Information disclosure : theory, policy and experiment

Information Disclosure

Theory, policy and Experiment

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Chapter 1

Introduction

In the article "The use of Knowledge in Society", Friedrich Hayek points out that information is important for making optimal decisions and that price systems communicate information about scarcity of goods and guide resources to be allocated efficiently. However, relevant information can be asymmetric which means that one party in the interaction has more information than another. Such asymmetry in information can lead to a change in behavior in comparison to symmetric information situations. The informed party may try to take advantage of the less informed party. To prevent being taken advantage by the informed, the less informed party may change his behavior too. These changes in behavior could lead to an inefficient outcome. The less informed party may have incentives to get information from the informed if the cost of acquisition is lower than the benefit of this additional information, and may not otherwise. When information asymmetry cannot be mitigated by the parties involved and eliminating the information asymmetry can increase market efficiency, we regard this phenomenon as a market failure. The intervention by a third party who steps in to eliminate such information asymmetry and increase efficiency would be desired. For instance, in the food industry, producers have more information on food quality than consumers. To reduce information asymmetry, governments regulate the industry by forcing producers to provide necessary information on quality to consumers.

Sometimes the informed party may consist of two or more agents who share the same information but whose interests are not totally aligned. In this situation, to get more information from the informed, the less informed party may take advantage of the conflict of interests among the informed. Since the informed agents share the same information, the less informed party may provide a reward only to the first agent who reports all relevant information. If the expected reward is higher than the benefit from concealing information,

agents will rush to report. In practice, antitrust authorities use leniency programs to induce informed cartel members to report evidence of the cartel. And these programs are quite successful in terms of the number of cartels that have been cracked.[1]

There are also some situations where all parties can benefit from sharing information. The party with more information has an intention to communicate the information to the less informed party and some communication channels are available. But whether such channels really convey all useful information needs to be tested. Notice that communication usually involves human beings. Human behavior in communication, e.g. whether to send truthful information and how to interpret the information received, should be taken into account when we test the efficiency of a communication channel. If there is no such channel to successfully exchange information due to high cost of communication or mistrust between parties, designing a mechanism to promote information transmission is a key to enhance efficiency.

This thesis comprises three self-contained chapters which are addressing the asymmetric information issues mentioned above. Chapter 2 is a theoretical investigation on the incentives of information acquisition and revelation in a model of price competition. Chapter 3 addresses the policy related issue of how to improve the effectiveness of antitrust policies. It discusses how antitrust authorities take advantage of the conflict of interests among the colluding firms to get evidence of the cartels. Chapter 4 experimentally tests whether the communication channel "cheap talk" is an effective way to mitigate information asymmetry and enhance efficiency in a setting where potential entrants decide whether to enter a market of unknown size or not.

In Chapter 2, we try to understand the economic logic behind some food quality scandals. We observe that in the recent past there have been numerous scandals around bad practices in the food industry. Although it can be easily rationalized why these bad practices have not been reported by the inflictors themselves, it is more difficult to understand why the non-inflicting competitors did not report their rivals' conspicuous acts. For instance, in the 2008 Chinese milk scandal, there are many firms that had been selling good milk and didn't disclose that their rivals were selling melamine-tainted milk. The first question is whether they did possess all relevant information, and if not, why not? But, in case they did know, are there any viable reasons not to publicly disclose this delicate

[1] Gary R. Spratling, Detection and Deterrence: Rewarding Informants for Reporting Violations, 69 The George Washington Law Review 798, 799 (2001)

information? May they have anticipated the bans by importing countries, which makes disclosure a self-defeating course of action? We address these questions via a theoretical investigation to a firm's incentive to acquire and to disclose information on the quality of its rival's product, and how regulatory intervention may enhance information disclosure.

The model considers two firms that compete in prices within a differentiated product market, where the quality of one of the firms is publicly known and that of the other firm unknown. Before the firms set their prices, the former firm has the possibility to acquire information on the quality of the latter firm's product, and, if decided to do so, subsequently, the possibility to credibly reveal this information to the public. We define a market in which the incumbent's profit is increasing (decreasing) in the entrant's quality as a complement (substitute) market.

We find that when the costs of acquisition are low, the incumbent will acquire information on the entrant's quality. Low quality levels of the entrant's product can be disclosed by the incumbent in a substitute market, but should not be expected to be disclosed in a complement market. In addition, when the quality level of the incumbent's product is high, the incumbent is willing to spend more on acquiring information on the quality of the entrant's product, willing to disclose lower quality levels of the entrant's product in the substitute market, and willing to disclose higher quality levels of the entrant's product in the complement market. Policies that mandate acquisition or disclosure may enhance disclosure of low quality levels, but fail to be welfare enhancing.

In Chapter 3, we investigate whether introducing individual sanctions increases the effectiveness to deter cartels and how a policy with individual sanctions changes the governance of firms. To study the effectiveness of individual sanctions, we have to set some benchmarks. The first benchmark is the case that only corporate sanctions are available. We compare it with the case where both corporate and individual sanctions are available to check whether the latter deters more cartels. The second benchmark is the case that corporate sanctions and corporate leniency programs are available. Then, we compare it with the case where corporate and individual sanctions and leniency programs are available to test whether introducing the individual leniency program decreases the frequency of cartel formation.

We find that given that corporate sanctions are installed, only introducing individual sanctions cannot deter more cartels because the potential punishment for a manager is compensated by a high wage in equilibrium when a firm's owner tries to induce his manager

participating in collusion by a contract. In contrast, combining individual sanctions with an individual leniency program is more effective to deter cartels than only imposing individual sanctions because the individual leniency program strengthens the conflict of interests between managers and owners and such conflicts cannot be mitigated by the contract set before.

Moreover, if we allow the owner to choose whether to hire a manager at the beginning, he is less likely to hire a manager under the leniency program because the new policy reduces the possibility that the owner successfully induces the manager to participate in collusion. Our results suggest that with a leniency program splitting a penalty among the corporate and the individual involved in cartels is more effective to deter cartels than only imposing the penalties on the corporate.

In Chapter 4, we experimentally test whether cheap talk can improve market efficiency. Our experiment resembles the situation in which an incumbent firm can signal market conditions to two possible entrants via one public message. The three possible market conditions refer to the demand in the market, which is either small, medium or large. In this situation, independent of the state, the incumbent has a preference to deter entry. The incumbent can achieve this by having the potential entrants believing that the demand is small, in which case it is a dominant action for them not to enter. Since the incumbent firm (the sender) is endowed with incentives to understate the true size of the market demand to two potential entrants (the receivers), only babbling equilibria exist.

Despite there only being babbling equilibria, from an ex ante perspective, all parties involved would prefer full revelation to any babbling equilibrium. Thus, there is a mutual benefit to ameliorate the failure to communicate. In order to assess whether cheap talk yields more efficient entry levels and higher payoffs, we implement two baseline treatments: one in which full information is given to the potential entrants and one in which the communication channel is disabled.

We find that cheap talk does not generate any efficiency of entry and payoffs beyond the level that is obtained without information transmission. On average, senders' (incumbents) messages convey truthful information. In case senders send deceptive messages, most of the time it concerns strategic deception (understating the state), but there is a robust substantial amount of obscure deceptions (overstating the state). The receivers' (potential entrants) empirical probability to enter is increasing in the size of the market as it is claimed to be by the sender. Thus, despite cheap talk not being able to enhance overall

performance, messages contain relevant information and this is picked up by the receivers. So, while we find overcommunication (relative to standard theoretical prediction) in the laboratory, compared to the situation without information transmission, cheap talk doesn't work to alleviate the asymmetric information problem. The reason is that receivers fail to optimally translate the information received in their entry decision, possibly due to overcautiousness.

Chapter 2

Information acquisition and disclosure

2.1 Introduction

The 2008 Chinese milk scandal broke on 16 July, after sixteen infants in Gansu Province, who had been fed on milk powder, were diagnosed with kidney stones.[1] By November 2008, China reported an estimated 300,000 victims, with six infants dying from kidney stones and other kidney damage, and a further 860 babies hospitalized. It was found that infant formula had been adulterated with the chemical melamine by some producers to cause it to appear to have a higher protein content. This issue raised concerns about food safety and political corruption in China, and damaged the reputation of China's food exports, resulting in numerous countries stopping all imports of Chinese dairy products.

Although it can be easily rationalized why the adulterating producers did not report their 'bad' practises, it is more difficult to understand why the non-adulterating competitors did not report their rivals' conspicuous acts. The first question is whether they did possess all relevant information, and if not, why not? But, in case they did know, are there any viable reasons not to publicly disclose this delicate information? May they have anticipated the bans by importing countries, which makes disclosure a self-defeating course of action? More generally, it raises the question when we can leave the information disclosure process to (the competitive pressure of) markets and when there is need for governmental intervention to protect consumers against misbehaving firms.[2] In this chapter we address

[1]This chapter is based on a paper by Li and Peeters (2013a).

[2]For instance, in 1990, the Nutrition Labeling and Education Act was signed into United States Federal law to give authority to the Food and Drug Administration to require nutrition content labeling of most

these questions via a theoretical investigation to a firm's incentive to acquire and to disclose information on the quality of its rival's product.

In our model there are two firms competing in prices within a differentiated product market; one firm we label as incumbent, the other as entrant. We assume that the quality of the incumbent's product is publicly known (i.e., it is known by the incumbent, the entrant and all consumers) while that of the entrant is private information (i.e., it is known by the entrant, but not by the incumbent and the consumers). Before the firms set their prices, the incumbent has the possibility to acquire information on the quality of the entrant's product, and, if decided to do so, subsequently, the possibility to credibly reveal this information to the public. Neither the incumbent's information acquisition costs, nor the decision to acquire information or not, are observed by the entrant and the consumers. The realized demand for the firms depends on the (lack of) information on both firms' product qualities and the prices charged.

In a nutshell, we find that low quality levels may be disclosed in a market where the products can be considered substitutes, but are never disclosed in markets where products can be considered complements. Moreover, regulatory policies that implement full information acquisition and disclosure are typically welfare reducing. A policy that mandates firms to disclose information upon acquisition (assuming that acquisition is detectable by authorities), while leaving the acquisition itself voluntarily without imposing additional incentives via cost subsidization, can achieve disclosure of low quality levels even in a complement market, but does not positively affect (nor negatively) ex ante overall welfare.

The remaining of the chapter is organized as follows. In the next section, we shortly discuss the related literature. In Section 2.3 we present the details of our model of rivalry information acquisition and disclosure. In Section 2.4 we present the results for the situation without governmental regulation and disclosure is voluntary (and strategic). In Section 2.5 we introduce various regulatory instruments and assess them on the welfare that they generate (relative to the situation without regulation). Section 2.6 concludes.

foods. From the same year onwards, the Council Directive of the European Commission strictly requires nutrition labeling to be presented in a standardized form applying throughout the Community for the benefit of the consumer and to avoid any possible technical barriers to trade.

2.2 Related literature

An important result of the early literature on strategic disclosure is the "unraveling theory"; see a.o. Akerlof (1970), Grossman (1981) and Milgrom (1981). This theory predicts a monopolist to make a full disclosure of its quality when disclosure is costless, in anticipation of consumers assuming the worst possible quality that is consistent with the available information (or lack thereof). Hence, when disclosure is costless and information is ex post verifiable at no cost (with appropriate legal litigation), there is no need for governments to step up as the free market offers enough incentive for business to disclose.[3] However, as is shown by Viscusi (1978) and Jovanovic (1982), when disclosure is costly, information disclosure unravels from the top down and business only fully discloses if the quality exceeds a certain threshold (that is related to the disclosure cost).

Recently, sellers' disclosure behavior has been examined in duopoly markets by Levin, Peck and Ye (2009), Board (2009), and Hotz and Xiao (2010). Levin et al. (2009) consider a horizontal differentiation model with the firms' quality levels being private information. Before announcing their prices, at a cost, firms can publicly and truthfully disclose their own quality. In line with the results by Viscusi (1978) and Jovanovic (1982), they find that there is a threshold below which firms will not disclose their quality.[4] Although there is excess disclosure from a welfare perspective, consumer welfare benefits from mandated disclosure. Board (2009) examines a vertical differentiation model with firms knowing their own and each others' quality level. However, they can only disclose (at no cost) their own quality level to the public. He finds that competition does not lead to full disclosure even though disclosure is costless, and it may be the case that only the high quality firm chooses to disclose. Mandatory disclosure laws can promote competition and raise consumer surplus at the expense of firm profits, potentially increasing the efficiency of the market. Hotz and Xiao (2010) consider a duopoly model where products are both horizontally and vertically differentiated with, as in Board (2009), firms knowing their own and each other's qualities, but can disclose only their own quality. Consistent with Board (2009), they find that a firm may not reveal the quality even with zero disclosure costs. The reason is that information

[3] Okuno-Fujiwara, Postlewaite and Suzumara (1990) provide fairly general conditions for complete disclosure to result in a regime of voluntary disclosure.

[4] The impact of competition on disclosure has already been studied in Cheong and Kim (2004). They find that full unraveling is obtained with zero disclosure cost. However, when there is a positive disclosure cost, complete concealment of information is obtained (in the symmetric equilibrium satisfying a monotonicity property on disclosure behavior) when the number of firms grows large.

disclosure may trigger more intense price competition and erode profits.

One assumption that the literature mentioned in the preceding two paragraphs has in common, is that sellers are a priori informed about the quality of their product. Matthews and Postlewaite (1985) study the impact of an explicit information acquisition decision on eventual information disclosure. They show that when information can be acquired at no cost and there are no disclosure rules in effect, sellers will acquire and fully disclose. However, sellers will not acquire information only if disclosure is mandatory (upon acquisition). The reason is that, opposed to a situation with voluntary subsequent disclosure, a seller can credibly claim ignorance. Building on the model introduced by Farrell and Sobel (1983) and Farrell (1986), also Shavell (1994) studies incentives to acquire product information and the effect of a mandatory disclosure rule. He finds that sellers have an excessive incentive to acquire information in the absence of a rule that mandates disclosure of available information. Again, the reason is that a seller's silence will lead to an inference by the buyer that if the seller obtained information, it must not have been favorable.

The only papers where incentives to acquire and to disclose information have been studied in a setting where sellers are in strategic conflict with other sellers, as far as our knowledge reaches, consider the information transmission process between competitors (most often about the private production costs – see Yin and Yan (2011) and the references therein) rather than that from the supply side to the demand side. Studies on incentives to disclose information on the rival's product quality to the public seems yet nonexistent.

2.3 The model

We investigate a firm's incentive to acquire and to disclose information on the quality of its rival's product. Thereto, for convenience, we assume there is an incumbent (firm I) with a product of commonly and publicly known quality $\theta_I \in [0, 1]$ that faces entrance by an entrant (firm E) with a quality θ_E that is drawn from the unit interval according to the uniform distribution and of which the realization is not known by the incumbent nor by the public. We assume that revelation of the entrant's quality to the public cannot credibly be done by the entrant (due to a lack of reputation) and that the incumbent would be able to disclose the entrant's quality credibly once this information is acquired of. The incumbent can acquire information on the entrant's quality via a detailed product investigation at a cost c that is randomly drawn from the unit interval according to the uniform distribution

of which the realization is only known by the incumbent (prior to making this information acquiring investment). Finally, the incumbent and the entrant compete in prices.

Let the firms' individual demands be given by

$$q_I = v + a\,\theta_I - b\,\tilde{\theta}_E - m\,p_I + n\,p_E \qquad \text{and} \qquad q_E = v + a\,\tilde{\theta}_E - b\,\theta_I - m\,p_E + n\,p_I,$$

where $\tilde{\theta}_E$ is the quality of the entrant as it is perceived (expected) by the public. The positive parameters a, b, m and n capture the sensitivity of the demand to quality levels and prices. So, demand increases in the own quality and decreases in that of the rival. Likewise, demand decrease in the own price and increases in that of the rival. We assume $a > b$ and $m > n$, such that "own effects" dominate "cross effects". Finally, the common value v is assumed to be large enough to imply positive prices in equilibrium.[5] We assume firms to produce up to demand and do not face any production cost.

In short, the game proceeds as follows. First, nature randomly chooses the entrant's quality θ_E (and reveals it to the entrant). Second, the incumbent decides whether to spend an amount c to acquire information on the entrant's quality, where c is uniformly distributed over $[0, 1]$. Neither the decision, nor the cost of acquisition are observed by the entrant and the consumers. The distribution according to which this cost is drawn is common knowledge. Third, in case the incumbent has decided to acquire the information, now it has to decide whether to disclose it to the consumers or not.[6] Fourth, both firms set their prices p_I and p_E. Fifth, consumers observe prices, update their beliefs about the quality of the entrant's product and make their purchasing decisions.

The expectations that the consumers hold about the quality of the entrant's product has a negative direct effect on the the demand of the incumbent. However, as the entrant's price will be positively affected by the consumers expectations, there is a positive indirect effect on the incumbent's demand. Therefore, whether to disclose information or not, and if so, which quality levels to disclose, will depend on which of these effects dominate. The next section will deal with this in detail.

Our solution concept is Perfect Bayesian Equilibrium, which consists of the equilibrium strategies (the incumbent's acquisition and disclosure decision and both firms their pricing strategies), and the consumers' equilibrium beliefs about the quality of the entrant's product. Because quality does not affect production cost, the profit maximizing prices do

[5] Some sufficient conditions are provided in the proof of proposition 2.2.

[6] In case the incumbent is indifferent between acquiring or not, we assume it acquires. And, in case of indifference between disclosing or not, we assume it discloses.

not depend on the value of any undisclosed quality. Hence, we can ignore the possibility of product qualities being signalled via prices,[7] and restrict attention to Perfect Bayesian Equilibria in which consumers' beliefs about undisclosed qualities do not depend on either price.

2.4 Voluntary disclosure and acquisition

In this section we study the incumbent's rivalry disclosure behavior when disclosure is voluntary. Given the incumbent's quality θ_I and the entrant's quality as it is perceived by consumers $\tilde{\theta}_E$, in equilibrium, the firms set the following prices:

$$\begin{aligned} p_I^* &= \frac{(2\,m+n)\,v + (2\,a\,m - b\,n)\,\theta_I + (a\,n - 2\,b\,m)\,\tilde{\theta}_E}{4\,m^2 - n^2} \\ p_E^* &= \frac{(2\,m+n)\,v + (2\,a\,m - b\,n)\,\tilde{\theta}_E + (a\,n - 2\,b\,m)\,\theta_I}{4\,m^2 - n^2}. \end{aligned} \tag{2.1}$$

Hence, equilibrium profits of the firms are given by:

$$\begin{aligned} \pi_I^* &= \frac{m\,[(2\,m+n)\,v + (2\,a\,m - b\,n)\,\theta_I + (a\,n - 2\,b\,m)\,\tilde{\theta}_E]^2}{(4\,m^2 - n^2)^2} \\ \pi_E^* &= \frac{m\,[(2\,m+n)\,v + (2\,a\,m - b\,n)\,\tilde{\theta}_E + (a\,n - 2\,b\,m)\,\theta_I]^2}{(4\,m^2 - n^2)^2}. \end{aligned} \tag{2.2}$$

From the incumbent's profit function, we get the following proposition.

Proposition 2.1. *The incumbent's equilibrium profit is increasing (decreasing) in the entrant's quality as it is perceived by consumers if* $a\,n - 2\,b\,m$ *is positive (negative).*

This proposition identifies two different types of market structure depending on whether $a\,n - 2\,b\,m$ is positive or negative. In case the expression is positive, the profit of the incumbent is increasing in the rival's perceived quality and we can regard the market a "complement market"; in case the expression is negative, we can regard the market a "substitute market."

In the third stage, in case the incumbent has acquired the information about the true realization of θ_E, the incumbent has to decide whether to (truthfully) disclose the available information or not. In case the incumbent decides to disclose, consumers will update their beliefs such that $\tilde{\theta}_E = \theta_E$. When consumers do not receive any information regarding

[7] We refer to Daughety and Reinganum (2008) for a study that unifies disclosure and signalling.

the value of θ_E, this is because either the incumbent didn't acquire the information or the incumbent did acquire the information but decided not to disclose it. Suppose that in such a case consumers update their belief to the value being θ_E^* (in expectation). In a complement (substitute) market, the incumbent will disclose if and only if the true value of θ_E is above (below) θ_E^*. This level θ_E^* depends on the threshold for the acquisition cost, c^*, below which the incumbent will acquire rival information. For the complement market this θ_E^* can be implicitly formulated as[8]

$$\theta_E^* = \frac{\frac{1}{2}\,\theta_E^*\,c^*\,\theta_E^* + \frac{1}{2}\,(1-c^*)}{c^*\,\theta_E^* + (1-c^*)} \tag{2.3}$$

and as

$$\theta_E^* = \frac{\frac{1}{2}\,(1+\theta_E^*)\,c^*\,(1-\theta_E^*) + \frac{1}{2}\,(1-c^*)}{c^*\,(1-\theta_E^*) + (1-c^*)} \tag{2.4}$$

for the substitute market. These equations give us the solutions (the other solutions are not within the unit interval)

$$\theta_E^* = \frac{\sqrt{1-c^*} - (1-c^*)}{c^*} \tag{2.5}$$

and

$$\theta_E^* = \frac{1-\sqrt{1-c^*}}{c^*} \tag{2.6}$$

for the complement market and the substitute market respectively.

Since c^* takes only values in the closed unit interval, we find that in the complement market (substitute market), θ_E^* takes values below (above) 0.5. This means that even quality levels below (above) the level that is expected by consumers in absence of information acquisition and disclosure technologies are disclosed in case of a complement market (substitute market). In the extreme case when $c^* = 1$ – i.e., when at any cost information is acquired (and this is understood and anticipated by consumers) – we find the "unraveling effect" of Grossman (1981), Milgrom (1981) and Milgrom and Roberts (1986), and all quality levels are disclosed for both market types.

The incumbent will only acquire information on the quality of the entrant's product, in the second stage, if the expected value of such information to the incumbent, v_I, exceeds the cost, c, of acquiring it. This value v_I equals $\int_{\theta_E^*}^{1} [\pi_I^*(\theta_I,\theta_E) - \pi_I^*(\theta_I,\theta_E^*)]\,\mathrm{d}\,\theta_E$ in a complement market and $\int_0^{\theta_E^*} [\pi_I^*(\theta_I,\theta_E) - \pi_I^*(\theta_I,\theta_E^*)]\,\mathrm{d}\,\theta_E$ in a substitute market. The

[8] A quick glance at Figure 2.1 may be helpful to understand the right-hand side expressions.

equilibrium threshold c^* is the value of c for which $v_I = c$. For the complement market this equation is given by

$$c^* = \frac{m\,(a\,n - 2\,b\,m)\,(1-\theta_E^*)^2\,\{(2\,m+n)\,v + (2\,a\,m - b\,n)\theta_I + (a\,n - 2\,b\,m)\,[\theta_E^* + \frac{1}{3}\,(1-\theta_E^*)]\}}{(4\,m^2 - n^2)^2} \tag{2.7}$$

and for the substitute market by

$$c^* = \frac{m\,(2\,b\,m - a\,n)\,\theta_E^{*\,2}\,\{(2\,m+n)\,v + (2\,a\,m - b\,n)\theta_I - (2\,b\,m - a\,n)\,[\theta_E^* - \frac{1}{3}\,\theta_E^*]\}}{(4\,m^2 - n^2)^2}. \tag{2.8}$$

We can summarize the acquisition and disclosure decision of the incumbent by the following proposition (see Figure 2.1 for a graphical illustration).

Proposition 2.2. *(i) For the complement market, there exist thresholds $c^* \in [0,1]$ and $\theta_E^* \in [0, 0.5]$ such that information is acquired if and only if $c \leq c^*$ and disclosed if and only if in addition $\theta_E \geq \theta_E^*$. (ii) For the substitute market, there exist thresholds $c^* \in [0,1]$ and $\theta_E^* \in [0.5, 1]$ such that information is acquired if and only if $c \leq c^*$ and disclosed if and only if in addition $\theta_E \leq \theta_E^*$.*

Proof. **(i) Complement market.** Equation (2.3) can be rewritten as

$$c^* = \frac{1 - 2\,\theta_E^*}{(1-\theta_E^*)^2}. \tag{2.9}$$

Let us denote the right-hand side of this equation by $F(\theta_E^*)$ and denote the right-hand side of Equation (2.7) by $G(\theta_E^*)$. Since $a > b > 0$, $m > n > 0$, $a\,n - 2\,b\,m > 0$ and v is sufficiently large to guarantee positive prices, the first derivatives of F and G are both negative on the interval $(0,1)$. Moreover, since $F(0) = 1$ and $F(0.5) = 0$ and $G(1) = 0$, the condition $G(0) \leq 1$ guarantees at least one solution of $F = G$ in the interval $[0, 0.5]$.[9] Equation (2.9) implies that such a solution gives rise to a c^* in $[0,1]$.

In terms of restrictions on v, for given value of θ_I, $G(0) \leq 1$ is equivalent to

$$v \leq \frac{(4\,m^2 - n^2)^2 - m\,(a\,n - 2\,b\,m)\,[(2\,a\,m - b\,n)\,\theta_I + \frac{1}{3}\,(a\,n - 2\,b\,m)]}{m\,(2\,m+n)\,(a\,n - 2\,b\,m)}.$$

To ensure that this is satisfied for all values of θ_I, it requires

$$v \leq \frac{(4\,m^2 - n^2)\,(2\,m - n)}{m\,(a\,n - 2\,b\,m)} - \frac{(2\,a\,m - b\,n) + \frac{1}{3}\,(a\,n - 2\,b\,m)}{(2\,m+n)}.$$

[9] Notice that it only provides a sufficient condition.

A sufficient condition for the prices to be positive is

$$v \geq 0.$$

(ii) Substitute market. Equation (2.4) can be rewritten as

$$c^* = \frac{2\,\theta_E^* - 1}{{\theta_E^*}^2}. \tag{2.10}$$

Let us denote the right-hand side of this equation by $F(\theta_E^*)$ and denote the right-hand side of Equation (2.8) by $G(\theta_E^*)$. Since $a > b > 0$, $m > n > 0$, $2\,b\,m - a\,n > 0$ and v is sufficiently large to guarantee positive prices, the first derivatives of F is positive on the interval $(0, 1)$. Moreover, if $v \geq \frac{(2\,b\,m - a\,n) + (2\,a\,m - b\,n)\,\theta_I}{(2\,m + n)}$, then also the first derivative of G is positive on the interval $(0, 1)$. Moreover, since $F(0.5) = 0$ and $F(1) = 1$ and $G(0) = 0$, the condition $G(1) \leq 1$ guarantees at least one solution of $F = G$ in the interval $[0.5, 1]$. Equation (2.10) then implies that such a solution gives rise to a c^* in $[0, 1]$. In terms of restrictions on v, for given value of θ_I, $G(1) \leq 1$ is equivalent to

$$v \leq \frac{(4\,m^2 - n^2)^2 - m\,(2\,b\,m - a\,n)\,[(2\,a\,m - b\,n)\,\theta_I - \frac{2}{3}\,(2\,b\,m - a\,n)]}{m\,(2\,m + n)\,(2\,b\,m - a\,n)}.$$

To ensure that this is satisfied for all values of θ_I, it requires

$$v \leq \frac{(4\,m^2 - n^2)\,(2\,m - n)}{m\,(2\,b\,m - a\,n)} - \frac{(2\,a\,m - b\,n) - \frac{2}{3}\,(2\,b\,m - a\,n)}{(2\,m + n)}.$$

A sufficient condition for the prices to be positive is

$$v \geq \frac{(2\,b\,m - a\,n)}{(2\,m + n)}.$$

□

Combining Equations (2.3) and (2.7) ideally would provide us with explicit solutions θ_E^* and c^* (as functions of θ_I, a, b, m, n and v) for the complement market. Likewise, Equations (2.4) and (2.8) ideally would give us the explicit solutions for the substitute market. However, substitution of the latter equation in the former gives a fifth degree polynomial equation in θ_E^*. Although it cannot be explicitly solved, we continue with some comparative statics results showing how the thresholds c^* and θ_E^* relate to incumbent's own quality θ_I.

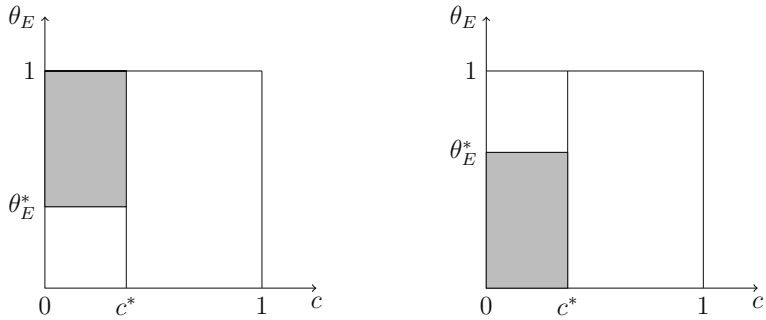

Figure 2.1: Information acquisition and disclosure rule of the incumbent in the complement market (left picture) and substitute market (right picture). Rivalry disclosure occurs only when the realizations of the acquisition cost and the entrant's quality combine to a point in the gray area.

Proposition 2.3. *(i) For both the complement and substitute market, the threshold of the acquisition cost, c^*, is increasing in the incumbent's own quality, θ_I. (ii) The threshold of the entrant's quality, θ_E^*, above (below) which the incumbent discloses, is decreasing (increasing) in the incumbent's quality, θ_I, in the complement (substitute) market.*

Proof. (i) The derivatives of c^*, as specified in Equations (2.7) (complement market) and (2.8) (substitute market), to θ_I is easily shown to be positive. (ii) The derivative of θ_E^*, in Equation (2.5) (Equation (2.6)), to c^* is negative (positive) for the complement (substitute) market. So, $\frac{\partial \theta_E^*}{\partial \theta_I} = \frac{\partial \theta_E^*}{\partial c^*} \cdot \frac{\partial c^*}{\partial \theta_I}$ is negative (positive) for the complement (substitute) market. □

So, the maximum cost the incumbent is willing to spend on acquiring information on the quality of the rival's product is increasing in the quality of its own product. In the substitute market lower quality levels of the rival's product are disclosed at larger quality levels of the own product, while in the complement market higher quality levels of the rival's product are disclosed at larger quality levels of the own product. So, the likelihood on information being acquired and disclosed is, in both market types, increasing in the quality of the incumbent's product. This comparative static property is graphically illustrated in Figure 2.2.

The fact that in the complement (substitute) market lower (higher) levels of the rival's quality are disclosed at higher quality levels of the own product may appear as a bit

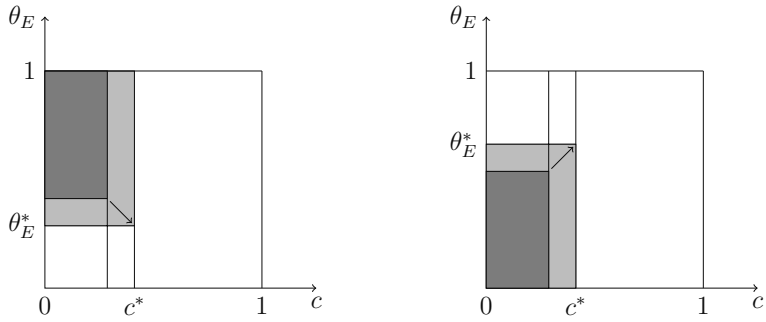

Figure 2.2: The area of realizations of the acquisition cost and the entrant's quality for which rivalry disclosure takes place is increasing in the incumbent's quality in the complement market (left picture) and in the substitute market (right picture).

paradoxical as the incumbent's profit is increasing (decreasing) in the rival's quality as it is perceived by the consumers. This seemingly paradoxical property can be explained by the incumbent being willing to invest more in information when it has a larger quality itself irrespective of the interaction structure of the market. As the consumers anticipate the likelihood of information being acquired being increasing in the incumbent's quality, the incumbent has to counterbalance the otherwise even more erosive impact of consumers' quality expectations on its profit via its disclosure policy.

2.5 Regulatory policies and their welfare consequences

One finding of the previous section is that low quality levels are disclosed in a substitute market (when the costs are low), but are never disclosed in a complement market. We can identify several regulatory policies that nudge an incumbent towards more information disclosure by obligating acquisition, disclosure conditional on acquisition, or both. Furthermore, in regimes with voluntary acquisition, the cost that the incumbent incurs upon acquisition can be subsidized or not.[10]

[10]In January 2013, in order to get its abysmal food safety record under control, the Chinese government started offering cash rewards to people who report on others who violate food safety laws (see `http://www.reuters.com/article/2013/01/15/us-china-food-safety-idUSBRE90E0H820130115`). Assuming that information is always available to at least one person who does not benefit from not disclosing information, one should expect disclosure of those quality levels for which rewards are granted. In this chapter, we will not dig deeper into the effectiveness and welfare implications of this particular policy instrument.

First, any regime in which acquisition is mandatory implements full disclosure, as the model assumes disclosure to be costless and, hence, the unraveling theory applies. Second, the regimes with voluntary acquisition also implement full disclosure when the costs of acquisition are subsidized (by means of a reimbursement). No matter whether the subsidization is conditional on disclosure or not, it sets the incumbent's cost of acquisition virtually at zero. As the ex ante value of information is always positive (which is shown below), regardless of the market being of the complement or substitute type, the incumbent will always acquire information at zero cost. As this is known by the consumers, the unraveling theory is again applicable. Among the possible regimes considered here, only one regime remains that can be regarded non-trivial: the one with voluntary acquisition and mandatory disclosure without cost subsidization.

When disclosure is mandatory upon acquisition, but acquisition is voluntary (and not subsidized), the incumbent's decision to acquire or not is a matter of weighing the ex ante benefits of having the information against the costs of acquiring it. In case the incumbent decides not to acquire, consumers do not update their prior belief (i.e. $\tilde{\theta}_E = \frac{1}{2}$) and it receives a profit of $\pi_I^*(\theta_I, \frac{1}{2})$. In case the incumbent decides to acquire the information about the quality of the entrant's product, consumers update their prior belief to the actual value (i.e. $\tilde{\theta}_E = \theta_E$), and the incumbent receives an expected profit of $\int_0^1 \pi_I^*(\theta_I, \theta_E)\,\mathrm{d}\,\theta_E$. The (ex ante) value of the information is the difference between these two (expected) profit levels, and equals

$$\tilde{v}_I = \int_0^1 \pi_I^*(\theta_I, \theta_E)\,\mathrm{d}\,\theta_E - \pi_I^*(\theta_I, \tfrac{1}{2}) = \frac{m\,(a\,n - 2\,b\,m)^2}{12\,(4\,m^2 - n^2)^2}.$$

If the costs of acquisition are below the threshold level $\tilde{c} = \tilde{v}_I$, the incumbent will acquire information on the quality of the entrant's product (and disclose it). Notice that $\tilde{c}$ is larger than 0 and, because the value of information cannot be more than in a situation where disclosure is voluntary, $\tilde{c}$ is below the threshold c^* of the previous section and thus below 1. Moreover, unlike in the previous section, the threshold $\tilde{c}$ does not depend on the quality of the incumbent's own product θ_I.

The failure to solve explicitly for the threshold levels of c^* and θ^* in the benchmark case without regulation hampers an explicit measurement of the impact of the regulatory policies on expected overall welfare, defined as the sum of the firms' profits (based on the esteemed quality levels) and the consumers surplus (calculated on basis of the true quality levels) with the cost of information acquisition subtracted. Therefore we continue with a

numerical analysis.

Numerical example

Set $v = 1$, $a = 1$, $b = \frac{1}{4}$, $m = 1$. Figure 2.3 shows for the range of values of n between 0 and 1, the welfare that is generated in each of the three possible scenarios: (1) the benchmark situation without regulation (dotted curve), (2) the regimes that induce full acquisition and disclosure (solid curve), and (3) the regime with voluntary acquisition and mandatory disclosure without cost subsidization (dashed curve). Notice that for values of n below 0.5 the market is of the substitute type, while for values of n above 0.5 the market is of the complement type.

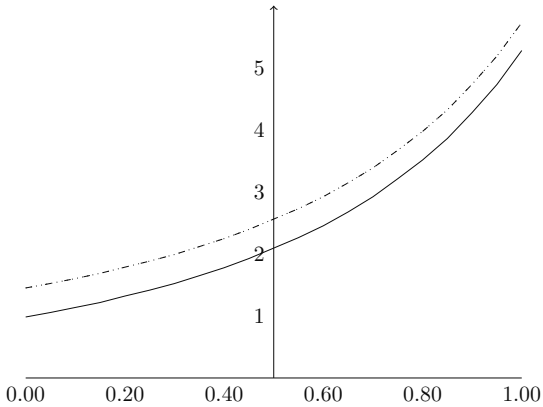

Figure 2.3: Welfare in the different scenarios as a function of market type.

It is clear from the figure that a regime that implements full disclosure negatively affects welfare (for all market types). The reason is of course that the benefit of the information does not exceed the cost of the information being acquired – a clear overinvestment information. What is less visible from the figure is the impact of the voluntary acquisition and mandatory disclosure policy on welfare. Here, the curve matches closely with that of the benchmark situation. In order to identify a possible difference, for the values of n with stepsize 0.05, we numerically computed the welfare twenty times on basis of thousand random draws for θ_I, θ_E and c. This generates for each value of n twenty approximations of the welfare for either regime. Next, for each value of n, we run a Mann-Whitney test to contest equality of welfare levels on basis of the two sequences of twenty approximation.

All p-values (one for each value of n) are in the range $[0.79, 0.99]$. So, we cannot reject equality of the generated welfare levels, and hence, we cannot conclude that a policy with voluntary acquisition and mandatory disclosure has any effect on welfare, neither positively nor negatively.

2.6 Conclusion

In this chapter we study, by means of a duopoly model, the incentives of businesses to acquire and disclose information on their rivals' product qualities. This helps us to understand when we can leave the information disclosure process to (the competitive pressure of) markets and when there is need for governmental intervention to protect consumers against misbehaving firms. We find that low quality levels may be disclosed in a substitute market (when the costs are low), but are never disclosed in a complement market. Moreover, regulatory policies that implement full information acquisition and disclosure are typically welfare reducing. A policy that mandates firms to disclose information upon acquisition, while leaving the acquisition itself voluntarily without imposing additional incentives via cost subsidization, can achieve disclosure of low quality levels even in a complement market (when the acquisition costs are not too high), though does not positively affect (nor negatively) ex ante overall welfare.

Chapter 3

Antitrust Policy against individuals

3.1 Introduction

In December 2012, the European Commission imposed a fine of €1.47 billion on several producers of TV and computer monitor tubes for participating in cartels. It is a fine record for the fight against cartel so far. The huge monetary penalty shows the bravo and determination of the European antitrust authority to destroy cartels and deter cartel formation. But, we are still wondering whether the corporate sanctions are sufficiently high to deter cartels. Indeed, ample empirical evidence (Buccirossi and Spagnolo (2005); Connor and Lande (2006, 2012); Wils (2001) etc.) shows that the fines are below the optimal deterrent level in the sense that a lot of actual cartels are not detected and new cartels are still forming. But what else can the authority do? As Werden (2009) points out, individual sanctions are necessary to deter cartel activities. The fear of individual sanctions may keep the employee of a firm from participating in unlawful collusion given that the interest of the employee is not always aligned with that of his employer. It is what the antitrust authority does in the US. Individual fines, including imprisonment can be imposed directly on employees who participated in cartel activities. However, at the EU level, the authority only targets the firm and its profit because there is no consensus among member states on the effectiveness and the justification of individuals sanctions.[1] This chapter addresses the issue whether introducing individual sanctions is more effective to deter cartels by focusing on the critical discount factors of agents to participate in cartels.

[1]Even though there is no sanctions on individuals at the EU level, sanctions may be imposed on individuals at a national level in some member states (e.g. the UK and the Netherlands).

To study the effectiveness of individual sanctions, we have to set some benchmarks. The first benchmark is the case that only corporate sanctions are available. We compare it with the case that both corporate and individual sanctions are available to check whether the latter one deters more cartels. The second benchmark is the case that corporate sanctions and corporate leniency programs are available. Then, we compare it with the case that corporate and individual sanctions and leniency programs are available to test whether introducing the individual leniency program reduces cartels.

In this chapter, we only focus on firms where ownership and management is separated. Obviously, without the separation, corporate sanctions are equivalent to individual sanctions. In our model, a firm's owner first proposes a compensation contract to a manager. If the contract is accepted, the owner leaves the right of management over the firm to the manager. Generally speaking, there are two reasons for a firm to hire a manager. The first is that the owner needs some skill that he doesn't have but the manager does to run the firm. The second is that the owner can achieve some strategic advantage by appointing a manager to run the firm on behalf of him. For instance, the owner can set an incentive scheme for the manager and then use it as a commitment device to persuade rival firms to participate in collusion to get an extra profit that he cannot get without hiring a manager. In our model, a manager is hired for the second reason.

In addition, we assume that punishment is non-transferable, which means that the punishment on the manager cannot be reimbursed by the owner. If the manager can get a corresponding compensation from the firm when he is punished by the authority, individual sanctions cannot be more effective than corporate sanctions to deter cartels.

Under such assumptions, we find that given that corporate sanctions are installed, only introducing individual sanctions cannot deter more cartels. Because the potential punishment for a manager is compensated by a high wage in the pre-written contract when the firm's owner tries to induce collusion. In contrast, given individual sanctions are installed, introducing individual leniency programs can deter more cartels. The reason is that individual leniency programs strengthen the conflict of interests between the manager and the owner. The manager can get a fine reduction if he deviates from collusion and such extra benefit cannot be provided by the contract given that the contract is not contingent on whether the manager is punished in our model. Notice that the assumption that the punishment is non-transferable implies that the contract is not contingent on whether the manager is punished.

Moreover, we investigate how individual sanctions change the governance of firms in terms of whether the owner still chooses to delegate under a new antitrust policy. To address this issue, we extend our model by allowing the owner to decide whether to hire a manager at the beginning. We find that with individual sanctions and leniency programs an owner is less likely to delegate the production decision to a manager. Because the new policy reduces the possibility that the owner successfully induces the manager to participate in collusion.

The remaining of the chapter is organized as follows. In the next section, we provide a brief literature review. The model is outlined in Section 3.3. In Section 3.4 we set two benchmarks. In Section 3.5 we study the effectiveness of individual sanctions on cartel deterrence. Section 3.6 presents the effect of the new policy on corporate governance. Section 3.7 concludes.

3.2 Related literature

An important result of the early literature on strategic delegation is that the principal can use delegation as a commitment device to communicate with rivals to achieve some advantage that he cannot get without delegation; see a.o. Fershtman and Judd (1987) and Sklivas (1987). In this strand of literature, the principal can induce some desired behavior of the agent by providing a proper contract. The compensation of the agent in the contract is contingent on observable outcomes such as profit and sale. To spotlight the effect of individual sanctions, we take a similar type of contract in which a manager's compensation only depends on profit.

More recent papers have examined the role of strategic delegation in tacit collusion. Spagnolo (2000b) shows that if the stock market is perfect, profit is distributed as dividends and managers are paid more often or the payment is deferred, stock-related compensation schemes help managers to reach a tacit collusive agreement. Chen (2008) shows that strategic delegation facilitates collusion because it mitigates the enticement to deviate from collusion. This chapter shows that leniency programs make strategic delegation less attractive for the owner of a firm.

Aubert (2009) brings the moral hazard issue into the delegation by assuming that the owner only can observe the firm's profit but cannot identify whether a high profit is due to the manager exerting more effort or to his participation in collusion. She shows that

individual sanctions are effective to deter cartels and an individual leniency program is ambiguous to deter cartels.

Contrary with sanctions against individuals, Aubert, Rey and Kovacic (2006) argue that rewarding individuals is more effective to deter cartels because it makes the conflict of interests between the owner and the manager more severe. Since rewarding wrongdoers is difficult to be accepted politically, we don't consider rewarding schemes in this chapter.

This chapter also belongs to the branch of literature on leniency program design. Spagnolo (2000a) suggests that optimal leniency programs should maximize rewards for the first reporting firm and make this residual claimant for the fines paid by the others. Motta and Polo (2003) study the effectiveness of leniency programs against collusion and propose that leniency programs should apply to firms even after the authority started the investigation of the firms' collusion. Harrington (2008) confirms that it is optimal to waive all penalties only for the first firm that comes forward under some conditions. Similarly, in this chapter the leniency program only grants the first reporting agent a waive. However, from a different perspective, our study suggests that with leniency programs splitting a penalty among the corporate and the individual involved in cartels is more effective than only imposing the penalty on the corporate to deter cartels.

3.3 The model

We study the deterrence effect of sanctions against individuals in an infinitely repeated game. Two symmetric firms compete in a market. Each firm is owned by a principal (owner) and run by a manager. Owners and Managers maximize their expected payoffs with corresponding discount factor δ and $\alpha \in (0, 1)$. All players are risk neutral.

Timing In each period, the timing is as follows:[2]

1. An owner offers a contract to a manager.

2. Each manager decides whether to enter a collusive agreement. If at least one manager prefers not to enter, both managers take competitive strategies and the game ends for that period; otherwise,

[2]Like Aubert, Rey and Kovacic (2006), Chen (2008) and Chen and Rey (2012), we assume that evidence of collusion is generated by the collusive agreement and evidence only exists in the current colluding period.

(a) each manager decides whether to implement the collusive strategy or deviate;

(b) each manager or owner then decides whether to report evidence of the cartel to the antitrust authority. If evidence of the cartel is reported, the authority convicts the cartel for sure. Otherwise, the antitrust authority convicts the cartel with probability ρ that is constant over time.

Market strategy and profit In each firm, the manager privately chooses the market strategy. If both managers agree to collude, the gross profit of a firm is π^c; if both compete, the profit is π^n; if a firm competes while the other colludes, its profit is π^d and the other's is π^s. We assume that $\pi^d > \pi^c > \pi^n > \pi^s$ and $2\,\pi^c > \pi^s + \pi^d$.

Contract The contract between an owner and a manager is about the managerial compensation. The manager's compensation only depends on this firm's realized profit. In each period, the manager gets a wage $w > 0$ if the profit is greater than or equal to π^c and gets 0 otherwise.[3]

Autritrust authority For the case that only corporate sanctions are available, without leniency program, the antitrust authority can impose a fine F on the owner of a colluding firm once collecting evidence of the cartel, where the fine F is not big enough: $\rho\,F < \pi^c - \pi^n$. Recall ρ is the probability that the authority can convict a firm's cartel participation without firm's reporting.[4] All fines are paid in the period in which the cartel is convicted. With leniency program, the antitrust authority still imposes the same fine on the owner of a colluding firm if no firm provides collusive evidence. However, if an owner becomes the first to report collusive evidence to the authority, the fine on this owner is reduced to $q\,F$, where $q < \rho$, and the other owner still pays the full fine F.

For the case that both corporate sanctions and individual sanctions are available, without leniency program, the antitrust authority can impose a fine f_o on the owner of a colluding firm and a fine f_m on this firm's manager once obtaining evidence of collusion. We assume that $f_o + f_m = F$ because under this assumption we can study whether splitting the fine among the owner and the manager is more effective to deter cartels than

[3]Here we assume the wage is exogenously given. Under this assumption, we can focus on the short-run effect of an anti-trust policy change.

[4]Here we do not separate the discovery of a cartel from the conviction of a cartel. ρ represents the possibility of the cartel cracked by the authority.

only imposing the same fine on the owner. The fines are monetary and non-transferable. Especially, the fine on the manager may be the monetary equivalent in terms of utility loss from a reputation damage, managerial disqualification or even a jail sentence. The authority can convict the firm's collusion with probability ρ if no owner or manager reports. With leniency program, the antitrust authority still imposes the same fine on the owners of colluding firms and their managers if no owner or manager reports collusive evidence. However, if an owner becomes the first to report collusive evidence to the authority, only the fine on this owner is reduced to $q\,f_o$ and the other owner and two managers still pay their full fines. Similarly, if a manager becomes the first, the fine on this manager is reduced to $q\,f_m$ and the other manager and two owners pay their full fines.

3.4 Some benchmarks

To study the deterrent effect of individual sanctions, we take the case that only corporate sanctions are available as the baseline. Without leniency program, we study whether introducing individual sanctions increases the effectiveness to deter cartels. In addition, we want to know whether introducing individual sanctions with an individual leniency program deters more cartels.

Case 1: Corporate sanctions without leniency program Since the firm is run by the manager, we first look at the manager's incentive to collude. Given the contract provided by the owner, the manager maximizes his expected payoff. We assume that the manager will choose competing forever after the collusion is convicted no matter the conviction is due to other agents reporting evidence or the authority grabbing evidence by itself. We assume all agents follow this strategy.[5] A cartel is sustainable if and only if the gain from colluding is higher than the gain obtained by deviating and competing forever afterwards. We denote the discounted payoff from continued collusion for the manager as v_m^c. We have

$$v_m^c = w + (1-\rho)\,\alpha\,v_m^c.$$

[5]This assumption rules out the possibility that two firms collude and report systematically. Hence, we only focus on the "normal" collusion. In reality, the antitrust authority will keep firms that had been participated in collusion under close scrutiny, so these firms are less likely to collude for at least some time after being detected.

If the manager deviates from collusion, he will get an expected payoff w. Hence, for the manager, the incentive compatibility constraint for collusion is

$$v_m^c = \frac{w}{1-(1-\rho)\,\alpha} \geq w.$$

Since $\rho, \alpha \in (0,1)$ and $w > 0$, we know that the manager always prefers colluding.

Similarly, v_1 denotes the discounted payoff of the owner in Case 1. Given the manager's strategy, the owner's discounted payoff is

$$v_1 = \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta}.$$

Case 2: Corporate sanctions with leniency program Given the contract provided by the owner, the manager always prefers collusion. Since the authority only imposes corporate sanctions and the leniency program is not applied to the manager, the manager has no incentive to report evidence of the cartel to the authority. Hence, only the owner has an incentive to report the collusion under a leniency program. We denote the discounted payoff from continued collusion for the owner as v_o^c. We have

$$v_o^c = \pi^c - w + (1-\rho)\,\delta\,v_o^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F).$$

Under a leniency program, if the owner deviates from collusion by reporting evidence of the cartel, he will get an expected payoff $\pi^c - w - q\,F + \frac{\delta\,\pi^n}{1-\delta}$. So for the owner, the collusion is sustainable if and only if

$$v_o^c = \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} \geq \pi^c - w - q\,F + \frac{\delta\,\pi^n}{1-\delta}.$$

The above condition requires

$$\delta \geq \frac{(\rho - q)\,F}{(1-\rho)\,(\pi^c - w - q\,F - \pi^n)} \equiv \delta_1.$$

To make sure $\delta_1 < 1$, we need the condition $w < \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,F$.

Even though the manager always prefers collusion, the owner will report the collusion to the authority if $\delta \in (0, \delta_1)$ and will not if $\delta \in [\delta_1, 1)$. Notice that even though the owner prefers reporting the manager's collusion, he can only report after the manager colludes in

the first period.[6] Hence, the owner gets

$$v_2 = \begin{cases} \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} & \text{if } \delta \in [\delta_1, 1) \\ \pi^c - w - q\,F + \delta\,\frac{\pi^n}{1-\delta} & \text{if } \delta \in (0, \delta_1) \end{cases}$$

where v_2 denotes the discounted payoff of the owner in Case 2.

3.5 Sanctions against individuals

Case 3: Corporate and individual sanctions without leniency program We consider the policy that the antitrust authority introduces individual sanctions, and investigate whether such policy is more effective to deter cartels. Since the firm is run by the manager, we first look at the manager's incentive to collude given the contract offered by the owner. Now the manager will get a fine f_m if the collusion is convicted by the authority. We denote the discounted payoff from continued collusion for the manager as v_m^c. We have

$$v_m^c = w + (1-\rho)\,\alpha\,v_m^c - \rho\,f_m.$$

If the manager deviates from collusion, he will get an expected payoff $w - \rho\,f_m$. For the manager, the participation constraint for collusion is

$$w \geq \rho\,f_m;$$

the incentive compatibility constraint for collusion is

$$v_m^c = \frac{w - \rho\,f_m}{1 - \alpha\,(1-\rho)} \geq w - \rho\,f_m. \tag{3.1}$$

Since $\alpha, \rho \in (0, 1)$, we have the following proposition.

Proposition 3.1. *If $w \geq \rho\,f_m$, individual sanctions do not deter cartels. If $w < \rho\,f_m$, individual sanctions do deter cartels.*

If managers know that individual sanctions are installed, an owner who tries to induce manager participating in collusion must provide a wage $w \geq \rho\,f_m$. Given the purpose of hiring managers in our model, the wage will be high enough to satisfy the manager's

[6] Like Chen and Rey (2012), to keep the analysis tractable, we assume that an agent who decides to defect from collusion will be able to report first when the others do not intend to report. Hence, when an owner deviates from collusion by reporting evidence of the cartel, he will be the first one to obtain the leniency.

participation constraint, hence, introducing individual sanctions will not deter cartels in Case 3.

Given that no leniency is granted upon reporting, under this policy, the owner has no incentive to report evidence of collusion. The owner's payoff is

$$v_3 = \frac{\pi^c - w + \rho\left(\frac{\delta\,\pi^n}{1-\delta} - f_o\right)}{1-(1-\rho)\,\delta},$$

where v_3 denotes the discounted payoff of the owner in Case 3.

Comparing the owner's payoff in Case 3 with Case 1, we find that, if w is fixed and high enough, the owner earns more in Case 3 than Case 1 because he pays a smaller fine for colluding in Case 3.

Case 4: Corporate and individual sanctions with leniency program With a leniency program, the manager and the owner may have an incentive to report evidence of the cartel. For the manager, the expected payoff from continued collusion is

$$v_m^c = w + (1-\rho)\,\alpha\,v_m^c - \rho\,f_m.$$

If the manager deviates from collusion, he is better off by reporting evidence of the cartel, hence, his expected payoff from deviating and reporting is $w - q\,f_m$. For the manager, the participation constraint for collusion is

$$w \geq \rho\,f_m;$$

the incentive compatibility constraint for collusion is

$$v_m^c = \frac{w - \rho\,f_m}{1-\alpha\,(1-\rho)} \geq w - q\,f_m.$$

The incentive compatibility constraint requires

$$\alpha \geq \frac{(\rho - q)\,f_m}{(1-\rho)\,(w - q\,f_m)} \equiv \alpha_1.$$

The effectiveness of cartel deterrence by introducing individual sanctions depends on the value of α_1.

Proposition 3.2. *Under the condition $w \leq \frac{\rho\,(1-q)\,f_m}{1-\rho}$, the manager never colludes. Under the condition $w > \frac{\rho\,(1-q)\,f_m}{1-\rho}$, the manager chooses to collude if $\alpha \geq \alpha_1$ and chooses not if $\alpha < \alpha_1$.*

Proof. If $w \leq \frac{\rho\,(1-q)\,f_m}{1-\rho}$, we have $\alpha_1 \geq 1$. Hence the manager never colludes. If $w > \frac{\rho\,(1-q)\,f_m}{1-\rho}$, we have $\alpha_1 < 1$. Notice that $w > \frac{\rho\,(1-q)\,f_m}{1-\rho}$ implies $w > \rho\,f_m$ since $q < \rho$. Hence the manager chooses to collude if $\alpha \geq \alpha_1$ and chooses not if $\alpha < \alpha_1$. □

When the manager prefers collusion, the owner still could have an incentive to report evidence of the cartel. For the owner, the expected payoff from continued collusion is

$$v_o^c = \pi^c - w + (1-\rho)\,\delta\,v_o^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o).$$

If the owner deviates from collusion by reporting evidence of the cartel, his expected payoff is $\pi^c - w - q\,f_o + \frac{\delta\,\pi^n}{1-\delta}$. The collusion is sustainable for the owner if and only if

$$v_o^c = \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o)}{1-(1-\rho)\,\delta} \geq \pi^c - w - q\,f_o + \frac{\delta\,\pi^n}{1-\delta}.$$

It requires

$$\delta \geq \frac{(\rho - q)\,f_o}{(1-\rho)\,(\pi^c - w - q\,f_o - \pi^n)} \equiv \delta_2.$$

To make sure $\delta_2 < 1$, we need the condition $w < \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o$.

Given the manager is in collusion, the owner will report the collusion to the authority if $\delta \in (0, \delta_2)$ and will not if $\delta \in [\delta_2, 1)$. But the owner can report the collusion only after the manager colludes in the first period. If the manager is not in collusion, the owner only receives the competitive payoff. Hence, the owner's payoff is

$$v_4 = \begin{cases} \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o)}{1-(1-\rho)\,\delta} & \text{if } \delta \in [\delta_2, 1),\ w \in (\frac{\rho\,(1-q)\,f_m}{1-\rho},\ \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o), \text{ and } \alpha \geq \alpha_1 \\ \pi^c - w - q\,f_o + \frac{\delta\,\pi^n}{1-\delta} & \text{if } \delta \in (0, \delta_2),\ w \in (\frac{\rho\,(1-q)\,f_m}{1-\rho},\ \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o), \text{ and } \alpha \geq \alpha_1 \\ \frac{\pi^n}{1-\delta} & \text{if } w \leq \frac{\rho\,(1-q)\,f_m}{1-\rho}, \text{ or } w > \frac{\rho\,(1-q)\,f_m}{1-\rho} \text{ but } \alpha < \alpha_1 \end{cases}$$

where v_4 denotes the discounted payoff of the owner in Case 4 .

3.6 Extension

The model above assumes that the firm is managed under delegation. We extend the model by allowing the owner to decide whether to delegate before the first stage of the game. Then we can investigate how sanctions against individuals affects the governance of firms. In our model, the only reason for the owner to delegate is to achieve some strategic advantage by having a manager with different incentives play the game. In the extended

model, we can analyze how the new antitrust policy changes the owner's delegation decision.

Without leniency program We first consider the case that there is no leniency program. If the owner doesn't delegate and takes all strategic decisions by himself, his expected payoff from continued collusion is

$$v_o^c = \pi^c + (1-\rho)\,\delta\, v_o^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F).$$

The expected payoff of deviation is $\pi^d - \rho\,F + \frac{\delta\,\pi^n}{1-\delta}$. For the owner, the participation constraint for collusion is

$$\pi^c - \pi^n \geq \rho\,F;$$

the incentive compatibility constraint for collusion is

$$v_o^c = \frac{\pi^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} \geq \pi^d - \rho\,F + \frac{\delta\,\pi^n}{1-\delta}.$$

The incentive compatibility constraint is equivalent to

$$[(1-\rho)\,(\pi^d - \pi^n - \rho\,F)\,\delta - (\pi^d - \pi^c)]\,(1-\delta) \geq 0$$

Since $\delta, \rho \in (0,1)$ and $\pi^d - \pi^n - \rho\,F > 0$, the owner prefers collusion when $\delta \geq \frac{\pi^d - \pi^c}{(1-\rho)\,(\pi^d - \pi^n - \rho\,F)} \equiv \delta_3$. Notice that $\delta_3 < 1$ requires $F < \frac{\pi^c - [\rho\,\pi^d + (1-\rho)\,\pi^n]}{\rho\,(1-\rho)}$. The owner's expected payoff is

$$v_5 = \begin{cases} \frac{\pi^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} & \text{if } \delta \in [\delta_3, 1) \\ \frac{\pi^n}{1-\delta} & \text{if } \delta \in (0, \delta_3) \end{cases}$$

where v_5 denotes the discounted payoff for the owner in the situation without leniency program and without delegation.

If the owner chooses to delegate, we know from Case 3 that his expected payoff is

$$v_3 = \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o)}{1-(1-\rho)\,\delta}.$$

Proposition 3.3. *Under the condition $\delta \in (0, \delta_3)$, the owner will choose to delegate if $w < \pi^c - \pi^n - \rho\,f_o$ and will not otherwise. Under the condition $\delta \in [\delta_3, 1)$, he will not choose to delegate.*

Proof. By comparing the expected payoffs, the owner decides whether to delegate. Recall that v_5 denotes the owner's expected payoff without delegation and v_3 denotes the owner's expected payoff under delegation.

For $\delta \in (0, \delta_3)$, we know that

$$v_5 - v_3 = \frac{\pi^n}{1-\delta} - \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o)}{1-(1-\rho)\,\delta} = \frac{\pi^n - \pi^c + w + \rho\,f_o}{1-(1-\rho)\,\delta}.$$

Under the condition $w < \pi^c - \pi^n - \rho\,f_o$, we have $v_5 < v_3$. Hence, the owner will choose to delegate.

For $\delta \in [\delta_3, 1)$, we know that

$$v_5 - v_3 = \frac{-\rho\,F + w + \rho\,f_o}{1-(1-\rho)\,\delta}.$$

Since $w \geq \rho\,f_m$ and $F = f_m + f_o$, we have $v_5 \geq v_3$. The owner will not choose to delegate. □

The result shows that, without leniency program, a firm's owner may participate in collusion by himself if he is patient enough. If he is not so patient, he may seek a manager to participate in collusion. Of course, the extra benefit from hiring a manager should be large enough to cover the wage he offers to the manager and the possible fine he may get because of his manager's collusive behavior. If the extra benefit outweighs the potential cost, he will choose to delegate.

With leniency program If the owner chooses not to delegate, only the corporate leniency program is available for him. For the owner, the expected payoff from continued collusion is

$$v_o^c = \pi^c + (1-\rho)\,\delta\,v_o^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F).$$

If the owner deviates from collusion, he is better to report evidence of the cartel, hence, his expected payoff from deviating and reporting is $\pi^d - q\,F + \frac{\delta\,\pi^n}{1-\delta}$. For the owner, the participation constraint for collusion is

$$\pi^c - \pi^n \geq \rho\,F;$$

the incentive compatibility constraint for collusion is

$$v_o^c = \frac{\pi^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} \geq \pi^d - q\,F + \frac{\delta\,\pi^n}{1-\delta}.$$

The incentive compatibility constraint is equivalent to

$$[(1-\rho)\,(\pi^d - \pi^n - q\,F)\,\delta - ((\rho - q)\,F + \pi^d - \pi^c)]\,(1-\delta) \geq 0.$$

Since $\delta, \rho \in (0,1)$, $\rho > q$ and $\pi^d - \pi^n - q\,F > 0$, the owner prefers collusion when $\delta \geq \frac{(\rho-q)\,F+\pi^d-\pi^c}{(1-\rho)\,(\pi^d-\pi^n-q\,F)} \equiv \delta_4$. Notice that $\delta_4 < 1$ requires $F < \frac{\pi^c-[\rho\,\pi^d+(1-\rho)\,\pi^n]}{\rho\,(1-q)}$. The owner's expected payoff is

$$v_6 = \begin{cases} \frac{\pi^c+\rho\,(\frac{\delta\,\pi^n}{1-\delta}-F)}{1-(1-\rho)\,\delta} & \text{if } \delta \in [\delta_4, 1) \\ \frac{\pi^n}{1-\delta} & \text{if } \delta \in (0, \delta_4) \end{cases}$$

where v_6 denotes the discounted payoff for the owner in the situation with leniency program and without delegation.

If the owner chooses to delegate, his expected payoff is as shown before.

$$v_4 = \begin{cases} \frac{\pi^c-w+\rho\,(\frac{\delta\,\pi^n}{1-\delta}-f_o)}{1-(1-\rho)\,\delta} & \text{if } \delta \in [\delta_2, 1),\ w \in (\frac{\rho\,(1-q)\,f_m}{1-\rho},\ \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o), \text{ and } \alpha \geq \alpha_1 \\ \pi^c - w - q\,f_o + \frac{\delta\,\pi^n}{1-\delta} & \text{if } \delta \in (0, \delta_2),\ w \in (\frac{\rho\,(1-q)\,f_m}{1-\rho},\ \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o), \text{ and } \alpha \geq \alpha_1 \\ \frac{\pi^n}{1-\delta} & \text{if } w \leq \frac{\rho\,(1-q)\,f_m}{1-\rho}, \text{ or } w \geq \frac{\rho\,(1-q)\,f_m}{1-\rho} \text{ but } \alpha \leq \alpha_1 \end{cases}$$

Proposition 3.4. *If the manager prefers not to collude, the owner will not choose to delegate. If the manager prefers to collude, under the assumption $\delta_4 > \delta_2$, the owner will choose to delegate if $\delta \in (0, \delta_4)$ and will not otherwise.*

Proof. By comparing the expected payoffs, the owner decides whether to delegate. To compare the owner's expected payoffs, we distinguish two situations. The first situation is that the manager prefers not to collude, and the second is that the manager prefers to collude. Recall that v_6 denotes the owner's expected payoff without delegation and v_4 denotes the owner's expected payoff under delegation.

1). The manager prefers not to collude.

If the owner chooses to delegate, the manager will chooses competitive strategy, so the owner receives the discounted payoff $v_4 = \frac{\pi^n}{1-\delta}$.

If the owner chooses not to delegate, for $\delta \in (0, \delta_4)$, we have

$$v_6 - v_4 = \frac{\pi^n}{1-\delta} - \frac{\pi^n}{1-\delta} = 0;$$

for $\delta \in [\delta_4, 1)$, we have

$$v_6 - v_4 = \frac{\pi^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} - \frac{\pi^n}{1-\delta} = \frac{\pi^c - \pi^n - \rho\,F}{1-(1-\rho)\,\delta} \geq 0,$$

since $\pi^c - \pi^n - \rho\,F \geq 0$.

So, if the manager prefers not to collude, the owner will not choose to delegate.

2). The manager prefers to collude.

From proposition 2, we know that the manager prefers collusion if and only if $w \in (\frac{\rho\,(1-q)\,f_m}{1-\rho},\ \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o)$, and $\alpha \geq \alpha_1$.

To compare v_6 with v_4, we first rank the critical discount values δ_4 and δ_2.

Here, we assume $\delta_4 > \delta_2$. Recall that δ_4 is the critical discount value for the owner to decide whether to participate in collusion by himself without delegation and δ_2 is the critical discount value for the owner to decide whether to report his manager's collusive behavior with delegation. This assumption is quite reasonable because in our model an owner hires a manager only when he is too impatient relative to the manager to participate in collusion to get an extra benefit. Notice this assumption implies

$$\frac{(\rho - q)\,F + \pi^d - \pi^c}{(1-\rho)\,(\pi^d - \pi^n - q\,F)} > \frac{(\rho - q)\,f_o}{(1-\rho)\,(\pi^c - w - q\,f_o - \pi^n)}.$$

It is equivalent to

$$w < \pi^c - \pi^n - q\,f_o - \frac{(\rho - q)\,f_o\,(\pi^d - \pi^n - q\,F)}{\pi^d - \pi^c + (\rho - q)\,F}.$$

For $\delta \in (0, \delta_2)$, we have

$$v_6 - v_4 = \frac{\pi^n}{1-\delta} - (\pi^c - w - q\,f_o + \frac{\delta\,\pi^n}{1-\delta}) = \pi^n - \pi^c + w + q\,f_o < 0$$

since $w < \pi^c - \pi^n - \frac{\rho\,(1-q)}{1-\rho}\,f_o$ and $q < \rho$.

For $\delta \in [\delta_2, \delta_4)$, we have

$$v_6 - v_4 = \frac{\pi^n}{1-\delta} - \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o)}{1-(1-\rho)\,\delta} = \frac{\pi^n - \pi^c + w + \rho\,f_o}{1-(1-\rho)\,\delta} < 0,$$

since $w < \pi^c - \pi^n - \rho\,f_o$, $q < \rho$, and $\rho, \delta \in (0,1)$.

For $\delta \in [\delta_4, 1)$, we have

$$v_6 - v_4 = \frac{\pi^c + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - F)}{1-(1-\rho)\,\delta} - \frac{\pi^c - w + \rho\,(\frac{\delta\,\pi^n}{1-\delta} - f_o)}{1-(1-\rho)\,\delta} = \frac{w - \rho\,(F - f_o)}{1-(1-\rho)\,\delta} = \frac{w - \rho\,f_m}{1-(1-\rho)\,\delta} > 0,$$

since $w > \frac{\rho\,(1-q)\,f_m}{1-\rho}$, $q < \rho$, and $\rho, \delta \in (0,1)$.

Hence, the owner will not choose to delegate when he is patient enough and will choose otherwise. □

Recall that in our model the owner hires a manager only because he wants to get some benefit by letting the manager participate in collusion when he cannot do so by himself.

This proposition illustrates this point. The individual sanctions with leniency program makes the collusion less attractive for the manager. Hence given the only purpose of delegation in our model, the policy of individual sanctions with leniency program will lead to the owner less likely to choose delegation.

3.7 Conclusion

In this chapter we study whether introducing individual sanctions is more effective than only imposing corporate sanctions to deter cartels and how the policy with individual sanctions changes the governance of firms. We find that a policy with both individual and corporate sanctions does not deter more cartels compared to the policy with only corporate sanctions. But, if individual leniency program is installed, the policy with individual and corporate sanctions and leniency program is more effective to deter cartels. Moreover, if we allow the owners to choose whether to hire a manager at the beginning, we find that the owner is less likely to hire a manager when there is a leniency program.

The policy implication of this chapter is that to effectively deter cartels authorities should at least introduce individual sanctions in addition to corporate sanctions. Given the specific contract structure, only introducing additional individual sanctions does not deter more cartels. Individual leniency should be granted to make the individual sanctions effective to deter cartels.

Chapter 4

Cheap talk: an experiment

4.1 Introduction

In various economic environments of strategic information transmission, the message sent by an informed agent may simultaneously affect actions of multiple, possibly strategically interacting, uninformed agents.[1] One interesting two-audience communication problem, that is mentioned in Farrell and Gibbons (1989), is that of a firm's choice among accounting conventions. In an inflationary era, an inventory-carrying firm may report low profits (by calculating costs according to the LIFO convention) or high ones (adopting FIFO). While for reasons of taxation the former may be interesting, for stock market reasons it is definitely more interesting to use the latter option. Farrell and Gibbons show that the presence of multiple audiences may induce public messages to become informative where messages would not carry any information in any isolated bilateral interaction, but can also complicate information revelation where this would happen in all isolated bilateral communications. All depends on the level of agreement of the alignments of the preferences with the different audiences.

In a controlled laboratory experiment, Battaglini and Makarov (2014) examine the effect of adding one audience on the information transmission process and find that it alters the communication in a way that is consistent with the theoretical predictions by Farrell and Gibbons. Like Battaglini and Makarov, we examine strategic information transmission with multiple audiences in a controlled laboratory experiment. In contrast, where they restrict attention to the situation where the payoffs of the receivers are independent of each other's actions (in spirit of Farrell and Gibbons), we assume strategic interdependence between

[1] This chapter is based on a paper by Li and Peeters (2013b).

the two receivers.

Agranov and Schotter (2012) also consider a game with two interacting receivers and one sender. The sender communicates a payoff relevant state of the world to the receivers who play a coordination game with multiple equilibria. They find that by sending a vague message in the experiment the sender can mask the existing payoff asymmetry and make receivers believe on average they are playing the equal payoff game where they can easily coordinate using the focal point. Notice that the receivers and the utilitarian benevolent sender agree that coordination is desirable. The alignment of the preferences between the receivers and the sender leaves more room to the sender to manoeuvre the message space over the states of the world and makes communication efficiency enhancing. However, if their preferences are not totally aligned, interesting questions are how the sender sends messages, how the receivers respond to the messages, and whether communication improves efficiency. We investigate these questions in the following experiment.

The cheap talk setting (treatment CT) that we consider in our experiment resembles the situation in which an incumbent firm can signal market conditions to two possible entrants via one public message. The three possible market conditions refer to the demand in the market, which is either small, medium or large. In this situation, independent of the state, the incumbent has a preference to deter entry. The incumbent can achieve this by having the potential entrants believing that the demand is small, in which case it is a dominant action for them not to enter. As a result, only babbling equilibria exist (cf. Sobel, 2009). Where potential entrants should not enter in case of a small market, there are benefits for both when entering in case the market is large; in case of a medium sized market, there is room for only one potential entrant to enter with positive benefit. So, regarding the alignment of preferences between the incumbent and the potential entrants, there is perfect alignment in a small market and they are perfect antagonists in a large market; in the medium sized market it is somewhere in between.

Despite there only being babbling equilibria, from an ex ante perspective, all parties involved would prefer full revelation to any babbling equilibrium. Thus, there is a mutual benefit to ameliorate the failure to communicate. In order to assess whether cheap talk yields more efficient entry levels and higher payoffs, we implement two baseline treatments: one in which full information is given to the potential entrants (treatment FI) and one in which the communication channel is disabled (treatment NI). If the overcommunication (relative to sequential equilibrium assuming rational and egoistic agents) that is

found in one-sender/one-receiver experiments (cf. Dickhaut et al., 1995; Cai and Wang, 2006; Sánchez-Pagés and Vorsatz, 2007; and Wang et al., 2010), is also found in our one-sender/two-receivers setting (as in Battaglini and Makarov, 2014), there is scope for cheap talk to generate additional surplus relative to the situation without information revelation.

Our experimental findings are that cheap talk does not generate any efficiency of entry and payoffs beyond the level that is obtained without information transmission. On average, senders' (incumbents) messages convey truthful information. In case senders send deceptive messages, most of the time it concerns strategic deception (understating the state), but there is a robust substantial amount of obscure deceptions (overstating the state). The receivers' (potential entrants) empirical probability to enter is increasing in the size of the market as it is claimed to be by the sender. Thus, despite cheap talk not being able to enhance overall performance, messages contain relevant information and this is picked up by the receivers. So, while we find overcommunication (relative to standard theoretical prediction) in the laboratory, compared to the situation without information transmission, cheap talk doesn't work to alleviate the asymmetric information problem. The reason is that receivers fail to optimally translate the information received in their entry decision, possibly due to overcautiousness.

In the next section we present the experimental design and hypotheses. Section 4.3 deals with the data analysis and we search for further evidences that may explain our main results in Section 4.4. Section 4.5 concludes.

4.2 Experiment

In this section we present, subsequently, the central cheap talk setting, the treatments we implemented in our experiment and the corresponding hypotheses (based on standard theoretical prediction), and details on the precise design and procedures followed.

4.2.1 Setting

We consider a signaling game with one sender and two receivers. The game may be in one of three possible states of the world; each state being equally likely a priori. The sender is privately informed on the actual state and has the ability to inform the receivers on the actual state via one public message notifying both receivers about the state being drawn. The only information the receivers have about the true state is the message sent

to them and they have to choose independently out of two alternative actions: In or Out. The action choices of both receivers together with the true state of the world, determines the payoffs of the three players. The resulting payoffs are displayed in Table 4.1. In each cell, corresponding to the choices of the row receiver and the column receiver, the first entry presents the sender's payoff, the second the row receiver's, and the third the column receiver's payoff. Notice that the payoffs do not depend on the message being sent; so, talk is cheap.

	In	Out
In	1, 1, 1	3, 3, 4
Out	3, 4, 3	5, 4, 4

Small

	In	Out
In	3, 3, 3	5, 5, 4
Out	5, 4, 5	7, 4, 4

Medium

	In	Out
In	6, 6, 6	8, 8, 4
Out	8, 4, 8	10, 4, 4

Large

Table 4.1: The signaling game with two strategically interacting receivers.

This setting is a natural analogue of an entry game with one incumbent and two potential entrants and where the states of the world correspond to possible market sizes: small, medium or large.[2] The potential entrants have no experience in the market that they consider entering, apart from the three states being equally likely, and nevertheless have to decide whether to enter or to stay out. By staying out, the potential entrant can get a sure reservation profit of 4. When entering, the resulting profit may be smaller or larger, depending on the true state and on the entry decision of the other potential entrant. In general, everything else equal, the potential profit of an actual entrant is larger if the market is larger in size and larger with less competitors in the market. This does not hold only for the potential entrants, but is also a structural characteristic of the incumbents profit. Therefore, the incumbent has an incentive to deceive the potential entrants by understating the state of the world when giving the opportunity to provide information on the market condition to them. Of course, the potential entrants are aware of this possibility of the preferences being misaligned in better market circumstances.

[2]Individual payoffs are computed according to a market entry game (as in Sundali, 1995). If player i stays out, his payoff is k; If player i enters, his payoff is $k + 2(c - m)$, where k is the reservation profit, c is the market capacity, and m is the number of players active in the market. We set $k = 4$ and $c = 1.5$, 2.5, 4 corresponding to small, medium, large market capacity.

4.2.2 Treatments and hypotheses

Our primary treatment – which we dub the cheap talk (CT) treatment – is the setting described above. Apart from understanding how information is strategically transmitted in such a setting involving multiple strategically interacting receivers, we are interested whether cheap talk can ameliorate part of the information disparity between the sender on the one hand and the receivers on the other hand. In order to make such a comparison, we have two baseline treatments: the full information (FI) treatment and the no information (NI) treatment. The latter baseline positions receivers in the worst situation where no information about the state is given; the former baseline places them in the ideal situation where they have complete information on the state.

In case the receivers are fully informed about the actual state of the worlds (treatment FI), both will stay out in the small state and will enter in the large state; in the medium state there are three equilibria: two where precisely one of the receivers enters and one in which each of them enters with fifty percent probability.

The case where the receivers have no information at all (treatment NI), possesses three equilibria: two pure asymmetric equilibria in which one of the receivers enters while the other stays out and one symmetric mixed equilibrium in which each of the receivers enters with two-thirds probability. Comparing these payoffs (see Table 4.2) with those in the FI treatment learns that all players involved prefer, from an ex ante perspective, the FI treatment over the NI treatment.

As in the cheap talk setting (treatment CT), the sender always attempts the receivers to believe that the true state is the small one, all messages loose their credibility. As a result, there are no separating equilibria. All "babbling equilibria" render the same outcomes as predicted for the NI treatment.

We can compare the performance of the CT treatment with the two baselines on the basis of two efficiency criteria: the first regards the frequency of efficient entries (that is, entry until excess profits are eroded), the second regards the payoffs generated. Table 4.2 summarizes the expected frequency of efficient entry levels in each of the states and the ex ante expected payoffs to the sender and receivers for each of the three treatments, as predicted by the symmetric equilibrium in the respective treatment.

On basis of the numbers in the table we can formulate the following two hypotheses:

H.1-1. The level of efficiency and the payoffs obtained in the CT treatment equals that

	Frequency of efficient entry levels				Expected payoff	
Treatment	Small	Medium	Large	Average	Sender	Receiver
Full info (FI)	1.00	0.50	1.00	0.83	5.33	4.67
No info (NI)	0.11	0.44	0.44	0.33	4.67	4.00
Cheap talk (CT)	0.11	0.44	0.44	0.33	4.67	4.00

Table 4.2: Predicted frequencies of entry levels and payoffs in the (symmetric) equilibria in the various treatments.

of the NI treatment.

H.1-2. The level of efficiency and the payoffs obtained in the FI treatment exceeds that of the CT treatment and the NI treatment.

One reason to expect the first hypothesis to be rejected is that in cheap talk experiments overcommunication is a rather robust and frequently recurrent phenomenon (though, it is not clear that this phenomenon is robust to our extension to multiple strategically interacting receivers). That is, senders' messages typically convey more (truthful) information than is predicted by sequential equilibrium prediction (assuming pure payoff-oriented and self-centered players), which is picked up by the receivers. If this is found to be true in the present setting, then cheap talk has the potential to increase the level efficient entry and payoffs relative to the NI treatment.

Our base hypotheses with respect to the information transmission and processing are formulated relative to the standard theoretical prediction (cf. Crawford and Sobel, 1982):

H.2-1. In the CT treatment, the frequency of chosen messages is constant over states.

H.2-2. In the CT treatment, the likelihood to enter is constant over messages.

The combination of these two hypotheses, provides us with a third testable hypothesis:

H.2-3. In the CT treatment, the likelihood to enter is constant over states.

Although it is to be expected that the latter hypothesis will only be rejected in case at least one of the former hypothesis is rejected, not being able to reject this hypothesis may go hand-in-hand with rejecting both of the former two hypotheses (but not with rejecting only one of them).

4.2.3 Design and procedures

For the two baseline treatments (NI and FI) we had in total five matching groups, while we ran the cheap talk treatment (CT) with eight matching groups. All matching groups consisted of twelve subjects, who played the game as specified by the treatment over a sequence of fifty rounds.

Every round again the subjects in a matching group were randomly partitioned into four triples and, for each triple, one member was assigned the sender role while the other two members got one of the receiver roles. Next, a state was drawn at random and the sender was informed on the selected state. The information the receivers received depended on the respective treatment. In the FI treatment, also the receivers were informed about the state. In the NI treatment, the receivers did not get any information. In the CT treatment, the only information receivers held was the message that was sent to them by the sender. To do so, the sender had three messages at her disposal that were of the type "the real state is ...". Given the information, next, the receivers had to choose whether to enter or to stay out. Depending on the choices of the receivers and the state drawn, the three members obtained their respective payoff.

The phrasing in the experiment was chosen as neutral as possible: the sender and receiver roles were named role A and role B, the states where presented as payoff tables 1, 2 and 3, the messages were numbered similarly ("Table ... has been selected"), and the actions were called option X and option Y. To facilitate learning, during the session, each subject had a history table displaying the table selected, her role, the decisions by the members in their triple, and her payoff. After the last round of play, three rounds were randomly drawn with replacement and subjects were paid according to the sum of the payoffs they made in the three rounds drawn. The rematching in triples within matching groups, the random role assignment and the lottery payment were implemented to mimic a one-shot interaction between subjects as much as possible.

Subjects were invited and could sign up to participate in an economic experiment via ORSEE (Greiner, 2004). The sessions were run in the BEElab at Maastricht University in May and June 2012. The instructions and comprehension questions were paper-based; the decision phase was computerized using z-Tree (Fischbacher, 2007). In total 216 students participated in our sessions. An experimental session lasted between 60 and 90 minutes and the average earning of the subjects was 13.41 Euro, including a 3 Euro show-up fee.

4.3 Results

In total we have five independent observations for the baseline treatments (NI and FI) and eight for the treatment with cheap talk (CT). We do not find any substantial time trends in period averages for each matching group.[3] Therefore, we consider matching group averages over all periods in our data analysis.

4.3.1 Treatment comparisons

In this first subsection, we focus on the outcomes generated in the various treatments and the performance of the cheap talk treatment in particular. Thereby, we focus on the number of entrants in the various states and the average payoffs of the sender and the receiver(s).

Figure 4.1 presents the frequencies of the number of entrants in the different states for the three treatments. We see that in the FI treatment, there have been no instances

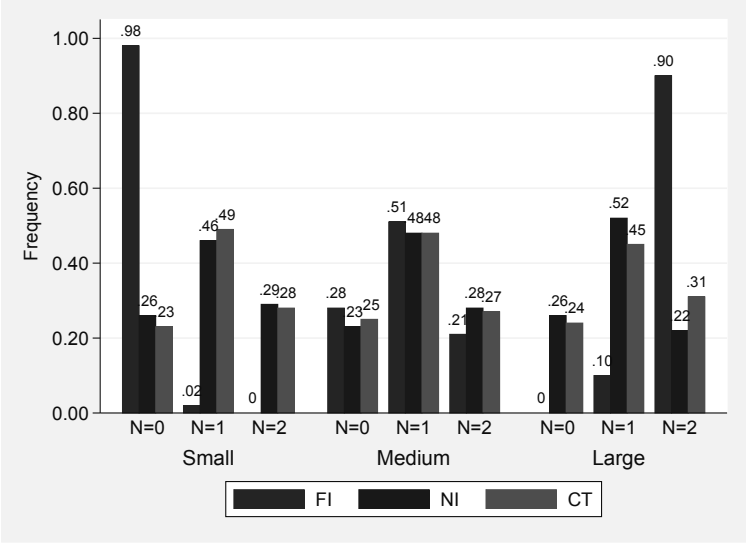

Figure 4.1: Frequency of the number of entrants.

where two receivers entered in the small state and where no receiver entered in the large

[3]All instructions, software, data files (raw and processed) and codes used for analysis are retrievable from the second authors personal webpage.

state. From this we can conclude that the structure of the payoffs has been clear to all participants. Furthermore, we see that the differences between the NI treatment and the CT treatment are rather small. Only in the large state there is a small difference visible; here, the expected number of entrants is 0.96 in the NI treatment and 1.07 in the CT treatment. Where cheap talk communication appears to successfully support entry in the large state, it fails to prevent receivers from entering in the small state. Yet another striking observation is that the entry outcomes are quite similar across all treatments in the medium state. While this is close to symmetric equilibrium prediction for the FT treatment, for the NI treatment and the CT treatment there is substantially less entry compared to symmetric equilibrium prediction.

Next, we compare the performance of the three treatments on basis of two efficiency criteria. The first efficiency criterium relates to the frequency of efficient entry levels in the different states. In a monopolistic competitive market, firms usually enter up to the moment that all excess profits from entry are eroded. In our configuration, this would mean that (if all information were to be available) there should be no entry in the small state, one entrant in the medium state and two entrants in the large state. Table 4.3 shows for each treatment the frequency of efficient entry outcomes per state and on average over states.

	Frequency of efficient entry outcomes				Average payoff	
Treatment	Small	Medium	Large	Overall	Sender	Receiver
Full info (FI)	0.98	0.51	0.90	0.80	5.44	4.69
No info (NI)	0.26	0.48	0.22	0.32	5.29	4.11
Cheap talk (CT)	0.23	0.48	0.31	0.34	5.24	4.14

Table 4.3: Frequency of efficient entry outcomes and payoffs in the various treatments.

The frequencies of efficient entry levels for the FI treatment are quite in line with the theoretical predictions in Table 4.2. For the other two treatments the frequency of efficient outcomes is larger in comparison to theoretical prediction when the state is small or medium, but lower in case the state is a large. These opposite effects lead to the overall frequency of efficient entry levels not being substantially different as predicted by theory.

On the overall level, the frequency of efficient entry outcomes in the CT treatment does not differ from that in the NI treatment (Mann-Whitney, two-sided: $p = .5549$). With regard to these frequencies on state-level, there are no significant differences between these

two treatments in the small state ($p = .2403$) and the medium state ($p = .2403$). However, and as was already visible in Figure **??**, cheap talk communication induces more efficient entry in the larger state ($p = .0475$). But, this effect is not sufficient to make cheap talk communication effective on the overall level.

Comparing these two treatments with the FI treatment, there is no difference in the medium state (CT: $p = .4624$; NI: $p = .6004$). However, in the small state and large state, the frequency of efficient entry outcomes in the FI treatment significantly exceeds that of the NI and CT treatment (all tests: $p < .01$). These differences are sufficiently strong to make the FI treatment more efficient than the other treatments on the overall level (both test: $p < .01$).

With respect to the expected payoffs, our findings are comparable to those for the frequencies: There is no significant difference between expected payoffs in the CT treatment and the NI treatment (sender: $p = .7140$; receivers: $p = .5582$) and the expected payoffs in the CT treatment are below that in the FI treatment (sender: $p = .0669$; receivers: $p = .0034$).

Result 1-1. Cheap talk communication fails to increase efficiency and payoffs beyond the level that is obtained in a setting where receivers do not receive any information on the actual state.

Result 1-2. The level of efficiency and payoff that is obtained in a setting where receivers are perfectly informed about the state are not achieved when receivers are informed via messages sent by the sender.

In order to better understand why cheap talk communication failed to enhance efficiency relative to the situation where receivers do not obtain any information regarding the state in our experiments, we continue with an analysis of the senders' and receivers' behavior in the cheap talk treatment.

4.3.2 Individual behavior

Table 4.4 shows the probabilities by which the senders have chosen messages in the different states. One property that stands out is that in each column the number on the principal diagonal exceeds the two numbers off the diagonal. Since the signaling behavior of the sender does not differ much across matching groups, it does not come as a surprise that we

	Message		
State	Small	Medium	Large
Small	0.69	0.22	0.10
Medium	0.50	0.41	0.10
Large	0.59	0.22	0.19
Overall	0.59	0.28	0.13

Table 4.4: Messages chosen by the senders in the different states.

can reject the hypothesis that probabilities by which messages are chosen are independent of the state: Given a message, the probability by which this message is chosen is significantly higher in the state that matches the message compared to the other two states (Wilcoxon, two-sided, $p < .03$ for all six comparisons) and are not significantly different between the other two states ($p > .12$ for all three comparisons).

Result 2-1. The messages sent by the sender do convey information on the actual state.

The dominance of the diagonal in the matrix that reflects signaling behavior in the cheap talk treatment, indicates that on the aggregate level senders tell the truth excessively compared to standard theoretical prediction. So, the excessive truth-telling that has been found in earlier literature appears robust to introducing multiple strategically interacting receivers. The numbers in the table also indicate a general tendency for strategic deception (understating the state) and a substantial amount of obscure deception (overstating the state). We will provide a further discussion on these two forms of deception in the discussion.

In order to estimate the amount of truth-telling, we decompose the sender's signaling behavior into a truth-telling component and a state-independent component:

$$\begin{pmatrix} m_{S,S} & m_{S,M} & m_{S,L} \\ m_{M,S} & m_{M,M} & m_{M,L} \\ m_{L,S} & m_{L,M} & m_{L,L} \end{pmatrix} = \lambda \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} + (1-\lambda) \begin{pmatrix} \sigma_S & \sigma_M & \sigma_L \\ \sigma_S & \sigma_M & \sigma_L \\ \sigma_S & \sigma_M & \sigma_L \end{pmatrix}$$

and estimate the four parameters that fit our data best:[4]

$$\lambda = 0.1365 \qquad \sigma_S = 0.62 \qquad \sigma_M = 0.27 \qquad \sigma_L = 0.10.$$

These numbers indicate, first, that if we were to partition the population into truth-tellers and perfect babblers, we would estimate about 14% of the population to consist of truth-

[4]The parameters listed minimize the sum of the distances to the eight independent observations.

tellers, and, second, that the perfect babblers have a general tendency to understate the state.

Now we know that messages do convey information, the next question is whether this is picked up by the receivers. Table 4.5 presents the entry decisions of the receivers in response to messages received. We see that the probability by which the receivers enter

	Entry decision	
Message	In	Out
Small	0.45	0.55
Medium	0.55	0.45
Large	0.81	0.19
Overall	0.53	0.47

Table 4.5: Entry decisions of the receiver after the different messages.

are increasing in the message, and find that the differences are significant (S-M: $p = .0251$; M-L: $p = .0117$). This result implies that the excess truth-telling is picked up by the receivers and their responses reflect some trust in the messages.

Result 2-2. Receivers respond to messages in a way that reflects that they regard messages somewhat trustworthy.

Table 4.6 combines the information presented in the previous two tables and shows the probability that the receivers enter for each state. We see that the receivers' entry prob-

	Entry decision	
State	In	Out
Small	0.51	0.49
Medium	0.53	0.47
Large	0.54	0.46
Overall	0.53	0.47

Table 4.6: Entry decisions of the receiver in the different states.

abilities for the three states are quite close. Yet, the probability by which receivers enter is significantly lower in the small state compared to the other two states and there is no significant difference between the larger two states (S-M: $p = .0357$; S-L: $p = .0173$; M-L: $p = .2626$).

Result 2-3. Cheap talk communication results in minor differences in entry decisions across states.

In sum, we find that messages are informative and this has been picked up by the receivers, but that the receivers' entry decisions in response to the messages is such that it does not produce sufficient differences in entry probabilities across states for cheap talk to be able to enhance efficiency.

4.4 Discussion

In this section we first aim to provide an explanation for why, despite senders' messages conveying information and the receivers recognizing this and responding to that, cheap talk does not induce an enhancement of efficiency levels and payoffs beyond that obtained without any information transmission. Second, we try to increase understanding in the senders' substantive use of messages that are destructive for the payoffs of all parties involved by investigating several alternative underlying motives that may play a role.[5]

4.4.1 Possible explanation

Table 4.7 shows the entry probabilities for the receivers in the symmetric equilibrium, given the sender's behavior in the experiment. Comparing these numbers with those in

	Entry decision	
Message	In	Out
Small	0.61	0.39
Medium	0.64	0.36
Large	1.00	0.00
Overall	0.67	0.33

Table 4.7: Equilibrium behavior of the receivers given the sender's behavior.

Table 4.5, we see that, while receivers do realize that the senders' messages capture some amount of truthful information, they fail to respond optimally. Receivers simply behave overly cautious after every possible message. This cautiousness was something that was

[5]Ideally, we would analyze the data on the level of the individual. We believe that the many changes in roles and states obstructs a clean analysis. Moreover, a better understanding of receiver behavior would require a design in which the receivers' beliefs over states after receiving a message would be elicited.

also observed in the NI treatment, where receivers only enter with 51% probability, while equilibrium predicts them to enter with 67% probability.

One obvious candidate explanation for the overly cautiousness to enter is risk aversion. In the post-experimental questionnaire we elicited our participants' risk attitudes by the direct approach as suggested in Dohmen et al. (2011).[6] We find that participants in the NI treatment report a slightly higher degree of risk aversion compared to the FI treatment ($p = .0729$). In the FI treatment the receivers enter with 47% probability in the medium state, which is close to the symmetric equilibrium prediction. So, risk attitude can explain (in part) the low entry rate in the NI treatment. However, participants in the CT treatment do not report a different risk attitude compared to those in the FI treatment ($p = .8103$). Therefore, risk aversion is not the likely explanation for low entry rates in the CT treatment. Yet, apart from the uncertainty about the other receiver's behavior, in the CT treatment, there is also uncertainty regarding the actual state being drawn while this type of uncertainty is not present in the FI treatment. So, the difference may be explained by the difference in the nature of the risk across treatments.[7]

4.4.2 Obscure deception

Despite there being excess truth-telling on the aggregate level, only in 43% of the cases senders told the truth. Obviously, our setting invites senders to deceive the receivers by understating the true state and it is not too surprising to find this to happen. However, in about one-fourth of the instances where a sender sent a deceptive message, she actually overstates the state – and this number is stable over time and across matching groups. Where there are clear strategic motives for understating the state (strategic deception), these overstatements appear somehow a bit obscure (obscure deception). Still, about three-fourth of the subjects at least once sent such an obscure deceptive message and about one-fourth of the subjects sent such a message in at least 20% of the instances they acted

[6] We asked the participants the question "How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?". Next they were asked to tick a box on a scale from 0 to 10 where the value 0 means: "not at all willing to take risks" and the value 10 means "very willing to take risks". The average response was 6.06, 5.38 and 5.96 in respectively the FI, NI and CT treatment.

[7] Actually, in case receivers have in mind to behave in the NI treatment as they would do in the FI treatment and take the average over these probabilities (because all states are equally likely to be drawn), this can explain the close to 50% entry. If they would indeed compound the probabilities in such a way, they falsely ignore the payoff differences across states (note here that the payoff differences between the small and medium state equal 2, while the difference between the medium and large state equals 3).

as sender. Given the large number of individuals using such a message and the use not vanishing over time, we further investigate on possible motives for using such a message.

Table 4.8 shows the costs and gains from lying for the sender and receiver, given the actual response to the messages by the receivers in the experiment. The first number in each cell corresponds to the gain to the sender of sending the respective message in the respective state; the second number corresponds to the gain for the receivers. We see that

	Message		
State	Small	Medium	Large
Small	—	$-0.42, -0.32$	$-1.44, -1.26$
Medium	$+0.42, +0.11$	—	$-1.01, -0.44$
Large	$+1.44, -0.53$	$+1.01, -0.32$	—

Table 4.8: Costs and gains from lying.

it is always beneficial for the sender to understate the actual state. Where these lies are harmful for the receivers in the large state, they are beneficial for them in the medium state. The reason for this is that the receivers enter with 55% probability (recall Table 4.5) after receiving the message saying that the state is medium, which is too high in the medium state. Sending the message saying that the state is small in this state helps the receivers in suppressing the entry probability to 45%, which happens to be beneficial for the receivers.

Overstating the actual state is always harmful for the sender and the receivers. It is questionable why in 32% of the instances in the small state and in 10% of the instances in the medium state such messages have been chosen by the senders. A strategic motive may be to spoil the communication channel in order to implement a babbling equilibrium. However, since the interaction properties in our experiment mimic that of a one-shot interaction (co-player rematching, re-assignment of roles, anonymous decision making, not all rounds are selected for payment, and in addition there is variation in states being selected), it is hard to build a babbler reputation. Therefore, this strategic motive seems not to be a plausible explanation for the high amount of obscure deceptions.

One other experimental study in which nonstrategic deception has been found is Clots-Figueras et al. (2012). That study considers a version of the trust game where the investor is not aware of the possible benefit on investment. The investee, who is aware of this benefit, has the capacity to transmit information on it to the investor prior to his investment decision. The investee has a clear strategic motive to overstate the benefit in order to

persuade the investor to invest a lot. Although more instances are found in which investees overstate the benefit, there are a substantial amount of instances in which they understate the true benefit. Their explanation for these nonstrategic deceptions is guilt aversion: by understating the benefit, investees decrease the return expectations of the investors, thereby decreasing their guilt from a possibly disappointing return. As in our situation the sender of the message has no further actions to take, guilt considerations seem not to play any role.

Another emotional motive for sending such a lie, that is given by Gneezy (2005), is a "spiteful reaction to unfair behavior". Therefore these lies are classified "spiteful black lies" in Erat and Gneezy (2012).[8] As participants in our experiment have been rematched and reassigned their role every round anew, such a spiteful reaction typically targets someone that cannot be held accountable for having caused a feeling of being treated unfairly. Nevertheless the spiteful reaction may be a mere act of getting rid of such negative feelings. Two prominent experiences that we recognize as potential triggers for spiteful response are: (1) having suffered from a lie as a receiver, and (2) having suffered from not having been trusted as a sender after having told the truth. Out of the 202 instances of obscure deceptions from the second round onwards, (1) only thirteen (6.44%) were sent after having received a payoff lower than the reservation payoff of 4 after a lie has been told to them as a receiver in the previous round, and (2) only eighteen (8.91%) were sent after having received a payoff below the full coordination payoff of 5 after having told the truth in the small or medium state as a sender in the previous round. From these numbers we infer that the high amount of obscure deceptions is not likely to be explained by spiteful reactions to unfair behavior.

Yet another explanation of these obscure deceptions may be found in "self-image" considerations. The idea is that a sender who recognizes her incentive to understate the state and that the receivers may be aware of this, may expect that the receivers expect her to do so. By overstating the state, she can avoid being considered a "selfish liar", thereby distinguishing herself from others who belong to this group. One other way to avoid being labeled as such is of course to tell the truth. Still, in the small state telling the truth does not help to get rid of a possibly "selfish" image. These arguments are

[8]Note that what we call obscure deceptions is close to what Erat and Gneezy call spiteful black lies, but not synonym. The reason is that the negative consequences of these lies for our players involved is according to payoff expectations based on the experimental data.

valid even in the one-shot interaction that our design aims to mimic. In our experimental data, we do not see any evidence that goes against self-image concerns being a plausible motive for the obscure deceptions in our experimental population. Although 74% of our experimental population has been responsible for at least one obscure lie, about one-thirds of the population has been responsible for 70% of the obscure lies and 19% of the population committed an obscure lie in more than one-fourth of the instances (while in the large state it was impossible to commit such a lie).

4.5 Conclusion

In this chapter we investigate in a setting with strategic tensions between a sender (incumbent) and two strategically interacting receivers (potential entrants) whether cheap talk can enhance efficiency (in terms of efficient entry levels and payoffs). Although there is excessive truth telling and this is picked up by the receivers, we find this not to be the case. The reason for this is that receivers fail to optimally translate the information received into their entry decision. An implication of this study is that we cannot rely on cheap talk to reduce the inefficiency caused by informational asymmetry in a complicated strategic environment.

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Nederlandse Samenvatting

Dit proefschrift bestaat uit drie zelfstandige hoofdstukken waarin asymmetrische informatie vraagstukken worden behandeld. Hoofdstuk 2 betreft een theoretisch onderzoek naar stimuleringsmaatregelen van informatie verwerving en openbaring in een model van prijsconcurrentie. Hoofdstuk 3 onderzoekt naar verbetering van de effectiviteit van mededingingsbeleid. Het bespreekt hoe mededingingsautoriteiten mogelijk kunnen profiteren van belangenverstrengeling tussen ondernemingen ten einde kartels te kunnen opsporen. In Hoofdstuk 4 wordt experimenteel getest of cheap talk een effectieve manier is om informatie asymmetrie te beperken en zodoende de efficintie kan verhogen in een omgeving waar potentile toetreders beslissen al dan niet toe te treden tot een markt van onbekende omvang.

In Hoofdstuk 2 proberen we inzicht te krijgen in de economische logica achter sommige voedselkwaliteit schandalen. Wij merken op dat in het recente verleden er talloze schandalen zijn rond slechte praktijken in de voedingsindustrie. Hoewel het gemakkelijk kan worden gerationaliseerd waarom deze slechte praktijken niet gemeld worden door de boosdoeners zelf, is het moeilijk te begrijpen waarom de correct gedragende concurrenten geen melding maken van het laakbare gedrag van hun rivalen. Wij vinden dat wanneer de kosten van informatie verwerving laag zijn, een actief bedrijf informatie zal verwerven over de kwaliteit van het product van een toetreder. Lage kwaliteitsniveaus van het product zullen bekend worden gemaakt in een substitute market, maar zullen naar verwachting niet openbaar worden gemaakt in een complement market. Bovendien, wanneer de kwaliteit van het product van de gevestigde aanbieder zelf hoog is, zal deze bereid zijn meer geld te besteden aan het vergaren van informatie over de kwaliteit van het product van de toetreder, en enkel lage kwaliteitsniveau onthullen in een substitute market en hoge kwaliteitsniveaus in een complement market. Beleid dat het verwerven en vrijgeven van informatie mandateert kan leiden tot meer transparantie in geval van lage kwaliteit, maar zal niet welvaart

verhogend zijn.

In Hoofdstuk 3 hebben we onderzocht of invoering van individuele sancties een preventieve werking hebben op het ontstaan van kartels en hoe dit de organisatiestructuur van bedrijven kan benvloeden. Wij vinden dat, gezien het feit dat sancties voor bedrijven reeds zijn genstalleerd, invoering van individuele sancties geen toegevoegde waarde hebben in de preventie van kartelvorming omdat, in evenwicht, de mogelijke boete zal worden doorberekend in het loon van de manager indien de eigenaar van de onderneming de manager ertoe zou willen bewegen deel te nemen aan het maken van kartel afspraken. Het toevoegen van een individuele clementieregeling voor klokkenluiders zal een positieve werking hebben op het ontmoedigen van kartel participatie daar een clementieregeling het belangenconflict tussen managers en eigenaren zal versterken en deze niet met contracten kunnen worden opgelost. Dit heeft tot gevolg dat eigenaren in mindere mate geneigd zijn managers aan te stellen. Onze resultaten laten zien dat in aanwezigheid van een clementieregeling een (gedeeltelijke) doorschuiving van de sanctie naar het individu een positief effect heeft op het ontmoedigen van kartels.

In Hoofdstuk 4 testen we aan de hand van een experiment of cheap talk marktwerking kan verbeteren. Ons experiment weerspiegelt de situatie waarin een gevestigde onderneming een openbaar signaal kan geven over de omvang van de markt aan twee mogelijke toetreders. Wij vinden dat cheap talk niet leidt tot een efficinter niveau van toetreding en ook niet tot grotere totale winsten in vergelijking met de situatie zonder informatieoverdracht. Ondanks dit negatieve resultaat vinden we wel dat de signalen van de gevestigde onderneming over het algemeen waarheidsgetrouwe informatie bevat. In de gevallen waar een misleidend signaal afgegeven wordt, betreft het meestal een misleiding met strategische motieven (de omvang van de markt wordt kleiner voorgedaan als deze werkelijk is). Desondanks is er een robuuste en substantile hoeveelheid aan obscure misleidingen (de markt wordt als groter voorgedaan). We vinden dat de kans dat potentile toetreders werkelijk toetreden stijgend is in de omvang van de markt zoals door het gevestigde bedrijf wordt beweerd. Dus, ondanks dat signalen relevante informatie bevatten en dit ook als zodanig wordt opgevangen door de potentile toetreders, leidt cheap talk niet tot betere marktprestaties. De reden hiervoor is dat de potentile toetreders de ontvangen informatie niet optimaal weten door te berekenen in hun beslissing al dan niet toe te treden, hetgeen mogelijk te wijten is aan overmatige voorzichtigheid.

Short Curriculum Vitae

Xinyu Li was born on October 15, 1982 in Shenqiu, China. He finished his High School in 2001. In September of the same year he started studying Economics at Zhengzhou University and received a Bachelor degree in 2005. He then attended a three-year Master program at Peking University and obtained a Master degree in Economics in 2008. Thereafter he continued his study in Economics in France and got another Master degree in Economics from Toulouse School of Economics in 2009. From 2010 he started his doctoral study at Maastricht University in the Netherlands. The results of his research are presented in this thesis.