“A plague on both your houses”: Why to preserve your rival reputation

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Abstract

Two firms produce a product that can be of high or low quality, which is not known to customers. One of the firms accuses another that it produces a low-quality product, while this information (or rumor) can be either true or not. Consumers believe rumors with some probability, but if they believe, they also may conclude that general quality in the market is low. I show that, as long as both firms stay in the market, the firm that spreads rumors is worse off relative to the case without rumors. Surprisingly, this holds even if consumers believe that this firm produces a high-quality product with certainty.

Keywords: reputation; competition

JEL codes: L1

1 Introduction

In April 2021, Russian and Chinese governments were accused by the European Union services that they “intensively promote their own state-produced vaccines around the world. The so-called ‘vaccine diplomacy’ ... is combined with disinformation and manipulation efforts to undermine trust in Western-made vaccines.”\(^1\) Russia developed a Sputnik V vaccine against Covid-19 and is interested to promote it. The Russian government is suspected in spreading rumors harmful for the reputation of other vaccine producers, Pfizer and Moderna.\(^2\) However, vaccination rate in Russia is relatively low, which is explained by the low level of trust of many of Russian citizens on the Sputnik vaccine, produced in their own country. Some analysts


\(^2\)Competition among Pfizer, Moderna and Sputnik V vaccines may by anticipated in the future. However, currently Sputnik V is not approved in most Western countries.
connect it to rumors promoted by the Russian government against other vaccines. As a side effect of government propaganda, many people have less trust on not only Pfizer and Moderna vaccines, but also vaccines in general.

This motivating example may be generalized to other industries. For instance, a restaurant may accuse a rival restaurant that its food is not healthy; however, consumers may conclude that all food in this market is not healthy. Observing that one firm blames another, some customers may feel “A plague o’ both your houses” (as said by Mercutio in Shakespeare’s “Romeo and Juliet”) and leave the market.

Consider two firms A and B which produce a similar product and compete in quantities. The product may be of high or low quality (vertical differentiation), and the quality is not known to customers. In a benchmark case, consumers believe with certainty that the product of both firms is of high quality. Next, firm A spreads rumors, blaming B’s product is of low quality. Customers believe in rumors with some probability only, but if they believe, they also believe with some probability (maybe zero) that A’s product is also of low quality. Namely, after spreading of rumors, customers’ expected utility of B’s product (B’s reputation) is lower than in the benchmark case. Moreover, expected utility for A’s product is lower or equal to the benchmark, but higher than for B’s.

I show that, as long both firms stay in the market, i.e., produce positive quantity, A is worse off after disparagement of B, comparing the case without rumors. This is not surprising if following rumors consumers believe with positive probability that A also produces a low-quality product. But even if A’s reputation is not damaged and consumers believe that it produces a high-quality product with certainty, A is worse off. This seems counterintuitive. An explanation is that since B’s reputation is damaged (but not completely ruined) by rumors, demand for its product declines. Since there is no improvement in A’s quality, the total demand for the product shrinks. B is forced to sell to consumers who are less interested in quality, but prefer to pay less. Thus, B produces a higher quantity of cheaper products. Consequently, due to a decline in total demand, even if A produces less quantity than in the benchmark case, its price is also lower.

This result may change if damage to B’s reputation is drastic, such that this firm is ruled out of the market (produces zero quality). Then A may be better off relative to the benchmark case, depending on the damage to its own reputation.

There is vast literature on vertical differentiation of products (to name a few, Shaked and Sutton, 1982, Bonanno, 1986, Chambers et al., 2006, and Baron, 2020). These studies report when it is preferable to firms to differentiate themselves in quality, and when it is not. In my model, firms are not free to choose their quality level. One of the firms can only reduce the consumers’ belief in quality of another firm, which may

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3 See, for instance https://carnegieendowment.org/2021/08/03/russia-s-vaccine-diplomacy-is-mostly-smoke-and-mirrors-pub-85074.
affect also the belief in its own quality.

This paper is also related to economics of advertising literature (for instance, see Nelson, 1974 and Johnson and Myatt, 2006; for survey, see Bagwell, 2007). In most of this literature, a firm provides information about its own products, while in my paper it provides information (which may be wrong) about the rival. False advertisement is costly, since it may be punished by a regulator (see Piccolo et al., 2015, Rhodes and Wilson, 2018). In my paper there is no sanction by a third party, but reputation of the firm which spreads rumors may also be damaged by them.

There exists also a literature on comparative advertising. In Barigozzi et al. (2009) comparative advertising is a claim that “my product is as good as my rival’s one”. In Anderson et al. (2016) comparative advertising by a firm damages its rival. However, in my model the firm A itself may be damaged by spreading rumors. In Grosset et al. (2011) two firms advertise one against other, which leads to a negative externality. In my paper only one firms spreads rumors, and still it is harmed.

In some sense this model resembles the literature about sabotage in Tullock contest (for a recent study, see Klunover, 2021). In that literature, rivals damage other side chances to win in a contest. In my paper, the damage to side B may, as a side effect, also be harmful for A.

For study of negative advertisement (campaigning) in politics see Barton et al. (2016).

2 Model

Let A and B be two firms that produce some product. The product can be of high or low quality. Utility of a low-quality product for customers is zero. Customers do not know the quality, and they believe that it is high with probability $Pr_h$. The demand function for this product is

$$Q = 1 - \frac{P}{gPr_h},$$

where $Q$ is quantity, $P$ is unit price and $g$ is positive. A cost of production of a unit of the product is $0 < c < g$ (linear production cost). I consider the Cournot competition between firms, where firms decide simultaneously about quantity each produces.

As a benchmark, consider a case where customers believe that the product is of high quality, $Pr_h = 1$. Then by standard calculations, in the symmetric equilibrium

$$\pi_A = \pi_B = \frac{(g - c)^2}{9g},$$

(1)
where $\pi_A$ and $\pi_B$ are revenues of A and B, respectively.

Next, consider a case where A spreads a rumor that product of B is of low quality, and after that firms compete in quantities. Consumers believe with probability $r$ this rumor to be true. If customers believe the rumor, they may also believe that there is a general problem with all products in this market, and thus A’s product is also of low quality. Let $s$ be probability that A’s quality is low, given that B’s quality is low. Note that $r = 0$ is equivalent to the benchmark case.

Let $g_A = g(1 - sr)$ and $g_B = g(1 - r)$. $P_A$ and $P_B$ respectively denote prices of A and B products. Let $Q_A$ and $Q_B$ be quantities of A and B, respectively. For $P_A > P_B$ demand is\(^4\)

\[
Q_A = 1 - \frac{P_A - P_B}{g_A - g_b}, \quad (2)
\]

\[
Q_B = \frac{P_A - P_B}{g_A - g_b} \cdot \frac{P_B}{g_B}. \quad (3)
\]

Consider first a simple case where $g(1 - r) < c < g(1 - sr)$, namely, A becomes a monopoly. A’s revenue is then $\frac{(g(1 - sr) - c)^2}{4g(1 - sr)}$. But even this monopolistic revenue may be worse for A than in (1) (for example for $g = 10$, $c = 5$, $r = 0.51$ and $s = 0.9$). However, this result is not general and does not hold, for instance, for $g = 2$, $c = 1$, $r = 0.6$, and $s = 0.3$. It is straightforward to verify that this monopolistic revenue decreases in $r$. Namely, even if monopolistic revenue is better for A than the benchmark case, A is worse off as consumer’s belief in rumors is higher.

Even if $g(1 - r) > c$, for sufficient high $c$ there is an equilibrium where B produces zero quantity. A’s is the only firm that produces positive quantity, and obtains the monopolistic revenue, which may be (not necessarily) higher than in the $r = 0$ case. This revenue decreases in $r$.

**Proposition 1.** Let $\frac{g(1-r)(1-sr)}{1-2rs+r} < c < g(1 - r)$. Then there is an equilibrium where $Q_B = 0$. A’s revenue decreases in $r$.

For low $c$, there is equilibrium where both firms produce a positive quantity. However, A is worse off relative to the case where no rumors are spread.

**Proposition 2.** Let $c < \frac{g(1-r)(1-rs)}{1-2rs+r}$. Then in equilibrium both A and B produce positive quantity of the product. Revenue of A is lower than in $r = 0$ case.

It should be emphasized, that, surprisingly, even if $s = 0$ the result of proposition 2 holds. As explained in the Introduction section, for positive $r$ the total quantity $Q_A + Q_B$ is lower than for $r = 0$. But $Q_B$ is

\(^4\)This demand function is similar to one that appears in Tirole (1988, Chapter 7.5.1).
higher, and $P_B$ is lower than for $r = 0$. Namely, since customers believe less in its quality, B sells more of its product, but for a lower price. As consequence, both $Q_A$ and $P_B$ are lower than in the $r = 0$ case.

To summarize, as consumers believe more in rumors (higher $r$), A’s revenue decreases. At some point, A becomes actually a monopoly, and then its revenue may be higher (but may be lower) relative to the case without rumors. Then again A becomes worse off as $r$ increases. This is illustrated in Figure 2.1.
Figure 2.1: A’s revenue for $g = 6, c = 4, s = 0.2$ and for $g = 9, c = 4, s = 0.7$, respectively.
3 Final remarks

I consider here Cournot competition. In Bertrand competition, if both firms stay in the market, both have zero revenue, disregarding $g_A$ and $g_B$. However, if $g_B < c$, B leaves the market and A has positive revenue (as long as $g_A > c$). Thus, for sufficient high $r$ and low $s$, A obtains positive revenue only if it spreads rumors.

References


Appendix

Proof of proposition 1. Assume $\frac{P_A}{g_B} = \frac{P_A - P_B}{g_a - g_B}$. Then by (2) and (3), in equilibrium $Q_B = 0$, $P_B = \frac{(1-r)[g(1-rs)+c]}{2(1-rs)}$ and $\pi_A = \frac{[g(1-rs)-c]^2}{4g(1-rs)}$, which decreases in $r$. B does not produce a higher (positive) quantity if $P_B = \frac{(1-r)[g(1-rs)+c]}{2(1-rs)} < c$ holds, which is equivalent to $\frac{g(1-r)(1-rs)}{1-2rs+r} < c$. \hfill $\square$

Proof of proposition 2. If both A and B produce positive quality, by (2) and (3) firms produce in equilibrium

$$Q_A = \frac{2g_A - g_B - c}{4g_A - g_B} = \frac{2g(1-rs) - g(1-r) - c}{4g(1-rs) - g(1-r)}$$

and

$$Q_B = \frac{g_A g_B - 2g_A c + g_B c}{g_B [4g_A - g_B]}.$$

Note that $Q_B > 0$ for $c < \frac{g(1-r)(1-rs)}{1-2rs+r}$. Revenue of A is

$$\pi_A = \frac{(2g_A - g_B - c)g_A (g_B - c)}{(4g_A - g_B)^2} = \frac{(1-rs)(g-2grs + gr - c)(g - gr - c)}{g(3-4rs + r)^2}.$$ \hfill (4)

By (4), for $s = 0$, $\pi_A = \frac{(g-c)^2 - r^2}{g(3+r)^2} < \frac{(g-c)^2}{9g}$. Recall that right-hand side of the last inequality is by (1) A’s revenue for $r = 0$ case.

$\pi_A$ increases in $g_A$, and $g_A$ decreases in $s$, namely $\pi_A$ decreases in $s$. That completes the proof. \hfill $\square$