



# Commercial software, adware, and consumer privacy<sup>☆</sup>



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## ABSTRACT

I study the choice between selling new software commercially and bundling it with ads and distributing it for free as adware. Adware allows advertisers to send targeted information to consumers which improves their purchasing decisions, but also entails a loss of privacy. I show that adware is more profitable when the perceived quality of the software is relatively low, when tracking technology improves, when consumers benefit more from information on consumer products and are less likely to receive it from external sources. I also show that improvements in the technology of display ads will lead to less violation of privacy and will benefit consumers, that depending on the software's quality, there are either too many or too few display ads in equilibrium, and that from a social perspective, adware dominates commercial software.

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## 1. Introduction

Until the end of the 1990's, most commercial software was sold to users in retail stores. By the end of the 1990's, software providers began to distribute their software online. While many software providers require users to pay for the software after a trial period, others distribute their software for free as an adware and collect fees from advertisers, who use the software to track the behavior of the users and send them targeted ads about their products.<sup>1</sup> This paper studies the choice between selling the software commercially and distributing it as an adware in the context of a model that explicitly accounts for the strategic interaction between software providers, firms that sell consumer products and may advertise them online, and consumers who buy software and products.

The model considers a software provider who has developed a new software and needs to decide how to distribute it. The software provider

faces consumers who differ in their preferences over products, but do not necessarily know at the outset which firm sells which product. Display ads (e.g., banner ads, pop-up ads, floating ads, flash ads) allow firms to send consumers targeted information about products that match their tastes. At the same time, adware raises privacy concerns among consumers, privacy advocates, government protection agencies, and media and marketing associations (see [Department of Commerce Internet Policy Task Force, 2010](#); [FTC, 2012](#)). Definitions of privacy vary widely according to context and environment. [Posner \(1981\)](#) discusses several possible definitions, including the “concealment of information,” “peace and quiet,” and “freedom and autonomy.” In this paper I consider the second definition, namely privacy as the right for “peace and quiet.” This right is a main reason behind the “do-not-call list” that is enforced in the U.S. by the FTC and FCC, and is intended to prevent telemarketers from violating consumers' privacy at home.<sup>2</sup> The desire of consumers for “peace and quiet” is captured in my model by assuming that, in addition to potentially useful information about consumer products, adware

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<sup>1</sup> This paper considers only “legitimate” ad-supported software which is installed with the end-user consent. I do not consider “spyware” which is often installed without the end-user consent and tracks and collects personal information without consent. For a discussion on the early history of adware, see for example [Stern \(2004\)](#).

<sup>2</sup> In a decision from February 17, 2004, the U.S. Court of Appeals for the Tenth Circuit held that “the do-not-call registry” targets speech that invades the privacy of the home, a personal sanctuary that enjoys a unique status in our constitutional jurisprudence (*Mainstream Marketing Services, Inc., TMG Marketing Inc., and American Teleservices Association v. Federal Trade Commission, et al.*, U.S. Court of Appeals for the 10th Circuit, No. 03-1429, and consolidated cases). Likewise, in *Frisby v. Schultz*, 487 U.S. 474, 484 (1988), the Supreme Court of the U.S. held that “One important aspect of residential privacy is protection of the unwilling listener. ... [A] special benefit of the privacy all citizens enjoy within their own walls, which the State may legislate to protect, is an ability to avoid intrusions. Thus, we have repeatedly held that individuals are not required to welcome unwanted speech into their own homes and that the government may protect this freedom.” And, in *FCC v. Pacifica Found.*, 438 U.S. 726, 748 (1978) the Supreme Court of the U.S. held that “[I]n the privacy of the home ... the individuals right to be left alone plainly outweighs the First Amendment rights of an intruder.”

users also get a disutility from display ads. Adware users then face a trade-off between the utility from using the software and the beneficial information they get about consumer products and the disutility from privacy loss. In equilibrium, consumers with large privacy concerns do not adopt the adware, while those with relatively small privacy concerns do. The number of adopters in turn determines the willingness of firms to pay for display ads and hence the profit from distributing the software as an adware.

I show that in equilibrium, the software will be distributed as an adware provided that its perceived quality is relatively low. When the perceived quality of the software is relatively high, it is more profitable to sell it commercially. This pattern is consistent with the experience of several popular software that were first distributed as adware, but then, newer and improved versions were distributed commercially.<sup>3</sup>

The fast technological improvements in context-based advertising have raised concerns about the increasing loss of privacy on the Internet.<sup>4</sup> In my model, such improvements affect both consumers' privacy, as well as their information on consumers' products. I show that such improvements induce the software provider to distribute the software as adware for a wider set of parameters. Hence, consumers with large privacy concerns may be worse off since in order to obtain the software, they are also forced to receive display ads which lower their utility. Yet, the analysis shows that on aggregate, the benefit to consumers from improved information on consumer goods outweighs the associated loss of privacy.

I also show that the software provider chooses to distribute the software as adware for a larger set of parameters when consumers benefit more from information on consumer products that they receive via display ads and when there is a smaller probability of learning about such products from external sources. In addition, I show that the price of display ads can be too high or too low relative to the social optimum, depending on the software's quality, and that from a social perspective, adware dominates commercial software. Not surprisingly then, the paper implies that a ban on ad-supported software or mandatory "Do Not Track" mechanisms that allow consumers to opt out of tracking by advertisers may harm consumers by inducing the software provider to switch from adware to commercial software.

This paper contributes to the small but growing literature on the economics of privacy (see Hui and Png, 2006, for a literature survey). Several papers in this literature equate the loss of privacy with the disclosure of information on the consumers' preferences. Such information allows firms to use personalized prices that extract more consumer surplus when firms have market power (e.g., Acquisti and Varian, 2005; Calzolari and Pavan, 2006; Conitzer et al., 2012; Taylor, 2004; Wathieu, 2002), or it can serve as a screening device to ration consumers when firms operate in a competitive market (Burke et al., 2012).<sup>5</sup> But as Varian (1996) points out, when firms learn information about consumers' preferences, they can also offer them products that better meet their

needs and thereby lower their search costs. Hence, disclosure of information on consumers' preferences involves a trade-off between a reduction of search costs and extraction of consumers' surplus. A different approach to consumers' loss of privacy is taken by Hann et al. (2008) and by Anderson and Gans (2011). Both papers consider a game in which firms send costly ads (or solicitations) to consumers who differ in their willingness to pay (WTP) for products, while consumers invest in ad avoidance.<sup>6</sup> They show that since low WTP consumers will avoid ads, ads become more cost effective and hence encourage firms to send more of them. They also show that ad avoidance can be welfare decreasing. My paper differs from the papers mentioned here since I abstract from the effect of information on consumer preferences on the prices of consumer products, and focus instead on the software provider's choice between commercial software and adware, and the resulting implications for consumers due to the effect on their purchasing decisions and on their loss of privacy.

Hann et al. (2007) empirically examine individuals' trade-offs between the benefits and costs of providing personal information to websites. They find that the benefits in terms of monetary rewards and future convenience significantly affect individuals' preferences over websites with differing privacy policies. Among U.S. subjects, protection against errors, improper access, and secondary use of personal information is worth \$30.49 – \$44.62, while among Singapore subjects, it is worth \$57.11.

Although my model considers the market for software, it can also be applicable to media markets (though in the software market it is generally easier to track the behavior of individual users and send them targeted ads).<sup>7</sup> In this context, my model suggests that ad-supported distribution of content (pure advertising) is more profitable than selling content for a fee (ad-free pay-per-view) when the contents' quality is low, and ad-free pay-per-view is more profitable when quality is sufficiently high. Moreover, my model suggests that pure advertising yields higher social surplus than ad-free pay-per-view and that consumers are better-off under pure advertising when quality is low and vice versa when quality is high. The last result seems at odds with Hansen and Kyhl (2001), who find that consumers are always better-off under pure advertising than under pay-per-view. However, unlike in my model, pay-per-view in their model is not ad-free, and in addition, they do not consider the beneficial effect of ads on consumers' choice of products. In addition, unlike in my paper, they do not consider the content providers' endogenous choice between pay-per-view and pure advertising.<sup>8</sup> Peitz and Valletti (2008) consider competition between two media platforms and show that under pure advertising, content is less differentiated than under pay-TV (where media platforms earn both advertising revenues as well as revenues from viewers), and moreover there is a higher advertising intensity if viewers strongly dislike advertising.

The rest of the paper is organized as follows: Section 2 presents the model. Section 3 characterizes the equilibrium when there is a single software provider who needs to choose whether to sell the new software commercially or distribute it for free as an adware and then make money by selling ads. Section 4 offers some comparative statics and Section 5 considers the policy implications of the model. Concluding remarks are in Section 6.

<sup>3</sup> Cases in point are Gozilla and GetRight which are two of the most popular download managers. For instance, on <http://www.gozilla.com/> (visited on March 1, 2012), they write "Under previous owners, Go!Zilla had included AdWare and bundled various other software programs in its installer. That is all gone now. We will do better. As of version 5.0, Go!Zilla will contain no bundled advertising software and 'extras' in its installer." Likewise, the "A History of GetRight®" page ([http://www.getright.com/getright\\_history.html](http://www.getright.com/getright_history.html), visited on March 1, 2012) says: "For awhile there, before the technology bubble burst, the Advertising in software really looked like the way to go. ...But the whole concept of ads in a program—no matter how it was done—was deemed spyware, and we pulled the ads in the later 4.x versions."

<sup>4</sup> See for instance, McDonald and Cranor (2012) and White House (2012). See also "Consumers turn to do-not-track software to maintain privacy" by Byron Achold, USA Today, December 29, 2011, <http://usatoday30.usatoday.com/tech/news/story/2011-12-29/internet-privacy/52274608/1> for a recent news report on online tracking and anti tracking technologies.

<sup>5</sup> de Cornière and De Nijs (2012) study a related model in which firms choose prices before learning information on consumers. Once they are informed, firms participate in an auction for displaying ads. When firms condition their bids on consumers' characteristics, they expect their ads to reach only the consumers with a low price-elasticity of demand and hence they set higher prices ex ante.

<sup>6</sup> Johnson (forthcoming) also studies the strategic interaction between ad targeting by firms and ad avoidance by consumers.

<sup>7</sup> See Anderson and Gabszewicz (2006) for a survey of the literature on media and advertising and Anderson (2012) for a review and extension of the economics of advertising on the Internet.

<sup>8</sup> Prasad et al. (2003) study the choice of content provider between different combinations of ads and subscription fees in order to screen among a population of viewers with heterogeneous disutility from ads. They show that in general, the optimal strategy is to offer a menu with different combinations of subscription fee and ads.

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