Collective Reputation, Entry and Minimum Safety Standard

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Abstract – This article deals with the issue of entry into an industry wherefirms shareacollectivereputation. First,weshowthatfreeentry is not socially optimal; there is a need for regulation through the imposition of a minimum quality standard. Second, we argue that a minimum quality standardcan induce firms to enter the market. Contrary to conventional wisdom, a minimum quality standardshould not alwaysbe consideredasa barrierto entry.

Keywords – Collective Reputation, Entry, Minimum Quality Standard.

I. INTRODUCTION

When food operators sell generic products, consumers mainly base their choices on the reputation of the entire industry. For instance, following an outbreak of food poisoning, everyone along the contaminated item's supply chain may suffer the consequences of a decrease in demand. The problem arises when consumers do not link the contamination to a particular producer but to a generic product. After the Fall 2006 spinach outbreak, the Economic Research Service of the United States Department of Agriculture reported that all US spinach growers suffered a drop in demand for their product even though only one grower's spinach was contaminated. Five months later, the value of retail sales was still down 27% compared to the same period in 2005 (Calvin, 2007). In another example from 1997, more than 200 people contracted hepatitisA after eating frozen strawberries. The USDA reported that concerns over the safety of strawberries affected demand for all berries. Experts estimated that the US berries industry bore losses of between $15 million and $40 million dollars due to the outbreak (Calvin, Avendaño and Schwentesius, 2004). In 2003, following the discovery of the first cow infected by Bovine Spongi form Encephalopathy in the USA, more than 30 countries banned US beef, threatening the 2.6 billion dollars export market. Using UPC scanner data, Schlenker andVillas-Boas (2007) show evidence of a drop in domestic beef sales as well.

The literature points out that a collective reputation is at stake in food industries in which food operators sell speciality orregionalproducts(Winfreeand McCluskey, 2005). This is particularly true when consumers cannot identify theproducerofa food product and/or food items are not traceable. Collective reputation has two main characteristics. First, producers are hostage to each others' behavior. Namely, an entire group of firms can lose consumer trust as a result of one firm's lack of diligence. Second, collectivereputation inducespricepremiumsonthe market. There are many empirical evidence which show that a positive collective reputation is a good tool to signal quality and is correlated with price premiums (Quagrainie, Mc Cluskey and Loureiro, 2003). Price premiums work as incentives for food operators to join the group.

There is little formal discussion in the literatureabout collectivereputation.Tirole (1996) considers that collective reputation should be assumed to be the aggregate reputation of individual agents. In a context of imperfect information available to consumers about quality, he shows that the composition of the producer group matters. Winfree and Mc Cluskey (2005) assume that collective reputationisa commonpropertyresourceand show that the number of firms should be considered closely because of free-rider effects. However, neither study allows for entry in or exit from the group of producers whose size is taken as fixed.

The current article addresses the issue of free-entry when food operators share a collective reputation (the industry reputation)

in a context of imperfect information about product safety available to consumers. We show that free entry is not socially optimal due to the producers' incentive to free-ride on the collective reputation. This statement supports the introduction of a minimum quality (safety) standard, that could be considered as a Mimimun Quality Standard (MQS) to correct this market failure. In the industrial organization literature, there is a controversial debate regarding the effect of a MQS on competition. Ronnen (1991) show that an adequate MQS can increase both quantities sold and quality and then social welfare. The intuition of this result is that an increase in the low quality induces an increase of the high quality (in order to soften price competition) but equilibrium prices are however lower and more consummers buy the product (see also Crampes and Hollander for a similar result). The robustness of this result has been questionned in few direction. Valetti (2000) shows that this statement is sensitive to the mode of competition and Scarpa (1998) shows that it depends on the duopolistic market structure. As Ronnen (1991) and Crampes and Hollander (1995) acknowledge, they do not consider the possibility of exit and/ or entry. As also underlined in Boccard and Wauthy (2004), who study quality regulation through quantity regulation, MQS would induce firm to exit the market and/or reduce the entry of new firms. The article proceeds as follows. In the light of empirical evidence, we set up the theoretical model emphasizing the free entry issue. Next, we analyze the competition effectswhenaMQSisimposedonthe industry. Finally, we provide our conclusions and their policy implications.

II. OLIGOPOLY WITH COLLECTIVE REPUTATION

We consider an industry in which identical and risk neutral food operators sell generic products. In this case, if a quality failure occurs the collective reputation at stake is the reputationof the entire industry.We consider a two-stage game: in the first stage, profit maximizing firms choose whether or not to enter the market. Whena firmenters the market, it faces a fixed (sunk) cost '$ $. In the second stage, the firm makes a quality decision in order to avoid quality failure, thereby contributingtothe collectivereputationofthe industry. Once they have entered the market and paid the sunk cost ', firms face a cost &!!" of providing quality with & $ $ and

$ $$ $. Mankiw and Whinston (1986) analyzea situationin which firmsproduceanhomogeneous product and the output per firm (strictly) decreases with the number of firms. Since we focus on the role of collective reputation, in our setting each firm produces one unit of the product.

Consumers only are able to imperfectly observe the average quality 2% of the product marketed.Wethus assume that thereputation of the industry is "good" with a probability *!2% ", with * $ $ $and * $$ " $. The inverse demand function is then) !1"(with) $ # $). The industry reputation is "bad" with probability % *!2% " and consequently demand drops to $. Therefore, the expected profit of a generic firm 0is ('*!2% ") !1"&!2('". We solve the game through backwardinduction. In the next section, we first present two reasonable assumptions from the monopolistic case.We then examine the oligopoly situation.

A. Monopolist Processor

We start our analysis by considering the case where there is only one firm in the market. In the second stage,the monopolistic firm makes a quality decision 2 in order to maximize its profit; (-4 *!2")# &!2"" where)# '
) !%". The corresponding first order condition is as follows * !2# ")# ' & !2# ". In the first stage, the monopoly payoff is given by !2# "%" ' *!2# ")# &!2# "'. Let consider the two following assumptions:

Assumption 1: ' " *!2# ")# &!2# "!

Assumption 2: ,+-!2"%"" $!

Assumption1states thata firm always enters the market when it foresees that no other firm would do so. According to assumption 2, a monopolistic firm cannot make any profit when its investment in quality reaches a certain level. All through the article, we assume that Assumption 1 and Assumption 2 hold. We now analyze the situation where more than one firm enter the market.

B. Oligopolist Processor

Proceeding with our analysis, we consider that 1 identical firms enter the market. These firmsproduceahomogeneousgoodandshare a collectivereputation. Accordingtothe latter statement, the entire industry can fail if one firm misbehaves (Winfree and Mc Cluskey, 2005; Carriquiry and Babcock, 2007). First, we consider that firms make their quality decision, taking the decisions of the others as given. Second, we examine the welfare effects of competition.

Collective Reputation and Quality

In the second-stage, firms individually make their quality decision, 2(, in order to prevent a drop in demand. The second-stage problem for a firm 0 is then (-4 *!2% ") !1"&!2(",
where 2% ' . The first order condition is * !2% ") !1"'& !2(". It defines firm 0's best response as an implicit function of the average quality level 2% and the number of firms 1. Hence, each firm has an incentive to decrease its quality if the average quality increases.

In an interior equilibrium, the firms' quality decisions are all the same, i.e. for all 0, 2(' 2 !1"which is characterized by:

(1) * !2 ") !1"'& !2 ""

2 represents the non cooperative equilibrium quality level.

Proposition 1 *An increase in the number of firms lowers the equilibrium quality level* 2 & #$.

Proof. Differentiating condition1 withrespect to 1we obtain

(2) ') !1") !1"

(3) ! "

This expression has a negative value. In deed,) # $, then) !1") ! # $! Moreover, * !2 " $ $ and) !1"$ $.

We distinguish two effects. On the one hand, when the number of firms in the market increases, the firms' incentive to provide quality decreases. This effect is identical to the findings of Winfree and Mc Cluskey (2005). On the other hand, competition strengthens and the price of the product consequently decreases.Afirm's benefits are thus diluted and each firmprovidesa lower levelof quality.

In the first stage, firms decide to enter the market if their ex-ante expected profit is posi

tive. The number of firms who enter the market is then characterized by:

(4) *!2 !1 "") !1"&!2 !1 """""

Where 1 denotes the equilibrium number of firms, which is an implicit function of ', the sunk costs of entry.
Differentiating condition 4 with respect to ', we obtain:

%1 % $! !
' ! %' (* !2 ") !1 "& $!2 ") !+ !*
#*!2 ") $!1 "

By definition,) $ # $. From condition (1), * $!2 ") !1 " & $!2 " # $ and according to Proposition 1, # $. Then, # $. Consequently, the size of the industry decreases as the entry cost increases.
With these results in hand, we turn to the welfare effect of competition.

The ambiguous welfare effect

In order to appraise the welfare effect of a change in the number of firms, we consider the first stage equilibrium.
If 1 firms enter the market, they anticipate that they will implement the non cooperative equilibrium quality level 2 in the second stage. Under the assumption of quasi-linear consumer utility, the consumer's surplus is &+!2 "1"' *!2 ") !3".3) !1"1 $% (% .
The total ex-ante profit of the industry is 1 !2 "1"' 1(*!2 ") !1"&!2 "') where !2 "1"represents the first stage equilibrium profit per firm. The social welfare is denoted by , ' , !2 "1", with , !2 "1" such that:

(5)

, !2 "1"'*!2 ") !3".31(&!2 "#')")* %

We can now evaluate the welfare effect of competition. Differentiating condition5with respect to 1, we obtain $ # !+ !$!$!+ !* .
The welfare effect is twofold. The direct effect is given by $ ' *!2 ")!1" (&!2 "#').
As long as profits remain non negative, !+ has a positive value. This represents the classical positive effect of competition. The in direct effect is given by . According to Proposition 1, the average quality on the market decreases with respect to the number of firms, # $. The welfare effect !$!+ of an increase in quality, , is given by

!$!+ ' * $!2 ") !3". (% 31 & ! $!2 ".) !1 " # *( ) !3".3, thusthis term hasa positive value.
Therefore, the indirect welfare effect !$!+ !+ !* hasa negative value.
When food operators share a collective reputation, the welfare effect of competition is ambiguous. An increase in the number of firms reduces each firm's market power and prices, thereby improving social welfare. Yet at the same time, it lowers the average quality on the market, reducing social welfare.

Proposition 2 *Free entry is not socially optimal.*

Proof. We evaluate the marginal variation of welfare at the free entry point. Differentiating condition 5 with respect to the number of firms 1" we obtain $!2 "1"' & * $!2 ") !3". (% 31 & ! $!2 " ! Ac !* cording to Proposition 1 and that

!$!+ ' * $!2 ") !3". (% 3 1 & ! $!2 " $ $,

this expression hasa strict negative value.
Numerical example: We consider the following specification of the model. The collective reputation is characterized by a logit function of the average quality, 2%: *!2% "'

+". The inverse demand function is assumed to be linear,) !1"' 1where $ $. The cost functiontoprovide qualityis &!2(" & ' !%#2(" . The individual ex ante profit function can be written as !2 !1""1"' ! % " % # & ! 1" + * ' * & # " #' . Consumer surplus is given by &+!2 ! !1""1"' (Marette, 2007). In the next section, we examine the competition effects when a minimum quality standardis introduced by the regulator. ! % " % # &* " ' . Therefore, the social welfare is: , !2 !1" "1"' % & 1 * ' + " , 1 &' * # #' . Figure1represents the ambiguous welfare effects of competition.

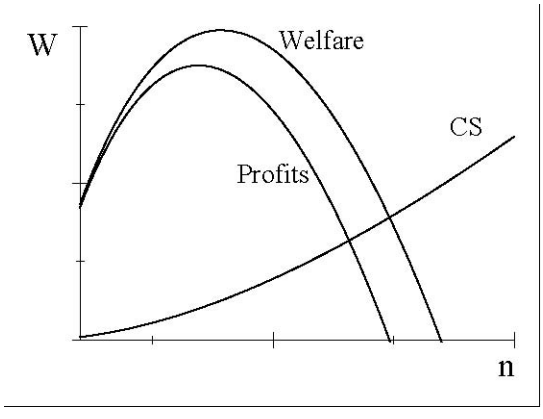

Figure 1. The Welfare Effects of Competition

When 1 ! firms compete in the market, the positive welfare effect of competition disappears. Therefore, the regulator needs to intervene in order to avoid free-riding incentives and to prevent the entire industry from failing to perform. This result contributes to the critical debate in the industrial organization literature concerning the justification of anti-competitiveregulation. For instance, Mankiw and Whinston (1986) have shown that in homogeneous product markets, free entry can lead to a socially excessive number of firms. They model a situation in which the output per firm falls as the number of firms in the industry increases. In our model, we assume that the output per firm is constant, however, thefree-riding incentiveson collectivereputation lead us to the same conclusion.

Minimum Quality Standard is the most commonly usedregulatory toolinthe foodindustry, guaranteeing product quality/safety (Marette, 2007). In the next section, we examine the competition effects when a minimum quality standardis introduced by the regulator.

III. MINIMUM QUALITY STANDARD

While maintaining our focus on the entry issue, we examine the situation where theregulator imposes a Minimum Quality Standard.

A. Magnitude of the MQS

First, we characterize a particular quality choice, 2&, which is the cooperative equilibrium quality in the second stage. This level is the solution of (-4 *!2") !1" &!2", +"% leading to the following first order condition * $!2& ") !1"& $!2& '"$. Note that 2& represents the optimal quality level for the industry.

Second, we assume that the regulator imposes a MQS denoted by 2,. 2, is exogenous and common knowledge. Firms make their entry and quality decisions according to the magnitude of 2,. Food operators are orderedto implementaquality level 2(such that 2(# 2,. Let 2 !! ' 2 ! !1"denote the non cooperative subgame perfect equilibrium quality level.

Proposition **3** *If* 2, " 2 !! , the MQS has no effect *on competition, i.e. the number of firms is* 1 ! *; There exists* 2 $ # 2& *such that for* 2 !! " 2, " 2 $ *, the number of firms is higher than* 1 ! and for

2, # 2$, the number of firms is lower than 1!. The number of firms is maximal for 2, '2&.

Proof. When the MQS is lower than the equilibrium non cooperative quality level 2, " 2!!, firms implement the (non cooperative) subgame perfect equilibrium quality level 2!! and the number of firms in the market remains 1!. When the MQS is higher than the (non cooperative) subgame perfect equilibrium quality level 2, # 2!!, let 1) denote the number of firms who enter the market. It is characterized by !2, "1) "' *!2, ") !1) " &!2, " ' '$. Differentiating the latter condition with respect to MQS level 2, we obtain

$$\frac{\partial 1)}{\partial 2,} = \frac{-. -.}{'+' !+'}$$

The number of firms 1) increases when 2! " 2, " 2& and decreases when the MQS level is higher than the cooperative equilibrium quality level 2&. By assumption,)$ # $ and !2, "1" " !2, "%". Consequently, ,+$%# !2, "1"" ,+-!2, "%". From Assumption 2(monopolist case), we conclude that ,+$%# !2, "%" " ,+-!2, "1)"'$. Finally, ,+-1) " %! Accordingly, there exists 2$ which satisfies the conditions set in the proposition (see Figure 2).

If the MQS is sufficiently low, it does not influence either competition or the firm's quality choice. Increasing the level of the MQS raises the level of the collective reputation by increasing firms' quality level. The MQS does not alter competition and induces firms to enter the market as long as the cost of providing the MQS level is sufficiently low. At the cooperative equilibrium quality level !2& ", the collective reputation and the total profit are maximal. When the MQS is imposed at such a level,a maximum numberof firms enter the market.

For MQS levels higher than the cooperative level, the marginal cost of providing quality overcomes the marginal benefit, leading to a drop in profits. Consequently, the MQS alters competition and less firms enter the market. The number of firms remains higher than it would under free entry as low as the MQS is low enough (up to 2$). For higher MQS levels, the number of firms becomes less than the number of firms at the free entry point. This is the only situation in which the MQS can alter competition. Figure2illustrates theseresults.

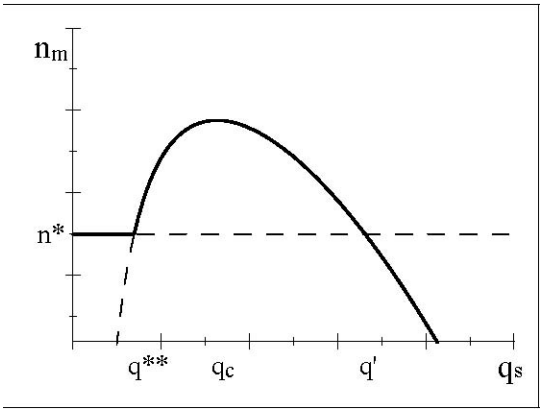

Figure 2. Number of Firms and MQS.

In the light of these statements, we turn now to analyze the welfare effect after a MQS has been imposed.

B. Welfare effect of the MQS

Let consider the welfare function at the free entry point when there are 1! firms in the industry who have implemented the non cooperative quality level equal to ' 2!!1!", which can be written !2 "1'" *!2!! " (&%)!3".31)!1!" . At the free entry point, if the MQS is such that 2!!2, " 2$, 1, firms operate in the industry and the welfare is given by

$%
,!2, "1, '" *!2, ")!3".31,)!1, " .
Namely, *!2" " *!2, ". Therefore, average quality is higher once a MQS has been introduced. The MQS increases competition, there are more firms in the industry !1 " 1, " which increases consumers' surplus. Therefore,)!3".3 1)!1" ")!3".31,)!1, ". Relative to free entry, the introduction of a MQS improves welfare as long as the level of the MQS leads to a greater number of active firms. This result differs from previous conclusions on minimum quality standards and collective reputation. Winfree and Mc Cluskey (2005) argue that when firms share a collective reputation, the introduction of MQS limits incentives to free-ride. The minimum quality standard is then Pareto improving for firms but they do not take into account a competition effect.

IV. CONCLUSIONS

The issue of collective reputation is not exclusive to firms who sell regional or specialty products. Collective reputation may be at stake when food operators sell food items that consumers consider as generic. For instance, an entire industry may suffer decreased demand following a food safety outbreak. In order to prevent quality and safety failures, food operators endeavour to sustain an accurate level of quality in the market. However, the more firms there are in the industry, the greater the incentive to free-ride on the qualityof others.We show thatfree-entry leadsto a sub-optimal number of firms in the market. Therefore, the regulator needs to intervene in order to avoid the incentive to free-ride and to prevent the entire industry from failing to perform. A solution could be to restrict the number of firms in the market. However,such regulation would lead to an increase in price. Moreover, it would limit the incentive to free ride but it won't eliminate it. This statement supportstheintroductionofaminimumquality standard in the industry. Indeed, a minimum quality standard allows to avoid both negative welfare effects of the latter policy.

By focusing on entry, this article provides new results for research on collective reputation and minimum quality standards. We show that the introduction of a minimum quality standard can induce firms to enter the market and consequently it does not always alter competition, sustaining both the average quality in the industry and the level of welfare. To conclude, minimum quality standards should not be systematically considered bytheregulator as an anti-competitiveregulation.

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