theory**, 38, 166-175.
- _____ (1990): "Trade Association Disclosure Rules, Incentives to Share Information, and Welfare", **The RAND Journal of Economics**, 21(3), 409-430.
- _____ (1995): "Information Exchanges among Firms and their Impact on Competition Policy" **European Commission Document**.
- WAMBACH, A. (1999): "Bertrand Competition Under Cost Uncertainty", **International Journal of Industrial Organization**, 17, 941-951.
- WEITZMAN, M.L. (1974): "Prices vs. Quantities", **Review of Economic Studies**, 41, 477-491.
- ZHANG, J. and Z. ZHANG (1999): "Asymptotic Efficiency in Stackelberg Markets with Incomplete Information", **Discussion Paper FS IV 99-7, Wissenschaftszentrum**, Berlin.
- ZIV, A. (1993): "Information sharing in oligopoly: The truth-telling problem", **The RAND Journal of Economics**, 24(3), 455-465.