Social relationships have long been recognized for their role in shaping users’ opinions and decisions. However, online social relations are notably distinct from their offline counterparts. In this study, using a unique and objective data set collected from an online Web 2.0 site, we conduct a comparative event analysis around the establishment of online social connections. The results provide supporting evidence that explicit online social relations influence users’ product ratings and play a role in expanding a user’s product adoption into new product categories over time, which offers important implications for product adoption and design of online recommendation systems.

KEYWORDS: Online social relations, social influence, product adoption, product ratings, online community

INTRODUCTION

Social relations have long been recognized as a source of influence among individuals who are part of a social network. These social network members may influence each other’s choices and opinion (Deutsch & Gerard, 1955; Iyengar, Van den Bulte, & Valente, 2011). Traditionally, social networks are built upon the inter-personal connections in the physical (“offline”) world. Examining social relations and influence in an offline social network has long been a topic of interest in various fields such as marketing, sociology, psychology, and economics. Asch (1940) proposes that an individual’s actions and beliefs guiding them are either an endorsement of his (her) group, and therefore a bond of social unity, or an expression of conflict with it. That is, all judgments are made with reference to other people. Modern research on social influence has built on Asch’s insight and identified the ways in which individuals are influenced by their relations with other people and by larger social groups.

The recent advent and proliferation of various Web 2.0 platforms and tools have empowered individual users to establish presence and build social relations with other users in the online space. As pointed out by McKenna and Bargh (2000), however, there are four major aspects that make online social connections and interactions unique and different from those traditional ones in the offline world. First, it is quite possible to be anonymous while being online. Even when using one’s real name, one is relatively anonymous when interacting with people from other cities or countries. Second, the physical distance does not matter on the Internet means that one can establish online relationships and interact with people from all over the world, at least those who speak the same languages. In the real world, yet, physical distance is the major
The above differences demand renewed examination on the emerging formation and effects of social relations in the online world. In this study, we particularly look into the effects of online social relations on product evaluation and adoption. Specifically, how might the newly established online social relations among users influence one another’s online product ratings over time? Would the explicit establishment of online relations play a role in a user’s adoption of products in new categories? We conduct a comparative event study around the establishment of online social connections. Our data analysis shows the supporting evidence that explicit online social relations influence users’ digital product ratings and play a role in expanding a user’s product adoption into new product categories.

THEORETICAL BACKGROUND

Informational Social Influence and Product Evaluation

It has been long and widely believed that one of the most pervasive determinants of an individual’s choices is the influence of those around the person. This social influence has generally been referred to as conformity and looked upon as the relatively simple act of going along with or agreeing with a visible majority (Burnkrant & Cousineau, 1975). Much of the research in social influence has followed theoretically from the conformity studies and social judgment (Asch, 1940; Cialdini & Goldstein, 2004). Social influence can be classified as either informational or normative. Informational social influence is referred as “the influence to accept information obtained from another as evidence about reality,” that is, as evidence about the true state of some aspects of the individual’s environment. Conforming to the expectations of another person or group is considered as normative social influence (Deutsch & Gerard, 1955).

With the Internet’s growing popularity, online communities and product review sites are often important resources for people to seek information, particularly evaluations provided by other consumers, on various types of products (Zhu & Zhang, 2010). Recent studies suggest that such online product information can influence individuals’ purchasing decisions and subsequent product ratings to a great extent (e.g., Schlosser, 2005; Godes & Silva, 2009; Li & Hitt, 2008). Under these circumstances, people use others’ online product evaluations as a source of information about a particular product. The underlying mechanism appears similar to that informational social influence operates in product evaluation discussed previously in the studies prior to the Internet age (Sridhar & Srinivasan, 2012). Yet, in these contexts, consumers who have provided their reviews online and individuals who may have been influenced by the reviews do not necessarily have explicit social relationships established either online or offline. Thus, social influence considered is more on the aggregated level derived from overall review ratings of entire online community. On the other hand, social influence derived from explicit social relations at the individual-level is also considered a significant factor in shaping one’s
product decisions (e.g., Bearden, Netemeyer, & Teel, 1989; Hill, Provost, & Volinsky, 2006; Simpson, Griskevicius, & Rothman, 2012).

**Explicit Social Relations and Product Adoption**

Leveraging an individual’s social relations (“social network”) for product adoption and diffusion has been a subject in the marketing related research (e.g., Childers & Rao, 1992; Bearden, Netemeyer, & Teel, 1989; Kurt, Inman, & Argo, 2011). In the context of a social network, awareness or adoption of products spreads from one person to another. For example, an individual may influence his/her friends to purchase a new smart phone by making them aware of its new features that they were not aware of. Such instances of real-world (“offline”) social network-based marketing have been called word-of-mouth marketing, viral marketing, buzz marketing, or diffusion of innovation.

Yet, with the recent phenomenal growth in online social platforms and their use, gaining a better understanding of the effects of explicitly established online social relations on product evaluation and adoption has become more important than ever. The need for the study is even more compelling considering that online social relations differ from their offline counterparts in multiple dimensions (Amichai-Hamburger, Kingsbury, & Schneider, 2013; Cummings, Butler, & Kraut, 2002; McKenna & Bargh, 2000; Ploderer, Howard, & Thomas, 2008; Xiang, Neville, & Rogati, 2010). A few prior studies provide empirical evidence suggesting that online social connections can be an effective vehicle for new product adoption and diffusion by extending beyond the traditional (“offline”) word-of-mouth channels. An early classic example is the Hotmail free email service, which grew from zero to over 10 million in 18 months on a small amount of advertising budget. Such phenomenon was largely due to the inclusion of a promotional message with the service’s URL in every email sent (Jurvetson, 2000). Hill, Provost, and Volinsky (2006) use telecommunication data to show that “network neighbors” - those customers who linked to a prior customer of a particular service - have a higher rate of adopting that service.

**DATA AND METHODS**

**Data**

We collected the data from an Asian Web 2.0 web site using a software program. At the web site, a user may use an email address to register and choose his/her screen name, which offers anonymity. Registered users can rate and write reviews for the product items that fall into one of three product categories - books, music, and movies. The rating scale is from 1 to 5 stars with 1 being the lowest and 5 being the highest level. The site provides recommendation service for books, music, and movies. In addition, the web site also supports online social network service that a registered user can choose to follow another registered user by simply clicking a “Follow” button. Unlike other well-known social networking sites such as Facebook or Linkedin, the establishment of “following” relations does not need to be consented / invited by the followed user. With all these “following” relations among registered users, it forms an online social network. We extracted the users’ following relationships and dates of the “following” relationships formed as well as review ratings.

The web site provides relatively simplified two-level hierarchical classification taxonomies for the product categories. For example, books are organized into 6 first-level classes - Literature, Popular, Cultural, Living, Management, and Science; each of these classes is further classified into second-level subclasses. For instance, Literature is classified into Classic, Contemporary,
Fictitious, and so on. Music is classified in terms of genre, country/region, artists, and year produced. Movies are classified in terms of genre, country/region, and artists.

To collect data for addressing the research questions in this study, we focus only on the users who have been active for at least $\Delta t$ months both before and after establishing any “following” relations with other users (we consider a user being active if he/she has provided ratings for at least one item per month). In particular, we set $\Delta t$ as 12 months. The similar period lengths have been used in prior studies of social influence (e.g., Iyengar et al., 2011).

Methods

In order to examine whether the explicitly established online “following” relations would affect a user’s product ratings and product adoption in new categories, we use a difference-in-differences methodology by considering the establishment of online relations as the event (“treatment”). Specifically, given a pair of users $u$ and $v$, suppose that $u$ starts to follow user $v$ at date $T$ as described in the previous section. Such pair of users $u$ and $v$ is categorized as “treatment group”. The treatment group consists of 658 pairs of users, and each pair has established explicit online “following” relations. In the following, we describe how the control group is constructed.

For each user $u$ in the above treatment group, we then match user $u$ with a user $\mu$ who does not have “following” relation with user $v$ but otherwise similar to user $u$ (“control group”). We choose $\mu$ from a pool of candidates who are not in the “treatment group”. Out of these candidates, we select the nearest neighbor on the basis of the following characteristics of user profile: the date joined the site, age, gender, and disclosed interests. The nearest neighbor is the user with the lowest Mahalanobis distance to the treated user over the above characteristics. Such matching process ensures that the users in the control group are as similar as possible to the users in the treatment group ex ante. Therefore, they provide counterfactual evidence as to what product ratings would have been for the users in the treat group when absent from “following” relations.

To address the first research question, we conduct the following analysis. For each pair of users $u$ and $v$ in the treatment group, we first calculate the similarity of product ratings provided by user $u$ and $v$ both before date $T$ and after date $T$ by using Pearson Correlation Coefficient (PCC) method (Dowdy & Wearden, 1983). Then, we compare the difference in the similarity of ratings before and after the treatment for users that have online “following” relations established (“treatment group”) with the corresponding difference for users that do not have online “following” relations but otherwise similar (“control group”). In particular, for each pair of treated users and each matched control pairs, we calculate the difference between the similarity of ratings over $\Delta t$ months after the establishment of “following” online relations and the similarity of ratings up to $\Delta t$ months before the establishment ($\Delta t = 3, 6, 9, 12$). The difference is denoted by $\Delta \rho_i$, where $i$ indexes the pair of users. Having calculated $\Delta \rho_i$ for the treated and matched control pairs of users, we can estimate the effect of the establishment of online “following” relations on users’ product ratings by running regression analysis.

In order to evaluate the effects of online “following” relations on expanding a user’s product adoption into new categories, we take into consideration of product classification taxonomies provided by the web site and use users’ product reviews/ratings as a proxy for product adoption. Specifically, if a user has provided a review or rating for a product, that product is considered as having adopted by the user. Given a particular product category such as Literature, for each pair of users $u$ and $v$ (user $u$ started following user $v$ at date $T$) in the treatment group, we count the number of its sub-categories in which user $u$ started adopting the products both after and before date $T$, denoted by $n_a$ and $n_b$ respectively. The relative difference is computed as $(n_a - n_b)/ n_b$. 
Similarly, we calculate the relative difference for the corresponding control pairs. Then, for each pair of treated users and each matched control pairs, we calculate the difference between the relative difference over $\Delta t$ months after the establishment of online “following” relations and that up to $\Delta t$ months before the establishment ($\Delta t = 3, 6, 9, 12$). The difference is denoted by $\Delta J_i$, where $i$ indexes the pair of users.

RESULTS

Using the difference-in-differences method described in the previous section, we obtained the main results. First, Table 1 presents the results for assessing the differences of product ratings in the overall Books category. In all regressions, the dependent variable is the change in the similarity of product ratings measured by PCC over $\Delta t$ months after the establishment of online “following” relations and the similarity before the establishment of the relations ($\Delta t = 3, 6, 9, 12$). We include all control variables when testing the model. For each of the four $\Delta t$ values, the table reports the coefficient on the establishment of online “following” relations dummy and its standard error in parentheses. As can be seen from the results, when $\Delta t = 3$, the establishment of online “following” relations dummy is not significant. We see the similar result for $\Delta t = 6$. However, when $\Delta t = 9$, it is weakly significant; when $\Delta t = 12$, it is shown to be moderately significant. In other words, after the online “following” relations between users are established for less than nine months, we do not see its significant effect in terms of the similarity in product ratings. However, it is after one full year that the effect becomes significant at 5% level.

<table>
<thead>
<tr>
<th>Table 1. Does the Establishment of Online “following” Relations Lead to More Similarity in Product Ratings?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable</td>
</tr>
<tr>
<td>Establishment of online “following” relations</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
</tbody>
</table>

All tests two-tailed. *$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Second, Table 2 reports the results for assessing the differences of product adoptions in new categories at the second level (e.g., Classic, Contemporary, and Fictitious) in the books taxonomy. In all regressions, the dependent variable is the change in the relative change of new product categories over $\Delta t$ months after the establishment of online “following” relations and before the establishment of the relations ($\Delta t = 3, 6, 9, 12$). We include all control variables when testing the model. For each of the four $\Delta t$ values, the table reports the coefficient on the establishment of online “following” relations dummy and its standard error in parentheses. As can be seen from the results, when $\Delta t = 3$, the establishment of online “following” relations dummy is not significant. However, when $\Delta t = 6$, it is weakly significant. When $\Delta t = 9$, it is shown to be moderately significant; we see the similar significance for $\Delta t = 12$. In other words, after the online “following” relations between users are established for less than half year, we do not see its significant effect in terms of product adoption in new categories. After 9 months of the establishment, however, the effect becomes significant at 5% level.
Table 2. Does the Establishment of Online “following” Relations Lead to the Adoption of Products in New Categories?

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>$\Delta J$ ($\Delta t = 3$)</th>
<th>$\Delta J$ ($\Delta t = 6$)</th>
<th>$\Delta J$ ($\Delta t = 9$)</th>
<th>$\Delta J$ ($\Delta t = 12$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of online “following” relations</td>
<td>0.013 (0.031)</td>
<td>0.026* (0.037)</td>
<td>0.029** (0.044)</td>
<td>0.035** (0.057)</td>
</tr>
<tr>
<td>All Control Variables</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.325</td>
<td>0.378</td>
<td>0.391</td>
<td>0.430</td>
</tr>
</tbody>
</table>

All tests two-tailed. *p < 0.10; **p < 0.05; ***p < 0.01.

We note that, due to the space limitation, only the results for the category of Books are presented. In the other product categories, we have obtained similar results, which enables us to make the following discussion and conclusion applicable across all the categories.

**DISCUSSION AND CONCLUSION**

Our findings provide strategic implications for such fields as network marketing and recommendation systems. First, from a practical standpoint, our study indicates that a firm can benefit by leveraging the observed online social connections. In particular, one of the main concerns for any firm is when, how, and to whom they should market their products (Hill, Provost, & Volinsky, 2006). It provides evidence that whether a consumer is directly linked to existing customers in the online space is a characteristic on which a firm should base direct marketing decisions. Taking online relations into account may improve significantly on a firm’s own marketing effectiveness. In addition, our results suggest the time dimension in the newly established online relations should not be a neglected factor. It takes time for the potential online social influence to form and become an effect. The effect can be exploited as part of network marketing strategies (Richardson & Domingos, 2002), and further into product diffusion (Iyengar, Van den Bulte, & Valente, 2011), online word-of-mouth (Godes & Mayzlin, 2004), and identifying “influential” or “opinion leaders” in a group environment (Aral & Walker, 2012).

Second, our study suggests that online social relations play a role in expanding users’ product adoption into new product categories. It provides complementary evidence for the consideration of topic diversification in recommendation systems (Ziegler et al., 2005). The concept of topic diversification is to balance and diversify personalized recommendation list in order to reflect a user’s potential wide spectrum of interests. For example, recommending a list of very similar items, e.g., with respect to the author, genre, or topic, may be of little user for the user. Instead, suggesting a list of diversified items that a user’s social circles have adopted may be more appealing to the user and potentially increase user satisfaction. The idea is along the same line of “portfolio effect” (Ali & Stam, 2004).

**REFERENCES**

References available upon request.