



The informativeness of on-line advertising

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ABSTRACT

Sending general advertisements with inflationary claims may attract additional visitors with whom an advertiser is poorly matched. This is costly when ads are priced per-click because many visitors (clickers) will not purchase. This renders per-click advertising particularly conducive to the transmission of information via ads. The admissibility of information transmission depends not only on advertiser behaviour, but also upon consumers' interpretation of and trust in ads. In less conducive environments, consumers quickly learn to place little stock in the claims they see advertised. This mechanism undermines the ability of advertisers and consumers to communicate under per-impression or per-sale fee structures. Consumers benefit from increased informativeness, but distortions introduced by the market power given to advertisers imply that society may be better-off with no information transmission taking place.

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1. Introduction

I investigate the role played by the prevailing fee structure in determining whether advertisers and consumers are able to communicate and the extent to which information about products can be transmitted via advertisements. At the core of these results is the following simple idea: a per-click advertising fee can serve as a disincentive to sending uninformative advertisements of general appeal by making it costly for an advertiser to attract visits from consumers with whom it is poorly matched. By contrast, since a sale to a poorly matched consumer is as good as one to anyone else, firms that pay for ads on a per-sale basis have an incentive to attract a visit from any consumer that will purchase with positive probability. Likewise, once a consumer is shown an ad, the cost of that impression is sunk and firms that pay per-impression are incentivised to attract any consumer with some positive probability of purchase. This incentive causes advertiser–consumer communication to break down and undermines the existence of fully-informative equilibria. The usefulness of advertisements is then reduced and consumer welfare is harmed. However, for some specifications of search costs, reduced ad information content is beneficial for publishers and society as a whole.

The unique capacity of Internet publishers to monitor and track users' activity has given rise to a number of novel structures for the

pricing of advertisement facilities. My focus here will be on three fee structures in particular:

1. Pay-per-click (PPC): Advertisers pay each time a consumer clicks on their ad.
2. Pay-per-impression (PPI): Advertisers are charged each time their ad is shown to a consumer, regardless of whether that consumer takes any further action.
3. Pay-per-sale (PPS): An advertiser must pay for each consumer that clicks on its advertisement and subsequently makes a purchase.

As of 2010, PPI pricing accounted for around 35% of online ad spending, with performance-based pricing (which encompasses PPC and PPS) accounting for a further 61%.¹

Enforcement of honest advertiser behaviour becomes more complicated on the Internet, where a multitude of publishers broadcast advertisements that transcend jurisdictions. Large publishers may intervene to prevent abuse of their advertising resource, but the large and shifting volumes of advertisements handled by major publishers makes perfect enforcement impractical. Small, independent publishers are much less likely to have the resources or inclination to police their advertisers. Moreover, because both the size and types of audience delivered depend upon consumers' interpretation of ads in a non-trivial fashion, it is not a priori clear whether publishers benefit from more informative ads at all.

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¹ IAB Internet Advertising Revenue Report 2010 First Half-Year Results; available at http://www.iab.net/insights_research/947883/adrevenue-report (accessed 4th Feb 2011).

Arguably, the most effective check on deceptive advertiser behaviour is the consumers themselves. Consumers that view many advertisements each day and are media literate are likely to be intrinsically aware of the appropriate degree of trust associated with the messages contained therein. That is to say, rational consumers cannot be systematically deceived: when the environment is one that is not conducive to honest reporting, consumers are likely to place little stock in the claims that they see advertised. The result is that meaningful communication between advertiser and consumer becomes difficult in such environments. It is this equilibrium intuition that rests at the heart of the present paper.

Although the focus of this paper is on-line advertising, the work is of broader interest insofar as the above fee structures (or their analogues) are used in traditional media advertising. More broadly, other pseudo-advertising environments such as price comparison sites often use a fee structure that occupies one or more of the above categories. For example, the fee structure at *shopper.com* is a combination of per-impression and per-click pricing, and *Baye et al., (2004)* report the efficacy of a per-click fee in enforcing honest reporting (of prices) there. On-line auction platform *eBay*, whose fee structure most resembles a hybrid fixed fee/PPS arrangement, often hosts listings in which extraneous terms are appended to the title—evidently in the hope of capturing the interest of consumers shopping for substitute goods, and in obvious ignorance of the effect that such behaviour has on the overall usefulness of the search tool. Similar incentive structures also seem likely to be active in other areas of economic activity. For example, a firm that pays its sales force on a salary or commission basis is likely to encourage those salespeople to aggressively pursue leads, whilst a sales team paid per-lead is more likely to be discouraged from wasting time with clients that seem unlikely to buy. These factors may, in turn, influence a consumer's willingness to indulge a salesperson's approach.

Nelson (1974) pioneered the study of the informational role of advertising—notably with the idea that the very existence of an advertisement may be informative. *Nelson* also acknowledged that advertisements may not always be honest. In the tradition of *Nelson, Chen and He (2006)* study the implicit information content of ads. They consider bidding in position auctions, which are used to allocate sponsored search advertisements at search engines such as Google. Each firm has some probability of matching with an arbitrary consumer. Since firms that match more often value clicks more highly, consumers are able to make inferences about advertisers' match probabilities based upon the observed ordering of advertisements within a list and knowledge of advertisers' bidding strategies. In contrast to these papers, my focus is on the *explicit* information content of advertising messages, and I show that PPC environments can enable substantial additional information transmission over and above that implicitly revealed by the allocation of ads alone.

The literature has also treated the case in which advertisements are explicitly informative. *Anderson and Renault (2006)*, *Grossman and Shapiro (1984)*, and *Meurer and Stahl (1994)* are examples of papers of this kind. In contrast to the model below, all of these papers share the assumption that any informational content of an ad must be non-deceptive.

There is a small but growing literature on the efficacy of various advertising fee structures in on-line advertising—with the primary focus having been on vertically differentiated products. *Dellarocas and Viswanathan (2008)* show that pay for performance fee structures tend to favour low quality firms and yield lower surpluses for all. *Sundararajan (2003)* shows that performance-based pricing of digital marketing cannot screen out low quality advertisers. *Agarwal et al. (2009)* develop a model to explore the problem of a publisher that must aggregate bids across multiple actions in a pay-per-action environment.

More closely related to this paper, *Athey and Ellison (2011)* find that pay-per-click position auctions are less conducive to the obfuscation of advertisements than are pay-per-action auctions in a model of sponsored search advertising with firms that have some

idiosyncratic probability of satisfying a given consumer. In contrast to *Athey and Ellison's* model, I model advertisements as cheap talk messages and explicitly examine the effect of fee regime choice on consumers' equilibrium beliefs. The degree of sustainable communication—which depends on both the firms' willingness to talk and the consumers' willingness to listen—grows out of this framework as a major theme of this paper. This framework is useful for understanding when information transmission can be sustained under PPI and PPS fee regimes (*Athey and Ellison's* model always implies zero information transmission in pay-per-action environments). My paper is also distinct from *Athey and Ellison (2011)* in modelling PPI regimes (which account for more than a third of on-line ad spending), and considering the effect of pay-per-sale on the pricing of final goods—which I demonstrate to have important welfare implications.

Zhu and Wilbur (2011) model a platform that offers hybrid auctions in which advertisers can choose to pay either per-impression or per-click. Sellers who advertise for the purpose of brand exposure (rather than to directly make sales) have an incentive to exert low effort in attracting clicks and select a PPC payment scheme in order to advertise their brand at little or no cost. The authors show that there exist rational expectations for the publisher that ensure that no advertiser can profit from such behaviour. Unlike *Zhu and Wilbur (2011)*, I make consumer behaviour endogenous and examine the way that consumers respond to explicitly informative ad messages. Moreover, I explore the effect of consumer beliefs on firms' ability to influence their own click through rate. Thus, *Zhu and Wilbur (2011)* model whether firms do or do not wish to attract clicks, whereas my work is concerned with whether they can or cannot. I show that it is precisely when advertisers wish to inflate their own click-through rate that they are most unable to do so because consumers anticipate this adverse incentive and adjust their response to ad messages accordingly. This line of reasoning sheds new light on the extent of sustainable advertiser-consumer communication, and also admits a discussion of welfare.

Wilbur and Zhu (2009) consider the problem of click-fraud, that is to say of non-consumers strategically clicking on ads that are priced per-click either to drive rival advertisers out of the market or to inflate publisher revenues. In contrast, I model an increase in an advertiser's unmatched consumer clicks that it either brings upon itself by changing the information content of its advertisement, or else incurs as an endogenous consequence of consumers' inability to extract useful information from the ad. *Wilbur and Zhu (2009)* do not consider explicitly informative ads, and considerations of consumer-firm communication that are the main focus of the present paper are therefore absent.

Lastly, in a related literature, *Ellison and Ellison (2009)*, *Ellison and Wolitzky (2008)*, and *Wilson (2010)* discuss firms' general incentive to obfuscate consumer search in order to weaken price competition.

2. Model

The idea here is to build a simple model whilst capturing the key stages of on-line product search: (i) visiting a website or submitting a query to a search provider, (ii) finding an advertisement there—typically consisting of a short description—from which an initial assessment of relevance must be formulated, (iii) visiting a relevant link in order to obtain more detailed information, and (iv) (potentially) making a purchase.

There are n firms that produce (at zero cost) a subset of the set of available goods, $\{A, B\}$. In particular, let $\theta_j \in \{\{A\}, \{A, B\}\}$ denote the (privately known) set of goods sold by firm j . Thus, there are single-product firms that stock only a mainstream good, A , and larger multi-product firms that offer, in addition to A , a long-tail or niche good, B .²

² In Section 7, I extend the type space to allow type B single-product firms.

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