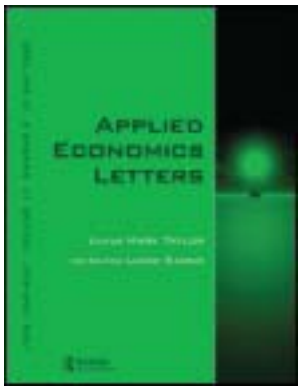

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Ignorance is bliss? Uncertainty about product valuation may benefit consumers

Tarcisio da Graça [a b c] & Robert Masson [d]

[a] Department of Economics, University of Ottawa, Ottawa, ON, Canada

[b] Department of Economics, Carleton University, Ottawa, ON, Canada

[c] Economic Policy and Enforcement Branch, Canadian Competition Bureau, Gatineau, QC, K1A 0C9, Canada

[d] Department of Economics, Cornell University, Ithaca, NY, 14853, USA

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Ignorance is bliss? Uncertainty about product valuation may benefit consumers

Tarcisio da Graça[a,b,c,*] and Robert Masson[d]

[a]*Department of Economics, University of Ottawa, Ottawa, ON, Canada*
[b]*Department of Economics, Carleton University, Ottawa, ON, Canada*
[c]*Economic Policy and Enforcement Branch, Canadian Competition Bureau, Gatineau, QC K1A 0C9, Canada*
[d]*Department of Economics, Cornell University, Ithaca, NY 14853, USA*

Product information which is beneficial for an individual consumer may hurt if disseminated widely. Even with rational expectations, a fallacy of composition may occur if information leads to demand and price increases.

Keywords: information; rational expectations; advertising; product reviews

JEL Classification: D8; M3

I. Introduction

Would providing consumers with information that dissipates uncertainty about the true value of a newly released good before their purchasing decision help them? Many people, even neutral smart economists, would probably say 'yes' without caveats. Based on the models, we present in this article, however, the answer that emerges is 'not necessarily'.

For any *individual*, providing information can be beneficial as [s]he would be more likely to make the right purchase decision. But there is a fallacy of composition. Providing better information to *all individuals* will alter the demand structure and endogenously the equilibrium price may rise. Through this mechanism, truthful information can reduce consumers' surplus. We refer to this outcome as an 'ignorance is bliss' (IIB) effect.

We show this fallacy can arise with Rational Expectations (REs). First, we model RE across products, some products are *ex ante* undervalued while others are *ex ante* overvalued; RE means that on average they are correctly valued. Then, we model RE across individuals. We assume that even though individuals have different *ex ante* valuations about *a* product, the average *ex ante* valuation across individuals is equal to the true valuation. In both cases, the fallacy can occur. Many economists feel perverse assumptions lead to perverse results. In this article's context, large misperceptions could be one such perverse assumption. Our model shows that more reasonable assumptions, small misperceptions, are what lead to perverse results.

We model credible product reviews such as many on the web or like *Consumer Reports* magazine. We model this scenario. A profitable advertising model is more complex. Using a continuity argument, however, we conjecture that there can still be IIB effects in advertising.

II. Literature Review

Our work is related to the literature in advertising widely construed, including display areas in stores, knowledgeable salespeople, customer demonstrations, etc. Bagwell's literature survey (2007) discusses three main views of advertising: persuasive (altering the utility function), complementary (the consumer values the ad itself) and, related to our model, informative. We do not detect our IIB effect in this survey.

Johnson and Myatt (2006) consider a monopolist's choice of information provision to passive consumers.

*Corresponding author. E-mail: tdagraca@uottawa.ca

The authors point out that despite conceptual distinctions, those three traditional views ultimately assume a demand shift outward at each possible price. They posit that some consumers may learn that the product is not suited to their tastes even as others realize that it is. They model this as a demand rotation around some interior point. The authors acknowledge in a footnote that welfare effects are outside the scope of this article.

Dixit and Norman (1978) [D&N] evaluate the welfare impact of advertising. An important insight is that Consumer Surplus (CS) may not be the area under demand if *a priori* valuation differs from true value in use. It is this insight that drives our results.

III. RE Across Products

Consider a product which – if consumers had full information about it – would be demanded according to the following inverse demand function: $p(q) = 100 - a\,q$. If consumers were fully informed about the product, a monopolist with marginal cost of c would maximize profits so that $q_f = \frac{100-c}{2a}$ and $p_f = \frac{100+c}{2}$.

Suppose that there are multiple different products, but each product's full information demand curve is the same as this. Some products are undervalued *a priori* and some are overvalued. We model consumers' misperceptions as a rotation around the horizontal intercept of the full information demand curve (proportional misperception).

Look at a specific product with misperception parameter k. Inverse demand is given by $p_k(q) = k(100 - a\,q)$. A monopolist facing this demand would maximize profits with $q_k = \frac{100\,k-c}{2\,a\,k}$ and $p_k = \frac{100\,k+c}{2}$. The price-cost margin would be $1 - \frac{2c}{c+100k}$.

Consider an *a priori* undervalued product, $k < 1$. For this product, $q_f > q_k$. *If prices were unaltered* by the availability of information, consumers of this product would unequivocally be better off with full information. Conversely, *if the quantity sold was unaltered* by the information, consumers would unequivocally be worse off with the higher price. Hence, the change in CS depends upon how price and quantity change when misperception is replaced by full information. Note that we are applying an insight from D&N; we measure CS using the true value in use – full information demand curve.

Consider a product for which there is no misperception. Then, it is immediate to see that CS with full information is $CS_f = \frac{(100-c)^2}{8\,a}$. In Fig. 1, it is represented by area $a1 + a2 + a4$, the area between the full information price and the full information demand curve.

Without full information, the monopoly solution corresponds to a point which is not on the full information demand curve. For undervalued products ($k < 1$), the full information CS corresponds to the area below the full information demand curve, above the horizontal price line at $p_{k<1}$ and to the left of the vertical quantity line $q_{k<1}$, i.e. area $a1 + a2 + a3$ in Fig. 1. For overvalued products ($k > 1$), CS_k is represented by area $a1 - a5 - a6$. Analytically, in both cases $CS_k = \frac{10\,000\,k^2\,(3-2\,k)-200\,k\,c\,+\,(2\,k-1)\,c^2}{8\,a\,k^2}$.

We find that CS_k is greater than CS_f, whenever $(1-k)\left(20\,000k^2 - k(200-c)c - c^2\right) > 0$.

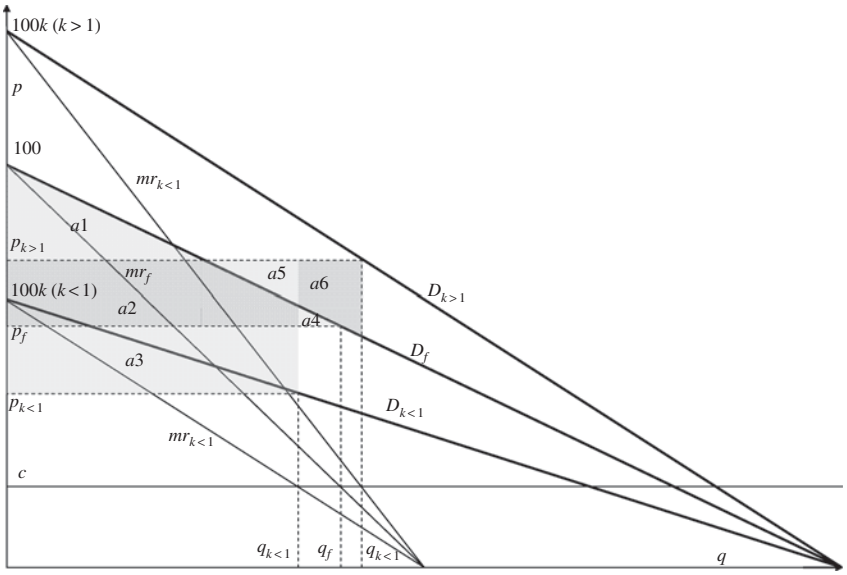

Fig. 1. Inverse demand curves and marginal revenue curves with RE across products

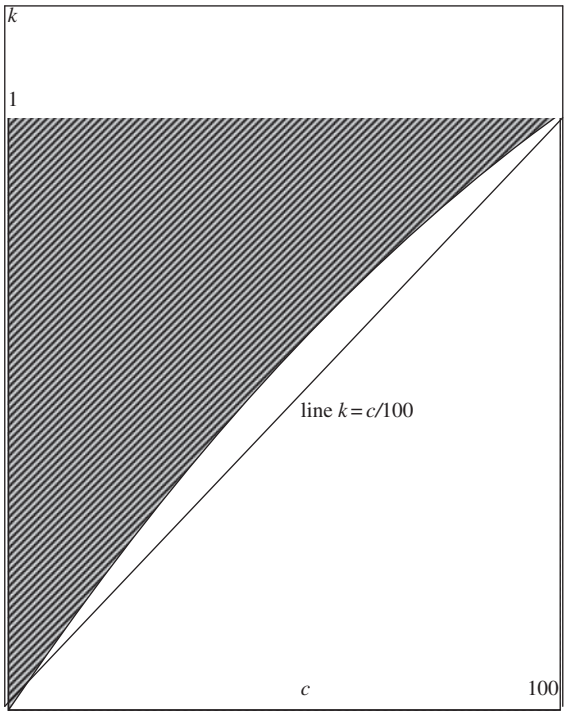

Fig. 2. IIB region with RE across products

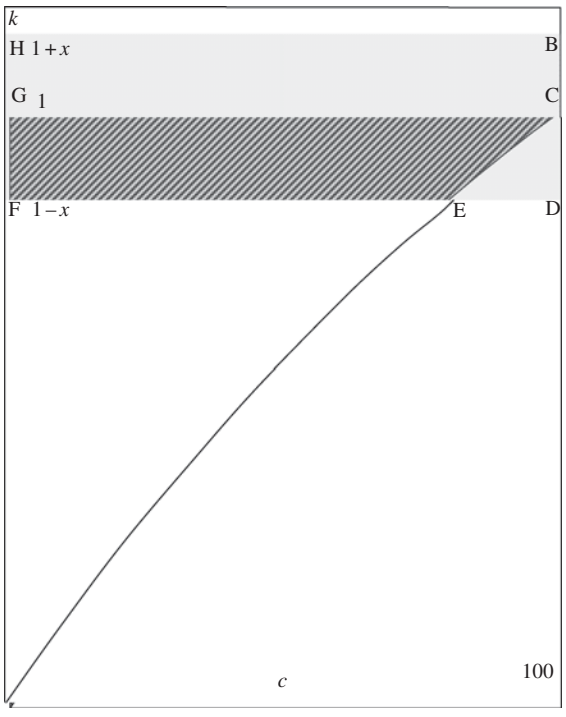

Fig. 3. Distribution of products and IIB occurrence areas

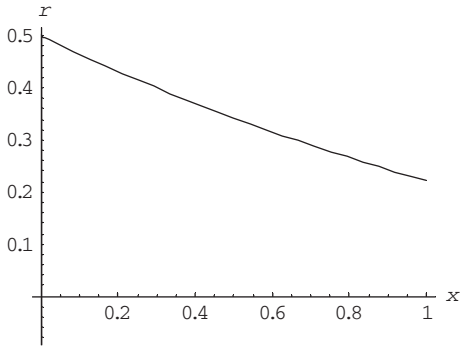

Fig. 4. Ratio of IIB occurrence

Graphically, ignorance is bliss for combinations of k and c over the shaded area in Fig. 2.

We model RE by assuming that across products k is uniformly distributed on the interval $(1 - x, 1 + x)$. RE with half of the products overvalued or undervalued and on average products are correctly valued. In Fig. 3 below, the products are in the grey rectangle [BDFH]. The IIB effect occurs for products located in the area [CEFG]. The ratio of these areas (the latter divided by the former) – call it r – is a measure of the occurrence of the IIB effect. r is a convoluted function of x; so, we omit its burdensome analytical expression (available upon request). We instead offer its graphical representation in Fig. 4.

Note in Fig. 4 that as x approaches zero, the ratio approaches 50%. As x approaches 1, the ratio approaches 22.1%.

In synthesis, if misperception is large, providing information is more likely to increase CS. But if misperceptions are modest, our models suggest that the adverse price effects are more likely to outweigh the better informed consumer effects for some products.

IV. RE Across Individuals for a Single Product

Suppose that RE means that *a* product is correctly valued on average across buyers. Some consumers overvalue it, others undervalue it, but that on average consumers correctly value it. There can still be an IIB effect.

We retain our full information inverse demand function: $p(q) = 100 - q$. If consumers were fully informed about the product, a monopolist with marginal cost of c would maximize profits so that $q_f = 50 - \frac{c}{2}$ and $p_f = 50 + \frac{c}{2}$.

Suppose that *a priori* half the consumers undervalue the product by $(1 - x)$ and that the other half

overvalue it by $(1+x)$, so that, on average, that product is correctly valued *ex ante*.

The 'optimist' demand is $q_o(p) = \begin{cases} \frac{1}{2}\left[100 - \frac{p}{1+x}\right], & 0 \le p \le 100(1+x) \\ 0, & \text{otherwise} \end{cases}$.

The 'pessimist' demand is $q_p(p) = \begin{cases} \frac{1}{2}\left[100 - \frac{p}{1-x}\right], & 0 \le p < 100(1-x) \\ 0, & \text{otherwise} \end{cases}$.

The less than fully informed demand is the sum of the optimist and the pessimist demand functions, i.e.

$$q_x p = \begin{cases} \frac{1}{2}\left[100 - \frac{p}{1+x}\right], 100\,(1-x) \le p \le 100\,(1+x) \\ 100 - \frac{p}{1-x^2}, \; 0 \le p < 100\,(1-x) \end{cases}.$$

The inverse demand function is

$$p_x\,(q) = \begin{cases} (100 - 2\,q)\;(1+x), & 0 < q \le \frac{100x}{1+x} \\ (100 - q)\;\left(1-x^2\right), & \frac{100x}{1+x} < q \le 100 \end{cases}.$$

The marginal revenue function is

$$mr_x(q) = \begin{cases} (100 - 4\,q)\;(1+x), & 0 < q \le \frac{100x}{1+x} \\ (100 - 2q)\;\left(1-x^2\right), & \frac{100x}{1+x} < q \le 100 \end{cases}.$$

The monopolist quantity is

$$q_x = \begin{cases} 25 - \frac{c}{4\;(1+x)}, & x > \frac{100-c}{300} \\ 50 - \frac{c}{2\;\left(1-x^2\right)}, & x \le \frac{100-c}{300} \end{cases}.$$

The monopoly price is then

$$p_x = \begin{cases} 50\;(1+x)\; + \frac{c}{2}, & x > \frac{100-c}{300} \\ 50\;(1-x^2) + \frac{c}{2}, & x \le \frac{100-c}{300} \end{cases}.$$

When $x > \frac{100-c}{300}$, there is no scope for an IIB effect as q_x is less than the full information quantity and p_x is greater than the full information price. With large x, the pessimists are out of the market without full information. The price is high because it is determined by the demand of optimists. Full information improves CS as pessimists enter the market and optimists benefit from lower prices.

If, however, $x \le \frac{100-c}{300}$, price without full information $\left(50\left(1-x^2\right) + \frac{c}{2}\right)$ is less than the full information price $\left(50 + \frac{c}{2}\right)$ leaving scope for an IIB effect.

Figure 5 depicts the concepts with zero marginal cost to reduce graphical clutter. At the monopoly

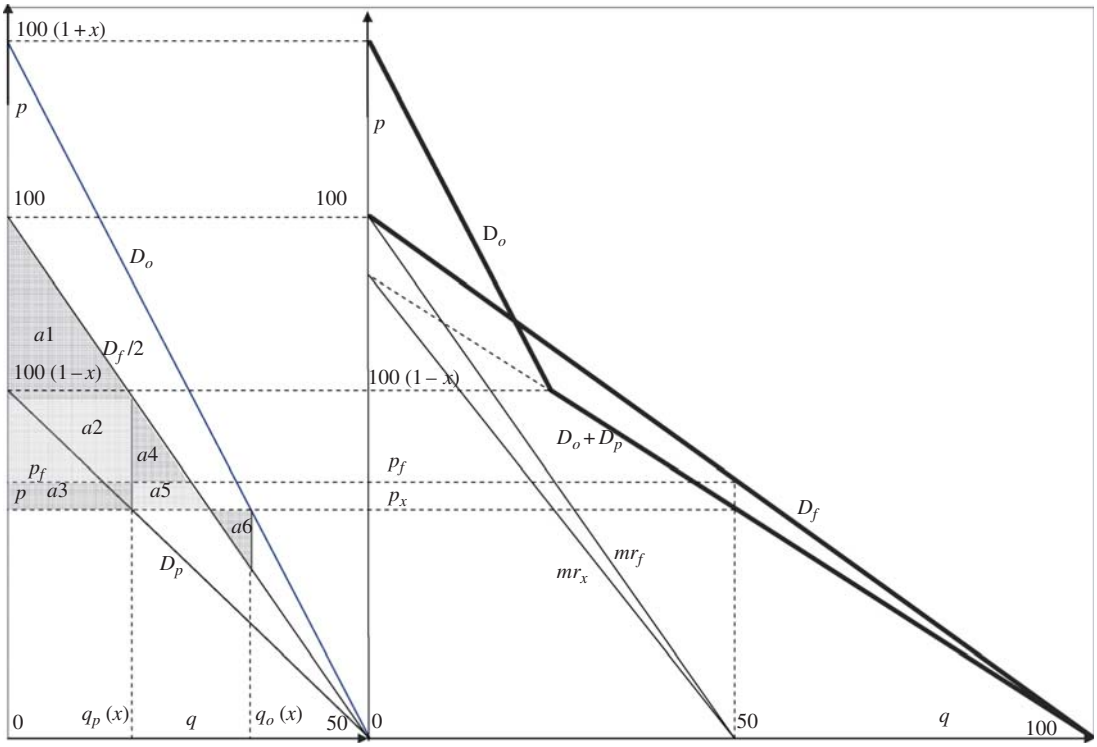

Fig. 5. Individual and market demand curves and marginal revenue curves with RE across individuals

price p_x, the optimists' quantity demanded is $q_o(x) = 25(1+x) - \frac{c}{4(1+x)}$. The optimists' CS is indicated in Fig. 5 by the area $a1 + a2 + a3 + a4 + a5 - a6$. Analytically, it corresponds to

$$CS_o(x) = \frac{\left(c - 100(1+x)^2\right)\left(c + 2cx - 100\left(1 + x^2 + 2x^3\right)\right)}{16(1-x)^2}.$$

The pessimists' quantity demanded is $q_p(x) = 25(1-x) - \frac{c}{4(1+x)}$. The pessimists' CS is indicated in Fig. 5 by the area $a1 + a2 + a3$. Analytically, it corresponds to

$$CS_p(x) = \frac{\left(c - 100(1-x)^2\right)\left(100 + (1-2x)\left(100x^2 - c\right)\right)}{16(1-x)^2}.$$

Total CS is $CS(x) = CS_0(x) + CS_p(x)$, which corresponds in terms of the areas in Fig. 5 to 2 $(a1 + a2 + a3) + a4 + a5 - a6$.

Full information CS is $\mathrm{CS}_f = \mathrm{CS}(0) = \frac{(100-c)^2}{8}$. In Fig. 5, it is represented by $2(a1 + a2 + a4)$.

The IIB effect occurs when the less than full information CS is greater than full information CS. $CS(x) - CS_f$ which in Fig. 5 is area $a1 + a2 + a3 + a4 + a5 - a6$ and is positive for combinations of x and c in the blackened area in Fig. 6 below.

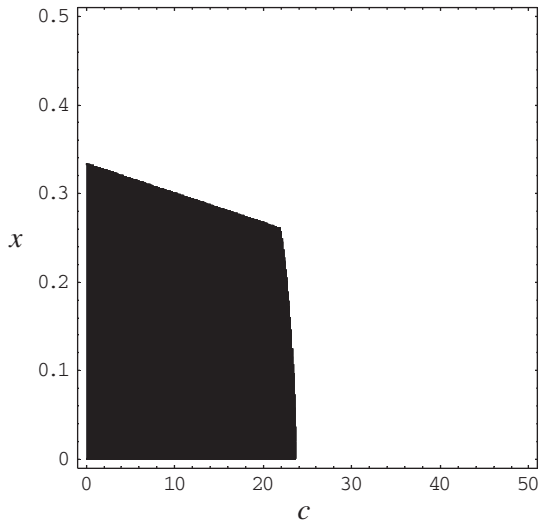

Fig. 6. IIB region with RE across individuals

Over the IIB region, the price-cost margin is $1 - \frac{2c}{c+100(1-x^2)}$. This margin is a decreasing function of c and x. It varies between 1 and 0.618 over the IIB region. Hence, even if consumers are on average correct about the value of a product, the potential for the IIB effect is concrete as it can occur for realistic levels of misperception and for products with economically sensible price-cost margins. The results are realistic to the extent that if misperception is large, providing information is uniquely good. But suppose that misperceptions are modest, our models suggest that the adverse price effects outweigh the better informed consumer effects for some consumers.

V. Conclusion

We all want to be well informed when making purchases. *Consumer Reports* is flourishing after 75 years[1] and numerous websites provide information about products. Better information should be to everyone's benefit? At least this would seem to be true.

We demonstrate that this intuition suffers from a fallacy of composition; information which can be beneficial for one consumer may in fact be adverse to consumers as a whole. We cannot help but to notice the irony of it: in the case of *Consumer Reports*, consumers pay for truthful and unbiased information that can in some cases hurt them.

We model two forms of consumer RE: across products and across consumers. In both forms, we find that for an economically relevant group of products and for realistic misperceptions about the value of a product, consumers can lose surplus if given information that dissipates *ex ante* misperceptions. Of course, better information is beneficial when misperceptions are huge, but when misperceptions are modest, there is a greater likelihood of cases for which enhanced price effects exceed the better informed purchasing effects. The more informed are consumers the more likely we are to have IIB effects from more information. CS can be reduced because that information alters the demand curve so that equilibrium prices can go up. Moreover, if consumers pay to obtain that information, their losses are larger.

In providing information about a product to correct consumers' misperceptions, advertising can also generate IIB effects, but the model is different than the one we present here because advertising may be seen with some scepticism, as it is a manufacturer's

[1] http://www.nytimes.com/2011/12/11/business/media/consumer-reports-going-strong-at-75-digital-domain.html?_r=1&emc=eta1

self-interested effort that enhances its producer surplus. We model information that is perfectly credible. In the case of profitable advertising, if the IIB effect is great enough, even total surplus may go down.

In our reading of the literature, it appears that economists have overlooked the possibility that valuable information for an individual may in some cases be detrimental for the aggregate – ***Ignorance is Bliss***!

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