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On the Efficiency of Spam Mailing and Portal Advertising

Martin Bandulet

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Martin Bandulet*
Universität Augsburg

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Abstract

The objective of this paper is to provide a simple approach endogenizing the welfare reducing or welfare enhancing effect of informative advertising. Using this approach, it is possible to analyse the welfare consequences of a technology shock that reduces unit information costs, and to explain whether electronic junk mails or portal advertising will cause welfare gains or losses in a competitive environment.

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*Address: Martin Bandulet, Wirtschaftswissenschaftliche Fakultät, Universität Augsburg, D–86135 Augsburg, Deutschland, Tel. +49 (0821) 598-4166, Fax +49 (0821) 598-4228, E-mail: Martin.Bandulet@Wiwi.Uni-Augsburg.DE

1 Introduction

Advertising is often assumed to be a bad that reduces customers' utility. Machlup (1980, p. 130) uses colourful words to illustrate this disutility of advertising: "The existence of such unwanted knowledge will hardly be contested by anybody who has his radio [...] program rudely interrupted by long-winding commercials [...]. Some of the jingles which advertise the wonderful qualities of this or that product [...] may stick with the musical memory of some unhappy listeners like wads of chewing gum to the shoe soles of unhappy pedestrians and resist all efforts to remove them."

In recent years, new tedious sources of advertising have been added to those of television and radio commercials: Contemporaneous to the commercialisation of the Interet, the amount of unsolicited e-mail, commonly referred to as "spam", has proliferated (see Cranor and LaMacchia, 1998). In addition to spam, also portal advertising has emerged, causing a nuisance to surfers on the internet (see Barros et al., 2002).

However, advertising may also increase welfare, since it provides information about sellers, product attributes and prices, allowing beneficial trades to occure. This social function of advertising was originally mentioned by Kaldor (1950) and later by Butters (1977), who provided a formal approach to analysing the welfare enhancing aspect of informative advertising.[1]

When manufacturers or retailers decide on advertising, they tend to ignore both external welfare augmenting and reducing effects herein before mentioned. Thus, it is initially unclear, wether a free market generates the optimal amount of advertising and maximises possible welfare or not. New approaches have shed some light in this question by considering media advertising as a two-sided market, namely a market in which a portal as an intermediary serves customers and firms who want to advertise their products on that portal.[2] Thereby, contributions of Anderson and Coat (2003),

[1]See Schmalensee (1986) and Kulenkampff (2000, ch. 4, p. 143 et seqq.) for comprehensive surveys of the literature related to this topic.

[2]Reisinger (2004) provides a good overview of recent literature on two sided markets, especially on portal competition.

Barros et al. (2002) and Reisinger (2004) focus on the competition between portals and advertising firms, but omit the informational aspect of advertising with regard to its effect on consumer surplus. Gal-Or and Dukes (2003) and Dukes (2004) consider this aspect in their research.

The contribution of this article is to provide a comprehensive view of (media) advertising that integrates the above-mentioned aspects into a welfare analysis that is applicable to comparative statics.

Therefore, the article has two main aims. First, it provides a simple framework which includes both externalities specified above and thus is able to endogenise the overall welfare reducing or welfare enhancing result of informative advertising. It is then possible to analyse the welfare effect of a technology shock that reduces unit information costs, and to explain whether electronic junk mails or portal advertising will cause welfare gains or losses in a competitive environment.

2 The model

Consider a market as described by Butters (1977), where a large population of producers and consumers trade a homogeneous good. All sellers use an identical technology for producing the good at constant marginal costs c. All consumers have the same reservation price p_m for the traded good, and each consumer buys one unit of the traded good, unless the price does not exceed p_m. However, customers are initially uninformed and do not know where to buy the products. In order to inform buyers, sellers send out advertisements at random. Each advertisement reaches a single buyer and is regarded as a binding offer to sell the product at price p. If a customer receives more than one advertisement, he will accept the cheapest offer as long as this price offer does not exceed the reservation price p_m, while customers who have not received any advertising will not be able to buy the product. If a consumer receives two or more offers quoting the same price, he chooses one of them randomly.

Let w_H be the cost of sending one advertisement to one consumer, selected accidentally and independently, and let w_L be the customer's cost of "reading"[3] this advertisement. While the expedient of an advertisement (i. e. the producer or, in the extended model, the internet portal) bears w_H, the reading cost w_L is borne by the recipient of the ad, i. e. the customer. Hence, total social costs of advertising add up to $w = w_H + w_L$ per advertisement.

The pricing decision of a firm depends on the advertising cost it has to bear and the probability of a sale generated at the announced price p. Note that this probability is influenced by the number of other advertisements quoting a price lower than p a customer is expected to receive. Assume that this number can be characterised by an advertising price distribution function $Z(p)$, showing the expected number of ads per customer sent out at a price less than or equal to p. Note that $Z(p)$ is approximately continuous, with a large population of sellers and consumers. As a matter of fact, there will be no advertising at prices $p > p_m$, as such a price would exceed the customers' willingness to pay. Hence, the total amount of advertising per consumer is given by $Z(p_m)$.

Advertising is successful whenever the consumer reading an ad has received no other advertising offering the product at a lower price. For a given $Z(p)$, the probability of success $\pi(p)$ can approximately be calculated using the Poisson distribution (see Butters, 1977, p. 468):

$$\pi(p) = e^{-Z(p)} \tag{1}$$

Note that, due to random delivery of ads, there will always remain some uninformed customers who are therefore not in position to buy the good. However, this proportion of uninformed customers declines when $Z(p)$ grows large.

Given the assumptions stated above, it is now possible to investigate the market outcome for three different scenarios:

(i) In section three, I consider a market model where reading costs do not exist or are negligibly small. Thus, firms bear the total social cost of advertising, when sending

[3]Readers should not take this expression too literally: It involves any costs borne by the reader of the ad, e. g. costs to identify and discard the message.

advertisements randomly to potential customers. This model may be applied to describe (approximately) the traditional direct mailing that is characterised by a high unit cost w_H of enveloping and mailing the advertisement letter, while the cost w_L of opening and reading that letter is comparatively low and may be neglected. This is the case investigated by Butters (1977). It will serve as reference for the other scenarios, because its outcome is efficient.

(ii) In section four, I consider the case of spam mailing. I presume that reading costs do exist and make up an important part of the total social costs of advertising. They are borne by the consumers who receive the advertisements. It is then possible to eveluate the welfare loss arising from the external effect of sending advertisements. I will show that a reduction of the unit information cost w_H—as happened with the advent of electronic mailing—will lead to an increasing welfare loss, if the reading cost w_L does not change.

(iii) In section five, I extend the model to the case of portal advertising. I assume that producers do not engage in direct (electronic) mailing, but place their advertising on the website of an internet portal and pay a price per view w_I to the portal operator. All internet portals are assumed to provide the same editorial content and to bear the same unit cost w_H to provide the advertisement, that is, to transmit the advertisement information to the viewer. However, it is assumed that this unit information cost w_H has declined (close) to zero due to the new advertising technology. Note that there are virtually no costs incurred by an internet portal, when the advertisement information is transferred to its visitors.

It is then possible to compare the (in-)efficiency of spam mailing with the outcome of portal advertising. I will state that portal advertising is a more efficient way to provide customers with advertising information. However, there is still too much advertising on portals.

3 Base case: direct mailing

Consider first the case where the firms bear total advertising costs $w = w_H + w_L$. Butters (1977) argues that firms will engage in additional price offers p as long as they can expect positive profits from additional advertising. In a free-entry competitive equilibrium, this implies zero expected profit $G(p)$ for any advertisements sent out and announcing a price p between $c - w$ and p_m:

$$G(p) = \pi(p)(p - c) - w = 0 \tag{2}$$

Simple transformation leads to

$$\pi(p) = \frac{w}{p - c} \tag{3}$$

Note that both equations (3) and (1) have to be fulfilled. Hence, the equilibrium advertising price distribution is as follows:

$$Z(p) = \begin{cases} \ln(p_m - c) - \ln w & \text{iff} \quad p \geq p_m \\ \ln(p - c) - \ln w & \text{iff} \quad c + w \leq p < p_m \\ 0 & \text{iff} \quad p < c + w \end{cases} \tag{4}$$

In equilibrium, all prices between $c + w$ and p_m will be advertised. However, the probability of success $\pi(p)$ declines from 1 (for a price offer $p = c + w$) to $w/(p_m - c)$ for $p = p_m$. To calculate the net surplus per consumer, W, one has to regard the gains from trade $p_m - c$, which occur with probability $1 - \pi(p_m)$, and the total information costs $w \cdot Z(p_m)$:

$$W = p_m - c - w - w\ln(p_m - c) + w\ln w \tag{5}$$

It is easy to see that the market equilibrium maximises W: Assume that an additional advertisement is sent. This will be welfare increasing if an uninformed customer is reached—which happens with probability $\pi(p_m) = w/(p - c)$. Hence, expected gains of an additional advertisement are $(p - c)[w/(p - c)]$ and equal its social unit cost in w.

4 The (in-)efficiency of spam mailing

I do now consider the case where reading costs exist. Assume that every consumer has to bear a unit reading cost w_L when he receives an advertisement, no matter whether he will accept this price offer or not. However, sellers ignore this reading cost when they decide on their advertising strategy. As a consequence, they send too many ads: The lower bound of the advertising price distribution lies at $c + w_H$, whereas a lower bound of $c + w = c + w_H + w_L$ would be socially efficient. Hence, the total amount of advertising $Z^*(p_m) = \ln(p_m - c) - \ln w_H$ exceeds the efficient value $\hat{Z}(p_m) = \ln(p_m - c) - \ln(w_H + w_L)$. Thus, the equilibrium surplus is given by

$$W^* = p_m - c - w_H - (w_H + w_L)\ln[(p_m - c)/w_H] \tag{6}$$

From (5) we can derive the welfare maximum by replacing w with $w_L + w_H$:

$$\hat{W} = p_m - c - w_H - w_L - (w_H + w_L)\ln[(p_m - c)/(w_H + w_L)] \tag{7}$$

The welfare loss due to the reading cost externality is given by $\Delta W = \hat{W} - W^*$:

$$\Delta W = (w_H + w_L)\ln[(w_H + w_L)/w_H] - w_L \tag{8}$$

Note that this welfare loss can be approximated by a simple Taylor expansion:[4] [5]

$$0 \leq \Delta W \leq w_L^2/w_H \tag{9}$$

Whereas the welfare loss from excessive advertising does not depend on the potential gains from trade, the relation between the unit information cost w_H and the unit reading cost w_L is crucial.[6] As soon as the reading costs account for a larger portion of total advertising costs, this leads to an increase of the welfare loss. On this account, the welfare loss by "spam" advertising has risen after new information

[4]From standard textbook mathematics, it follows that $\ln[(x+y)/y] \leq x/y$ and $\ln[(x+y)/y] \geq x/(x+y)$ generally holds for any $x, y > 0$

[5]I use the Taylor approximation here because the resulting formula is more "eye catching". However, the main results of this section will remain unchanged, regardless whether the Taylor approximation is used or not.

[6]This proposition is affirmed by the derivatives of ΔW with respect to w_H and w_L: The results are $\partial \Delta W/\partial w_L = \ln(w_H + w_L) > 0$ and $\partial \Delta W/\partial w_H = \ln[(w_H + w_L)/w_H] - w_L/w_H < 0$.

technology had been introduced: While the cost of "reading" an advertisement has roughly stayed the same, unit information cost has declined dramatically with the emergence of electronic mailing. Nowadays, spammers who send electronc bulk mail bear less than 5% of the social costs of advertising.[7] As a consequence, electronic bulk mailing has increased dramatically. As Lueg (2003) emphasizes, an average customer received some 1400 electronic junk mail messages ("spam") in the year 2003. In total, spam is estimated to cause damages of some 3 billion EUR p. a. in Europe and 8 billion EUR in the U. S. The policy implication is to ban electronic junk mailing since there exists a more efficient way of informing the customers about products. This will be shown in the next section.

5 The (in-)efficiency of portal advertising

Consider now the third scenario: Advertisements are not sent from producers, but are placed on internet portals. Internet users—that is the customers—are assumed to choose one portal each, to read its advertising and to benefit from editorial content. There may be a benefit from the advertising information, if reading the ad leads to a purchase. As in the case of direct advertising, I assume that the advertising information is transmitted to the customers by incidence. This will be the case when we assume that visitors surfing a portal (e. g., Yahoo), read different pages and ads that are installed on these pages, and they do not know which advertisement is placed on which site, before reading the sites. In their portal choice, consumers behave perfectly rationally: They regard the disutility of reading the ads as well as the expected surplus from a potential purchase.

[7]Cranor and La Macchina (1998, p. 75 et seq.) stress that "[s]ome bulk email services will send 100,000 email messages for under $ 200, and do-it yourselfers can buy a million email addresses for under $ 100". In contrast, reading or deleating as many junk massages is adherent to an opportunity cost of roughly estimated 4000 USD. Bandwidth and processing costs are incurred even when spam filtering programs are used (see Weinstein, 2003).

5.1 Model assumptions

To be more specific, I assume a three stage model for portal advertising: In the first stage, internet portals I set their ad-rates w_I. The ad-rate indicates the price the advertiser has to pay each time a consumer visits the page containing the recpective advertisement.[8] In the second stage, the firms decide on their advertising strategy, that is, they decide on where to place the ad and what prices to announce. In the last stage, consumers choose one portal, each.

To keep calculations simple, I assume perfect competition between two internet portals.[9] That is, they provide the same editorial content r (e. g. news, stories and hyperlinks), and the expected consumer surplus depends on both, the pleasure of reading the editorial content $v(r)$ and the customer's net expected benefit of advertising q_I:

$$U_I = q_I(w_I, w_L, p_m - c) + v(r) \tag{10}$$

While $v(r)$ is fixed in the context of this model[10], the portals implicitly decide on q_I when they set the advertisement prices w_I. One should note that this additional information rent q_I a consumer receives by visiting a portal and reading the ads, is similar to what I have called the "net surplus per consumer" in the basic model described in the preceding sections. While in the basic case, the net consumer surplus is equivalent to total welfare (because firms just earn zero profits), gains from trade are now shared by customers and internet portals. To calculate the correct value of q_I, one has to bear in mind that the producers are charged w_I for portal advertisements, and not the actual unit information cost w_H. They internalise this ad-rate w_I when calculating a price offer. As a consequence, q_I yields

$$q_I = p_m - c - w_I - (w_I + w_L)\ln[(p_m - c)/w_I] \tag{11}$$

The profit of an internet portal depends on its market share (i. e. the number of customers $x(q_I)$ visiting that portal), the amount of advertising per consumer which

[8]In reality, this is the most common buying model—however, the ad-rate is expressed by the "CPM", i. e. the cost of 1000 ad impressions.

[9]This is the most simple way to model perfect competition between internet portals.

[10]Still, it might be interesting to look at the portals' decision on r in an extended version of the model.

is given by the advertising distribution function $Z(p_m) = \ln[(p_m - c)/w_I]$ (please notice the analogy to the basic model), and the mark up on the unit information cost of advertising $w_I - w_H$. As I have mentioned in section two, I will assume that unit information costs w_H are negligible (i. e., close to zero) compared to the unit reading cost w_L, due to technology issues—however, in order to receive more general insights, I will consider w_H in the calculations. In addition, the fixed cost r for providing editorial content might be taken into consideration. However, r will be ignored within the further analysis, since it is assumed to be a sunk cost. Hence, the profit of an internet portal I can be written as

$$G_I = x_I(q_I)(w_I - w_H)\ln[(p_m - c)/w_I] \tag{12}$$

With this information on the consumers' and the internet portals' payoff functions, I am now in the position to calculate the subgame perfect equilibrium of the market outcome.

5.2 The market equilibrium

The market equilibrium is solved by backward induction. In the last step, customers decide on which portal to visit. Since both portals offer the same editorial content, they select the internet portal that offers a higher expected information rent q_I to their visitors. If both portals offer the same q_I, customers select one portal at random. Note that q_I depends on the amount of advertising, represented by the advertising price distribution, on the respective internet portal: If there was no advertising on that portal, a visitor could not gain from any additional trade. On the other hand, an internet portal full of advertising would be tedious to read, with reading costs that might well exceed the expected gains from trade.

Hence, the sellers' advertising policies, which is the second stage decision, seems to be crucial for the success of an internet portal. However, the average number of ads that a consumer will find on his preferred portal, is a result of the advertisement price w_I a portal charges to the producers. Since producers do not possess any market power, they just adapt their advertising policy to the market conditions, that is the portals' advertising prices. Please note that not all producers turn away from a portal that charges a higher unit ad-rate w_I, because an advertisement succeeds with a higher probability, there, due to a smaller amount of advertising (and less advertising of the competitors) on that portal. To conclude, the second stage advertising decision of the producers is predetermined by the the first stage decision of the internet portals on ad-rates w_I.

In general, players aim to maximize their own objective funtion. Take a look at the objective function of an internet portal (see equation 12): Its value depends on the number of visitors and the mark up on the unit information cost. It is important to know that the number of visitors is not a continous function. As explained in the discussion of the last step, consumers select the portal that offers the highest expected net utility. Hence, the portal operators engage in a Bertrand-like competition for customers. As a result, they adopt the objective of the consumers in order to maximize the customers expected net utility q_I. Note that both portals will set the same ad-rate because they maximize the same objective function (the one of the consumers).

Doing this, they face two constraints: Firstly, the ad-rate w_I has to cover the unit information cost w_H (otherwise it would cause losses for the internet portals offering advertising; I will call this the "zero profit constraint"). Secondly, advertising has to generate a positive surplus for visitors reading the ads. Else, the customers would select a portal that does not provide any advertising, and a portal may attract all customers by providing only little or no advertising (this I will call the "consumer participation constraint"). If this condition is not fulfilled, there always exists a Nash equilibrium in which both portals do not provide any advertisements.[11]

Taking this into consideration, we receive the following maximization problem:

$$\begin{aligned} \max_{w_I} q_I &= p_m - c - w_I - (w_I + w_L)\ln[(p_m - c)/w_I] \quad (13) \\ \text{s. t.} \quad & w_I^* \geq w_H \\ & q_I^* \geq 0 \end{aligned}$$

[11]However, this may not be the unique equilibrium, as will be stated below.

Now, consider the unrestricted solution w_I^* to this maximization problem. It is given implicitly by the first order condition

$$\frac{w_L}{w_I^*} - \ln \frac{p_M - c}{w_I^*} = 0. \tag{14}$$

Unfortunately, it is not possible to present an explicit solution for w_I^*. However, equation (14) can be simplified by expressing $p_m - c$ as a multiple k of the reading cost w_L, i. e. k is defined as $(p_m - c)/w_L$. In other words, I treat the unit reading cost w_L as a numeraire. This procedure is reasonable, because the reading cost is unlikely to be affected from technology change. It is then possible to implicitly determine the relative ad-rate w_I^*/w_L:

$$\frac{w_L}{w_I^*} - \ln \frac{w_L}{w_I^*} = \ln k \tag{15}$$

As can be seen easily, the equilibrium value w_I is only influenced by the potential gross gains from trade in terms of reading cost kw_L, and the reading cost w_L. Obviously, the minimum value of the left hand side of this equation is 1. This value is received for $w_L = w_H$, i. e. when the equilibrium ad-rate equals the reading cost. As a consequence, for any spread $p_m - c \leq ew_L$, no interior solution exists and zero advertising maximizes q_I. For the border case $p_m - c = ew_L$, a solution exists where the internet portals charge an ad-rate w_I equal to the reading cost w_L. For higher values of k, there are two relations w_L/w_I solving the first order condition. However, the second order condition holds only for the case that the reading cost exceeds the ad-rate, that is $w_I^* < w_L$. The other solution for the first order condition $w_I^* > w_L$ marks the minimum value of the objective function.

Until now, the two constraints $w_I^* \geq w_H$ and $q_I^* \geq 0$ have been neglegted. Take a look at the consumer participation constraint, first: Intuitively, this constraint is violated when the gross potential benefit from reading an ad is small in comparison to the reading cost w_L.[12] Indeed, reading will be profitable if potential gains from trade are large compared to the reading costs. As mentioned above, this relative

[12] For example, consider the case where $p_m - c = w_L$: Even if the product was offered at a low price close to c, the customer would harm from reading one ad, and his utility will be reduced further, when he has to read more than one advertisement.

benefit is denoted by k. Now, define $\bar{k}$ such that $q_i(\bar{k}) = 0$. Using equation (11) and (14) and the definition for k, $\bar{k}$ is implicitly given by

$$\frac{w_L}{w_I^*} - \ln\left(1 + \frac{w_L}{w_I^*} + \frac{w_L^2}{(w_I^*)^2}\right) = 0 \tag{16}$$

$$1 + \frac{w_I^*}{w_L} + \frac{w_L}{w_I^*} = \bar{k} \tag{17}$$

This equation system can be solved numerically.[13] As result, $\bar{k} = 3,35$, that is, the potential gains from trade have to be three times higher than the reading cost of an advertisement in order to generate a positive surplus of advertising. At this value of k, the portals charge an ad-rate $w_I^* = 0,56 w_L$. At first sight, it seems astonishing that gains from trade have to significantly exceed reading costs of an ad. However, notice that it cannot be assured that every consumer receives exactly one ad; actually, due to the distribution of ads at random, several portal visitors will suffer from reading more than one advertisement, while others do not receive any advertising information.

Assume that the consumer participation constraint is violated. The consequences should be mentioned in passing. Note that the interior solution w_I^*/w_L indicates an interior solution (that is a local maximum) to the customer's maximization problem. Hence, a marginal deviation from this ad-rate will not lead to an increase of the consumer's net expected utility, and a portal is not able to attract additional consumers by changing its ad-rate marginally. However, if $q_I^* < 0$, there will exist a $w_I^{**} > w_I^*$ such that $q_I^* < q_I^{**} < 0$, that is, a portal that deviates in a discrete way from strategy w_I^* will attract all customers of the economy. The discrete increase of the ad-rate will also lead to a significant decline of advertisement on this portal. Hence, the portal's profit does not increase necessarily by deviation, although the number of its visitors reduplicates.[14]

[13]Notice that two equations are sufficient to solve the system, since $\bar{k}$ depends on the relative ad-rate w_I/w_L, and not on the absolute values w_H and w_L.

[14]It depends on k, whether deviation is profitable: For $k > 3,06$, the deviation strategy is not attractive for a portal operator, because advertising has to be constricted too much in order to raise the customers net expected utility beyond q_I^*. Hence, two pure strategy equilibria exist: The well-established, in which both portals set $w_I = w_I^*$, and a second one, in which both portals

Note that the second constraint, namely the zero profit constraint, is not binding: As internet portals use electronic communication technology to distribute the advertisement, unit information cost w_H is (close to) zero and negligible compared to the reading cost of an advertisement, i. e. $w_H << w_L$. As a consequence, portals will earn positive (per consumer) profits $(w_I - w_H)\ln[(p_m - c)/w_I]$ from the advertisements they distribute, as long as w_I is strictly positive. Since both portals offer the same ad-rates, they share the market for advertising and for portal visiting equally.

5.3 Welfare analysis

In order to calculate the net benefit from portal advertising W_I, consider the total amount of portal advertising $Z_I^*(p_m) = \ln(p_m - c) - \ln w_I$ which determines the probability of trade to occur, and the unit cost of advertisement, $w = w_H + w_L$. Hence, the equilibrium net benefit from portal advertising can be written as:

$$W_I^* = p_m - c - w_I - (w_H + w_L)\ln[(p_m - c)/w_I] \tag{18}$$

In order to obtain the welfare loss of portal advertising $\Delta W_I = \hat{W} - W_I$, the equilibrium value is compared to the efficient solution (see equation 7):

$$\Delta W_I = (w_H + w_L)\ln(w_H + w_L) - (w_H + w_L)\ln w_I - (w_H + w_L) + w_I \tag{19}$$

In a further step, $w_H + w_L$ is replaced by $(w - w_I) + w_I$. It is then straightforward to estimate the welfare loss by a Taylor-approximation similar to equation (8):

$$0 \leq \Delta W_I \leq (w - w_I)^2/w_I \tag{20}$$

In the last section, I have pointed out that w_H is close to zero and the reading cost w_L is accountable for the bulk of total unit advertisement cost. Keeping this in mind, it is straightforward argumentation that the welfare loss is reduced by portal advertising—to see this, replace w by w_L and compare the Taylor-approximation (20) with equation (8).[15]

provide no advertising, that is, $w_I = kw_L$. If $k < 3,06$, only the latter exists. Notice that the value of k has been found numerically.

[15] A higher welfare loss due to portal advertising (compared to direct mailing) can be ruled out even for a positive unit information cost w_H: As can be seen by direct inspection, $\Delta W_I < \Delta W$ iff

A formal proof results by comparing the exact values of total welfare (18) to (6). From (18) – (6) yields the efficiency gain ΔW_{IE}, that is realised by the switch from direct mailing to portal advertising, as

$$\begin{aligned} \Delta W_{IE} &= W_I^* - W_E^* \\ &= w_H - w_I - w \ln w_H + w \ln w_I \end{aligned} \quad (21)$$

After transforming this expression, one receives:

$$\Delta W_{IE} = w \ln[w_I/w_H] - w[(w_I - w_H)/(w_I + w_H)] \quad (22)$$

Now denote $w_D = w_I - w_H > 0$ the always positive difference between the ad-rate and the unit information cost. Then for the logarithm term of equation (22) holds: $\ln(w_I/w_H) \geq w_D/(w_D - w_H)$. Further it applies that: $w_D/(w_D - w_H) > w_D/(w_D - 2w_H)$ and $w_D/(w_D - 2w_H) = (w_I - w_H)/(w_I + w_H)$. Thus $\Delta W_{IE} > 0$.

5.4 Stylized results

I am now in the position to summarize the results of the portal model and compare them to the results received for spam mailing:

(i) When setting the ad-rate, internet portals consider the reading costs of their visitors and so internalise them partialy. Thus portals set an ad-rate w_I higher than the zero unit information cost w_H and earn positive profits. Note that this result can only be applied to advertising intermediaries that use modern information technology. Else, w_H may well be high enough to be a lower bound for w_I (otherwise the zero profit constraint would be violated).

(ii) Although reading costs are partially internalised by the portals, the market equilibrium is not efficient, since we observe too much advertising: As has been shown, $w_I < w_L$. Thus advertising is still too cheap, because the ad-rate is lower than the social cost of an advertisement. Why do portals not internalise the complete

$w_I > w_H$. $w_I < w_H$ would hurt the zero profit constraint of the information intermediaries. Note that it makes no difference, whether to use the approximated or the exact values.

reading costs of their customers, although they aim to maximize their objective function? Note that there is no market interaction between the portals and their visitors, that is, the portal operators are not able to pay the customers for visiting their homepage. Actually, when setting their ad-rate w_I, they decide implicitely on both, the total welfare (i. e. the net gains from trade) and the distribution of that gains among the customers and themselves. And a higher ad-rate w_I means that the portals receive a larger part of the welfare gains, while customers lose due to higher product prices. To avoid this, the portals reduce the ad rate w_I beneath the welfare maximizing value w_L.

(iii) Still, the outcome is more efficient than in the case of spam mailing, because spammers do not internalise reading costs at all. In case of spam mailing, the welfare loss of reading costs may exceed the potential gains from trade. Internet portals, instead, will only engage in advertising when positive welfare effects are guaranteed.

6 Concluding remarks

I have shown that electronic junk mailing is a rather inefficient way to communicate product information to the customers, while portal advertising provides a more efficient alternative. Given the unique result I have received for "spam"-mailing, the lesson for public authorities should be clear: Junk mailing should be banned, as long as it is not possible to introduce a tax on spam advertising—a tax like this should cover the reading cost of some 3c per unit[16] advertisement.

Authorities may also think about introducing a (lower!) tax on portal advertising. Yet, market power will also prevent internet portals from charging too low ad-rates: Notice that the portals will charge higher rates for their advertisements in case of market power in order to keep a larger part of trade surplus. However, a strong monopoly may even charge ad-rates that exceed social costs. As a consequence, advertising activity may be inefficiently low. Whether market power of internet

[16] This crude estimation is based on the assumtion that it takes 10 seconds time to read an advertisement and that the opportunity cost of an average reader is roughly 10 EUR per hour.

portals works as an antidot to excessive advertising, should be an interesting topic for further research.

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