The Monetization of Information Broadcasts: A Natural Experiment on an Online Social Network

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In 2006, Facebook – then a startup with about 10 million active users – announced a change to their online social network that caused the very first uproar regarding the company's privacy policy (there would be many to follow). While the change did not expose any additional information about users of the social network, it altered the ease with which information already provided could be accessed. Previously, information that a user's contacts had shared was scattered about on the different profile pages that these contacts had curated (Donath and boyd 2004). This made the information that users shared on Facebook relatively hidden, since it was quite taxing for people to visit all of their contacts' profile pages on a regular basis. Facebook called their intervention – their invention – the "News Feed", and according to technology columnist Farhad Manjoo, "nothing on the web would ever be the same".[1]

Facebook's News Feed did something simple in concept – it aggregated the information that a user's contacts shared into a single stream that updated automatically as people shared more information. The implications of this feature change, however, were profound. It meant that users could broadcast a message to all of their contacts in a way that they could easily consume it. It meant that Facebook would see an explosive growth in its user base over the following years, reaching a whopping 1.43 billion users by 2012 – an increase of 20% over the previous year.[2] Needless to say, companies that provided similar services, like Twitter and LinkedIn, followed suit and enabled their users to exchange broadcasts as well. Companies like Yammer introduced broadcast features to the enterprise sector (Kane 2015). A revolution in information sharing and consumption was underway (Aral et al. 2013).

Information broadcasts did more than just increase the number of online social network users – they also increased how active users were. By 2012, people spent more time using online social networks than any other category of internet service; twenty percent of their online time on personal computers and thirty percent on mobile phones.[3] This growth in usage was met with a growth in interest among scholars in fields as diverse as marketing, sociology, information science, communication studies, and information systems to make sense of this consumption. However, existing research tends to focus on understanding the consequences of using online social networks (e.g. Ellison et al. 2007, Bakshy et al. 2012, Wu 2013). In this research, I ask the opposite question: what drives people to use these services?

To address this question, I study one of the defining capabilities of online social networks: the ability to consume information that one's contacts have broadcast to everyone in their networks. I do this by analyzing data from an online social network that started charging some – though not all – of its users to receive broadcasts of contact information from their connections. The monetized feature automatically populated users' Microsoft Outlook email address books with the newest information that their contacts had updated about themselves. Rather than charging users directly for the feature, the company moved it

[1] For more on the release of Facebook's News Feed, and the surrounding controversy regarding user privacy, see "Facebook News Feed Changed Everything", Slate, September 2013
[2] "Facebook Helps Get One in Five People Worldwide Socializing on Online Networks", eMarketer, March 2012
[3] Social Media Report 2012: Social Media Comes of Age, Nielsen, December 2012

to their existing premium bundle. The monetization event thus provides a unique natural experiment and, by analyzing how purchase of the bundle changed around the event, I identify the types of users that were willing to pay to continue receiving broadcasts in their address books.

To show how broadcast monetization influenced purchase rates of the premium bundle, I plot the purchase rates for users of the broadcast feature for Microsoft Outlook, who needed to pay for the bundle to receive broadcasts, and users of alternative email clients, like Mac Mail and Mozilla Thunderbird, who continued to receive broadcasts in the email clients for free. Figure 1 depicts these purchase rates in the eighteen months before monetization and the six months after. In the periods before Outlook broadcasts were monetized, the premium purchase trends of the two groups were similar. In particular, the purchase rates of both groups were steadily declining. Indeed, discussions with the company that provided the data for this study suggest that this was one of the main reasons they chose to add Outlook broadcasts to the premium bundle – to prevent further decline in purchase. The company eventually monetized broadcasts for other email clients as well, although not within the timespan of my data.

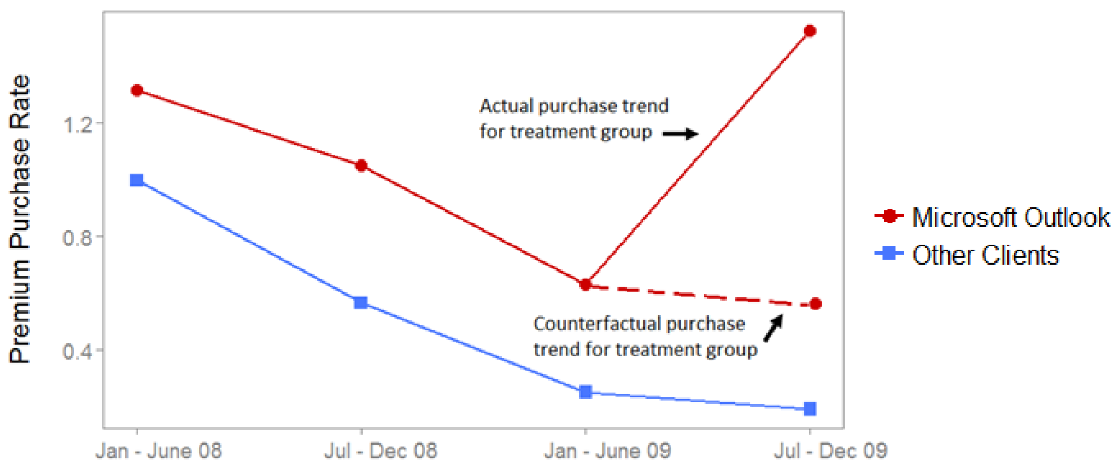

Figure 1: Illustrating the natural experiment.

In light of the similar trends of the two groups before monetization, the contrast in purchase after monetization is stark. While purchase rates for users of alternative clients continued to decline, purchase among Outlook users soared. The dashed line represents the counterfactual trend for Outlook users, which is an approximation of what purchase rates would have been if the Outlook broadcast feature had not been monetized. This approximation is based on the trend of users of alternative clients, for whom broadcasts were not monetized. It is worth noting that purchase rates among users of other clients may have reached a lower limit, and that purchase rates among Outlook users could have been even lower in the absence of monetization. The estimated increase in purchase rates due to monetization should thus be interpreted as a lower bound of the effect of monetizing broadcasts.

The broadcasts that were monetized in this setting only contained contact information, including mailing addresses, email addresses, phone numbers, job titles, and places of work. Due to the nature of this information, the setting provides a unique opportunity to study how broadcasts help people maintain relationships. I leverage data about users' connections on the online social network to construct network measures for each user, and relate these measures to the likelihood of paying for broadcasts. I find that users in large, structurally diverse networks (i.e. which contain several distinct social groups) were more likely to pay. Moreover, personal ties (i.e. family and friends) increased the likelihood of paying more than professional ties. I argue that the first effect is due to the costs of maintaining large, diverse networks – which broadcasts lower – and that the second effect is due to the benefits of maintaining personal ties.

To model the natural experiment and to incorporate user characteristics, I build a regression triple difference model (Angrist and Pischke 2009, p. 242-243). I define t to be an indicator that switches on in July 2009 (i.e. after broadcasts were monetized), and $\mathrm{Outlook_i}$ to be an indicator that switches on if user i downloaded the app for Outlook. I then model a user's decision to buy the premium bundle in period t as:

$$\mathrm{p_{it}} = \alpha_{00} + \beta_{00}\mathrm{X_{it}} + \alpha_{01}\mathrm{t} + \beta_{01}\mathrm{t} \times \mathrm{X_{it}} + \alpha_{10}\mathrm{Outlook_i} + \beta_{10}\mathrm{Outlook_i} \times \mathrm{X_{it}}$$
$$+\alpha_{01}\mathrm{t} \times \mathrm{Outlook} + \beta_{11}\mathrm{t} \times \mathrm{Outlook_i} \times \mathrm{X_{it}} + \gamma^{\mathrm{Geography}} + \delta^{\mathrm{Degree}} + \varepsilon_{\mathrm{it}}$$

Here, $\mathrm{p_{it}} = 1$ if i purchased the premium bundle in period t and 0 otherwise. The vector $\mathrm{X_{it}}$ includes several network properties and control variables that influenced purchase. The term $\gamma^{\mathrm{Geography}}$ represents fixed effects for users' countries of origin and zip codes for American users, which captures variation in purchase across geographic area. The term δ^{Degree} represents fixed effects for the number of connections users kept on the network. Finally, $\varepsilon_{\mathrm{it}}$ captures unobserved factors that influenced i's decision in period t.

The parameters of interest are found in the vector β_{11}. This vector captures the incremental effects of network properties on purchase probability after monetization, for users of Outlook, minus the incremental effects for users of alternative clients. That is, they capture the effects of network properties on the difference-in-differences in purchase probability. By estimating the effects of network properties on the difference in purchase rates before and after monetization, I control for factors that remained constant across both time periods, including the other tools in the bundle. I thus isolate the effects of the network properties on the probability of paying for broadcasts in particular, rather than the bundle more broadly. By including users of other email clients in the model, I control for any group invariant shocks, such as changes to the online social network that occurred concurrently with broadcast monetization.

Rather than showing estimates from this model, I describe the findings and show that the model explains aspects of the data well. First, users with networks that are structurally diverse, which contain several distinct social groups, were more likely to pay for broadcasts. To capture structural diversity, I measure the clustering coefficient and local betweenness of users' networks. The clustering coefficient captures whether one's ties are connected to each other, while local betweenness captures the extent that one's ties are connected to the same people. These effects are strongest for users in large networks, which suggests that structurally diverse ties are more difficult to maintain and that broadcasts lower the costs of maintaining them. Next, I look at the effects of the *types* of ties users had, which they needed to articulate when forming connections on the network. I find that personal ties (i.e. family and friends) increased purchase rates more that professional ties, suggesting that these ties are particularly beneficial to maintain. Figure 2 shows purchase rates and model predictions by time, email client, and the network properties.

These findings have important implications for the design and monetization of online social networks. For one, companies should pay attention to how specific features, like information broadcasts, alter their users' abilities to maintain relationships. Users in structurally diverse networks are less likely to find out information about those around them, because the people they know belong to difference social groups. Since broadcasts are often generated without a particular recipient in mind (Kane 2015), they may be particularly useful for maintaining relationships with people with whom we do not interact otherwise. However, obtaining information about our personal ties is likely less costly than doing so for professional ties. My findings thus indicate that companies should focus on both how their products decrease the costs of maintaining relationships, as well as the perceived benefits that can arise from keeping them.

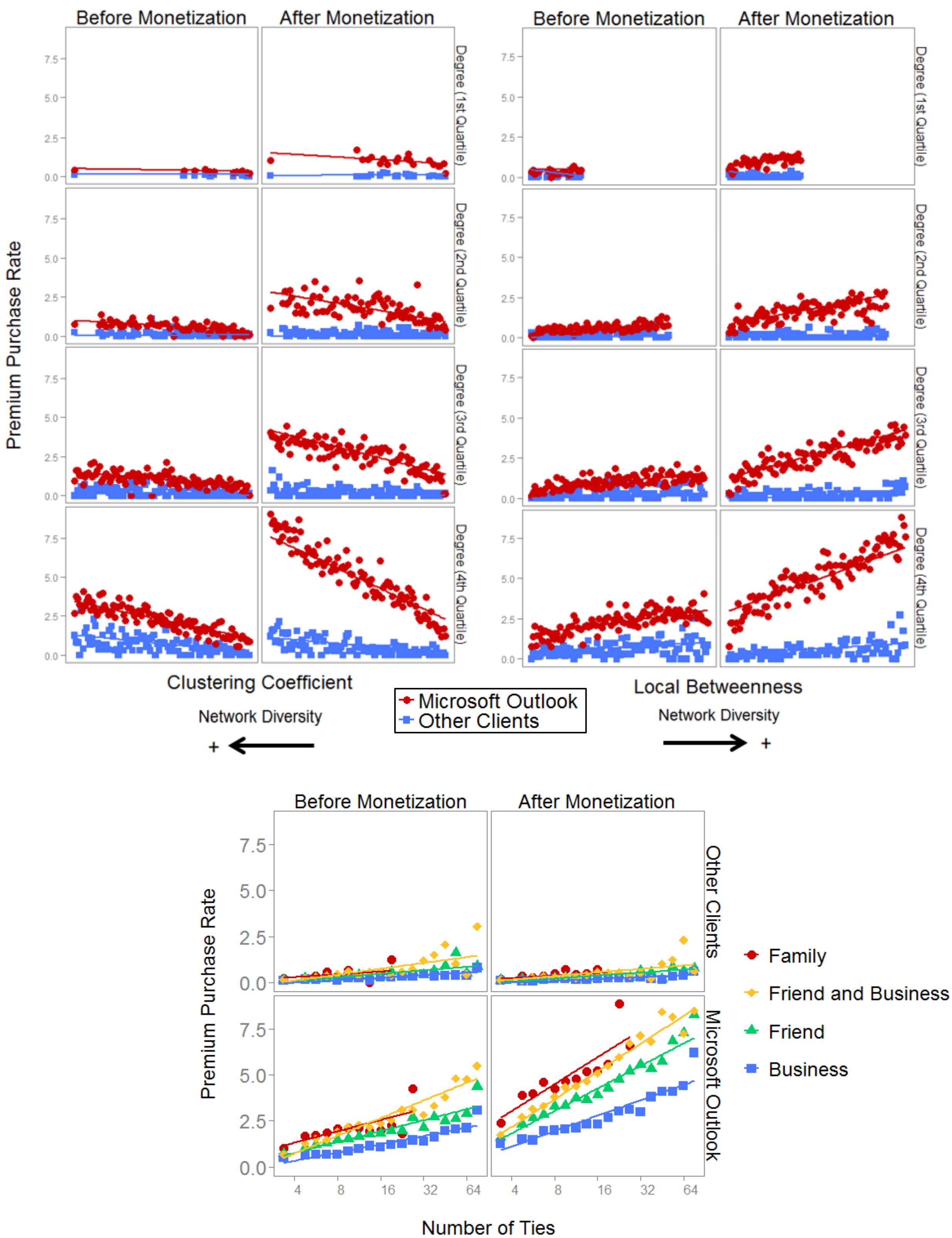

Figure 2: Data and model predictions. Top left: by degree and clustering coefficient; top right: by degree and local betweenness; bottom: by number and types of ties; dots are data and lines are model predictions.

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