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Disclosure-based price discrimination by information exchange platforms

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ABSTRACT

Consumers often face a trade off when considering whether to share more information with firms – for example, by letting an app access their list of contacts, location or browsing history. More precise information can help the sellers to make more targeted offers, and can yield multiple relevant offers and lower prices. However, information disclosure can entail costs via identity theft, fraud, extortion, etc. In this paper, we explore this trade-off in a model in which a monopoly platform can gather personal customer information, and offer it to other sellers. The consumers differ relatively to their aversion to information disclosure, and the platform can offer them menus with different disclosure levels. In equilibrium, options featuring greater disclosure levels command a premium, and information about the consumers choosing them is sold to the sellers at a lower price. If we compare scenarios with alternative menus, a greater number of options corresponds to a greater average disclosure level and a greater surplus. If the potential surplus from the induced exchanges is relatively large, equilibrium with a binary menu features levels of the platform's profit and the surplus close to those achieved with a continuum of offers.

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1. Introduction

1.1. Motivation and results

Consumers often face a trade off when considering whether to share information with firms – concerning for example their geographic location, gender, age, address and hobbies – when making purchases. Better information can help the sellers to make more targeted offers, and can yield offers from multiple firms and better prices. However, information disclosure can entail losses of different types. The mere awareness of information disclosure may cause discomfort, and giving details on purchases of embarrassing products or medical procedures may not only cause additional disutility but may have unintended consequences (Acquisti, 2010). Third parties may use sensitive information to identify vulnerable “trails,” either physical or virtual, and use them to carry out crimes, possibly in the form of identity theft (Anderson et al., 2008; IdentityTheft.com, 2013); these risks may be especially serious in the case of location-based services and other apps that broadcast very precise information about the user's physical location. Unsolicited recommendations may be “annoying” (Goldstein et al., 2014), and loading online advertisements and

their trackers can slow down sites navigation. Both the costs and the risks faced and the opportunities to avoid them can depend on personal characteristics such as education, occupation, wealth, and tech-savviness (Liao et al., 2011; Tucker, 2012).

In this paper, we explore the trade-off between the benefits and the losses from information disclosure in a model in which a platform offering a product (or service) can obtain personal information about its customers, and sell it to other producers. More refined information is a more effective facilitator of further exchanges – and thus entails a social benefit, potentially – and boosts competition among the sellers using it. However, the consumers also face an idiosyncratic, privately known nuisance from disclosure whose size is positively related to the amount of information disclosed. The platform can use menus with different combinations of disclosure levels and prices. We consider alternative scenarios in which the consumers face menus with one option, two options and a continuum of options, and focus the incentives for the platform to offer menus with more options and on market distortions.

We find that menus with a greater number of options are associated with higher average disclosure levels and greater levels of the surplus generated by the exchanges, net of the disclosure losses. The surplus- and profit-losses with a two option-menu are however small, at least if the potential surplus is large – in line with the findings of the literature on “small menus” (Bergemann et al., 2015; Wong, 2014) – and could be offset by the costs potentially associated with more complex contracts. The

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consumers choosing options with higher disclosure levels pay higher prices, whereas the sellers pay lower prices for the information gathered about them. If the platform can only partly appropriate the profits from the induced exchanges, the numerical results in Appendix A reveal that a lower proportional participation typically entails more differentiated disclosure levels, and that the average disclosure level can be non-monotonic.

The profit and surplus losses with fewer options are partly an expression of the Spence (1975) externality: as each option must exactly satisfy the participation constraint of the consumer choosing it who is most averse to disclosure, the equilibrium disclosure level or levels is/are typically too low. Moreover, greater disclosure levels boost the effects of the consumers' dispersed nuisance parameters, and make it more difficult for the platform to appropriate the consumers' gains from the induced exchanges. By contrast, lower disclosure levels can reduce competition and increase the profits of the sellers who purchase consumer information, which the platform can appropriate. Menus with a greater number of options improve the situation on both counts, by allowing the platform to offer better tailored options to different groups of consumers.

Our results reflect the fact that in the present model – unlike in the more traditional models of platforms linking monopolist sellers and consumers (Anderson and Gabszewicz, 2006) – a greater disutility for the consumers corresponds not only to a greater (expected) number of relevant offers, but also a greater probability of multiple, competing offers, with potentially unrestricted competition among the sellers. Hence, the model presented in the present paper can better account for cases in which fees, subscriptions or other forms of payment allow the consumers to obtain more qualified offers, rather than to avoid advertisements.

We relate our results to the contractual arrangements used by digital platforms which can gather information about their customers. Typically, these firms offer to the consumers multi-tier menus of service level and prices. In 2005, Amazon launched *Amazon Prime*, a premium service whose subscribers receive discounted offers on selected products, special delivery terms, and music and video streaming services. Since 2013, Google has offered *Google Express*, a premium shopping and delivery service mainly aimed at linking the consumers with local merchants. In both cases, service-specific apps are used as mobile interfaces. Google Express is viewed by many as a tool to solidify Google's position in the search engines market, particularly in the case of searches related to products and services. In a 2014 speech, Google's chairman Eric Schmidt explicitly stated that “our biggest search competitor is Amazon [...] if you are looking for something to buy, you are more often than not looking for it on Amazon” (Slate, 2014).

The information provided by the users' activities can easily be parsed together with other personal information, and can be used by these platforms to provide more valuable search results. Organic results are typically the main driver of web-traffic (Search Engine Watch, 2014). High quality organic links can however make sponsored links less appealing, and platforms funded by advertising can therefore deliberately suggest socially sub-optimal organic links (Burguet et al., 2015), also in the presence of competition between platforms (Taylor, 2013). Even the choice of the sponsored links proposed may be inefficient (de Cornière, 2016; Karle and Peitz, 2016), possibly even if a fee is charged to the consumers (Hagi and Jullien, 2011). The reputational incentive created by subscriptions can counter the effects leading to these distortions, and induce the platform to fully lever on the information available to recommend valuable organic links to their premium customers. As of 2016, Amazon Prime had over 66 million of US-based subscribers, corresponding to over half of the total number of users (Recode, 2017; Statista, 2016). These numbers, together with a double digit-growth rate and a renewal rate greater than

90% (Pymnts, 2016), testify the popularity of this bundle of services, and can motivate future empirical research on the performance of informational platforms for different balances of various sources of revenues. A model of information provision with subscriptions does have a counterpart in more traditional settings. For example, many supermarket chains offer membership cards, which allow them to acquire information about their customers and to propose special offers. Also, the readers in many magazine segments are willing to pay a premium for informative advertisements (Kaiser and Song, 2009).

In the equilibrium of our model, the sellers actually pay a (low) positive price even for the information related the consumers who choose to disclose more information. Organic results could however be incorporated in the model with relative ease – and with no substantial effects on the results, within limits. The possibility of manipulative information provision by the platform, as in the papers on seller-funded platforms cited above, could be explored in future research. The use of pricing models designed to elicit a substantial fraction of the revenues from the consumers could be facilitated by a shared measure of the consumers' gains. The lack of a counterpart to measures such as the number of contacts established, providing the basis for the price charged to the sellers in the “pay per click” format, could therefore be an obstacle, and the platform's reputation could be especially important for the consumers. A further obstacle, in the case of digital platforms, could be represented by the consumers' reluctance to pay for online services – which however is not a significant factor for all groups of consumers.

Other platforms could charge their users for disclosure. Sports and performing arts agents, relocation agents and head-hunters could also be able to gather a greater number of offers by disclosing additional information about the parties represented, and to charge their clients accordingly.¹ In cases such as location-based services, the disclosure fees may be incorporated in the price of add-ons providing enhanced tracking opportunities, such as bracelets and dedicated apps.

If we relate the consumer disutility to the costs of processing advertisements, the insights of the paper can also be relevant in the case of advertisements presented to non-premium users – representing over 95% of the users of services such as *Dropbox*, *Evernote* and *Google Drive* (Process.st., 2016). The revenues from these advertisements are threatened by ad-blockers, which may force the platforms to increase the advertising exposure of the more tolerant users, and may thereby create a vicious circle (Anderson and Gans, 2011; Johnson, 2013). In this situation, we seem to observe a trend toward a growing fraction of skippable advertisements – see for example *Search Engine Journal* (2017) and *TechCrunch* (2017). Considering the conclusions of the present paper, displaying skippable advertisements by competing sellers, which would be especially appealing for the low nuisance-users, could help the platforms to profitably screen their users. Exposure to advertisements that are either non-skippable, or not followed by advertisements for competing products could then effectively be the “price” charged for the exposure to valuable advertisements. Under this interpretation, skippable advertisements could be expected to be more often related to competing product, and to be sold at lower prices.

1.2. Related literature

Casadesus-Masanell and Hervas-Drane (2015) consider a duopoly market whereby the consumers can disclose information allowing the sellers to offer them more valuable products. The duopolists can offer the information to other sellers, and thereby

¹ We thank an anonymous referee for suggesting these examples.

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