

When Daily Deal Services Meet Twitter: Understanding Twitter as a Daily Deal Marketing Platform

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ABSTRACT

Twitter, a microblogging service which enables users to build social networks and share information, has been recognized as a potentially powerful marketing platform. Daily deal service is one of the many types of businesses that leverage Twitter for marketing purpose; daily deal providers such as Groupon and LivingSocial are not only engaged in active interactions with their potential customers on Twitter but are also encouraging the customers to participate in advertising products through Twitter. Despite the recent surge of interest in studying Twitter as a medium of information diffusion, little is understood about the daily deal information sharing behavior on Twitter. In this research we pose following questions: what kind of daily deals are being talked about in Twitter, when, and how? In order to answer these questions we crawl and analyze a large-scale Twitter and Groupon data to understand the characteristics of the user-generated tweets containing the URL links to daily deals. We also examine the relationship between the sharing of tweets and the actual sales performance of the daily deal service based on the data collected from LivingSocial. We discover the demands of users reflected through Twitter and characterize the customers' information sharing patterns across Twitter. Further, we provide evidence that sharing daily deals on Twitter contributes to the improved sales performance. These findings shed light on the significance of Twitter as a marketing platform, providing key insights for businesses to consider in formulating social marketing strategies.

Categories and Subject Descriptors

J.4 [Computer Applications]: Social and Behavioral Sciences

General Terms

Human Factors, Measurement

Keywords

Twitter, Daily Deal Service, Social Media Marketing, Electronic Commerce, Electronic Word-of-Mouth (eWOM), Consumer Behavior, Microblogging, Online Social Networking

1. INTRODUCTION

Twitter is one of the most popular microblogging and social networking services with over 300 million user base and more than 300 million tweets published per day as of 2011. Services such as Twitter create an environment for users to freely publish and share information, not to mention to form social relationships with each other. Twitter has introduced a new paradigm of news and information sharing [1][14]; users nowadays depend heavily on such social networking services in obtaining information and connecting with others.

With a rising popularity of social networking services, businesses are seeking new opportunities to advertise their products and increase brand awareness through Twitter. Prior studies claim that instantaneity, large target audience, and low cost are the unique benefits of using microblogging services for marketing [3][10]. The most distinctive characteristic of using Twitter or other microblogging services for marketing is the user involvement in the marketing process. Unlike the traditional media which only allow unidirectional communications, Twitter allows every entity in the network to become part of the marketing process through *electronic word-of-mouth* (eWOM) activity and to communicate with each other. A user plays a significant role as both a potential marketer and a potential customer at the same time. The user generated contents, or tweets, act as an important source of advertising and brand managing.

Groupon and LivingSocial are two of the many companies that utilize Twitter as a marketing platform. They use Twitter for promoting daily deals as well as for receiving feedback and opinions from customers. Groupon and LivingSocial are online businesses that offer daily discounts on products/services. Such type of website is often referred to as a *daily deal site*. Daily deal sites provide daily discounted offers, or *deals*, on a variety of products and services such as restaurants, salons, fitness centers, electronic goods, etc. Each deal is associated with detailed information including description, category, price, discount rate, location, quantity sold, etc., which are displayed on the webpage represented by a unique URL. Twitter users can post tweets including these URL links which directly lead users to the webpage containing the deal information. Groupon and LivingSocial provide explicit interfaces on their websites for users to easily share deal information through Twitter, Facebook, and email, encouraging users to participate in the eWOM activity, as shown in figure 1(b).

Because users play a major role in Twitter marketing as an intermediary medium through which the information spreads, it is critical to understand the nature of the deals shared by the users,

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what drives the users to share the information on daily deals, as well as any behavioral patterns associated with the daily deal information sharing. However, to the best of our knowledge, no research on understanding the daily deal sharing phenomenon on Twitter exists at present. Several natural questions arise regarding the phenomenon: what kind of deals are users mostly interested in, and in what pattern do users spread daily deal information on Twitter? Does the spreading of daily deal information on Twitter actually have impact on the overall sales performance of the daily deal services? In this study, we investigate the landscape of the user-generated tweets containing the daily deal URL links. In specific, we pose following research questions:

1. What are the characteristics of the daily deals shared on Twitter?
2. When are the daily deals shared on Twitter?
3. Through what channel are daily deals shared on Twitter?
4. Is the daily deal sharing on Twitter correlated with the actual sales performance of the deal?

We perform a quantitative analysis on Twitter data crawled over the 5 months period. In addition, we crawled Groupon data for 5 months and LivingSocial data for 3 months. Understanding the consumer behavior on social networking services will not only enable businesses to come up with better marketing strategies to strengthen competitiveness, but also eventually lead to a higher customer satisfaction as a result of better services.

The contributions of this paper are as follows:

1. This is the first research to observe and characterize the information sharing behavior of the daily deal consumers on Twitter based on a large scale data.
2. We take a novel approach in discovering the behavior of the consumers on Twitter; we analyze tweets containing the URL links that reference the daily deals to explore the interests of users as well as their daily deal sharing patterns on Twitter.
3. We verify that the daily deals that are shared more frequently on Twitter tend to be sold in larger quantities. We also discover several important characteristics of demands of

daily deal customers and tweeting patterns in sharing daily deals that will be helpful for both businesses and customers.

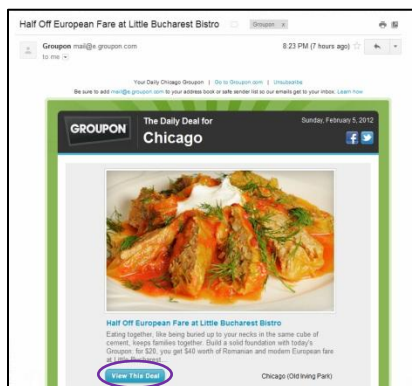
The rest of the paper is organized as follows. In Section 2, we provide a review of the related studies in the past. In Section 3, the research problems are defined. In Section 4, we explain data collection methods. In Sections 5 and 6 the results of the analysis are presented. In Section 7, we discuss the implications of our findings. Conclusions are made in Section 8.

2. RELATED WORKS

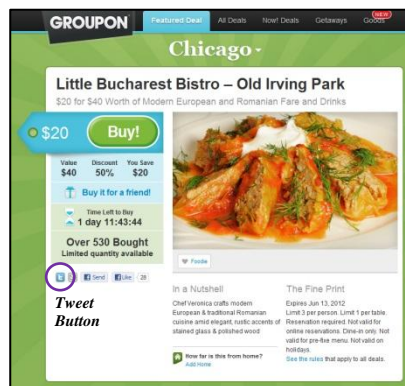
2.1 Twitter & Electronic Word of Mouth

Twitter, a microblogging and social networking service, has gained popularity worldwide since its launch in 2006, with over 300 million users as of 2011. Twitter allows users to publish posts, also known as *tweets*, of up to 140 characters. Users can subscribe to each other's tweets by *following* one another and build a network. If user A chooses to follow user B, whenever user B publishes a new tweet, it appears in user A's main Twitter page, which is also known as a *timeline*. Studies in the past indicate that Twitter serves a variety of purposes ranging from expressing oneself to sharing information [11][14][26]. Due to the versatility of Twitter, researchers from diverse disciplines try to investigate the use of Twitter by examining the publicly available tweets and user information.

Twitter can be used for businesses to advertise their brands and products through electronic word of mouth (eWOM) marketing. eWOM marketing refers to the idea of increasing brand and product awareness by spreading the words among customers through electronic means of communication. Studies on traditional Word-of-Mouth (WOM) marketing were conducted based on the face-to-face conversations in the offline environment. With the advancement in Internet and mobile technologies, eWOM marketing has become a topic of interest for many researchers as well as for industry practitioners [3][6][22]. There is a significant difference between the nature of traditional WOM and eWOM in terms of convenience and accessibility; eWOM is more powerful because it is immediate, has a significant reach, is credible by being made in print, and is accessible by others [6][24]. The online electronic contents available to us are thus valuable sources of information for studying eWOM phenomenon.



(a) Groupon sends daily deal information emails to its subscribers every morning.



(b) Upon click on "View this Deal" button, users are led to the Groupon website showing the daily deal information.



(c) When users click on the *Tweet Button* on the website, a tweet box prepopulated with the URL link to the Groupon daily deal appears to the user.



(d) When users click on the "Tweet" button, a tweet containing the URL link to the daily deal is posted on the Twitter timeline of the user.

Figure 1. An Example of Groupon Daily Deal Sharing Process

Previous studies on eWOM marketing mainly focus on its effect on consumer judgment and purchasing behavior. Many researches confirm that positive eWOM strategy has a positive impact on the consumer's buying decisions [10][23]. Some studies look at the psychological motivations behind eWOM behavior of the customers, which are mostly associated with the satisfaction towards the product they purchased or the level of trust towards a brand [2][25]. A majority of the eWOM marketing studies are based on the online reviews and ratings [16][19]. [20] and [21] study the impact of eWOM marketing using the data from email systems. It is only in recent years that microblogging services have been explored as eWOM marketing platform [12]. [11] examines the expressions of brand attitudes in Twitter postings. To date, little is understood about the nature of eWOM behavior, or the information sharing behavior, on Twitter although many companies are using Twitter for marketing and customer services.

2.2 Daily Deal Services

Many daily deal companies are using Twitter for business. Daily deal sites offer customers daily discounts, called deals, on products or services. The daily deal business model is increasing in popularity, and more than 200 daily deal companies exist in the United States as of December 2010. Groupon and LivingSocial are the top two leading companies in the U.S. As an example, figure 1 shows screenshots of Groupon. The company provides a detailed description of the deal on the website as shown in figure 1(b), and sends the deal information to subscribers through email as shown in figure 1(a). Daily deal sites are often called *group buying sites*, since a minimum number of purchases have to be reached in order for the discounted offers to become active. The required number of purchases is called a *tipping point* for the deal. To encourage customers to be a part of group buying, users can share the daily deal information with other users.

Prior studies on daily deal services mostly focus on the profitability of the group buying promotion, and whether it would be effective for affiliated merchants to run promotion through daily deal sites in the future [7]. A recent study presents a model that can be used to predict the sales outcome of a Groupon deal given the deal attributes [13]. By examining the effect of Facebook 'Like' buttons on Groupon sales performance, the authors provide evidence that daily deal sites benefit from eWOM marketing on Facebook. Another popular way of sharing deal information is by posting URL links of the deals on Twitter, which can be viewed as a type of eWOM activity. Posting URL links through Twitter is an explicit action which openly reveals a user's intention to share information, while Facebook 'Like's are much more implicit in nature. Furthermore, Twitter differs from Facebook in that relationships can be uni-directional, allowing one to exchange information with a wider range of other users. To the best of our knowledge, there has been no attempt to study the effectiveness of posting the URL links through Twitter. As shown in figure 1(b) and 1(c), daily deal sites provide buttons for users to share the URL links through social networking sites like Twitter and Facebook, as well as through email. Investigation of URL link sharing on Twitter can help one understand the eWOM behavior and characteristics of the daily deal customers, or the customers in general. What kinds of deals are spread, when, and how are common questions held by business providers, and understanding of the customers would lead to businesses' better marketing strategies.

3. RESEARCH PROBLEMS

In this study, we characterize the daily deal information sharing phenomenon on Twitter, with a focus on the spreading of tweets containing the URL links that reference the daily deal pages. From now on, we will refer to the sharing of tweets containing the URL links to daily deals as 'Twitter Sharing' for the ease of expression. We analyze the frequency, range, and timing of the daily deal sharing to address each of the following questions:

1. What are the characteristics of the daily deals shared on Twitter?

When choosing to share particular daily deal links on Twitter, customers may be attracted to certain properties associated with the deal, such as the price of the deal, discount rate of the deal, category of the deal, location of the deal, or whether the deal is offered in a limited quantity or not. A previous study [13] which examines the relationship between the price of the deal and the quantity of the deals purchased by the consumers suggests that user demands are price inelastic in case of daily deals, since the deals already offer heavy discounts. If Twitter Sharing represents the demand of users, we expect that it would not be dependent on price nor discount rates. However, we expect Twitter users to be sensitive to the limitedness in quantity and locality of the deal; we anticipate that the deals offered in a limited quantity would be of a bigger interest to the general public, and the deals available in multiple locations would be shared by a larger number of customers compared to local deals.

2. When are the daily deals shared on Twitter?

Understanding of customers also includes awareness of the time of the information sharing. The volume of tweets containing the daily deal URL links may vary across different time periods. A previous report [4] on the general usage pattern of Twitter claims that tweeting activity appears to be predominant during the weekdays, and that it occurs most frequently right after noon. We examine whether the deal sharing on Twitter displays similar pattern to the overall Twitter usage pattern, and if daily deal sharing happens more frequently during certain time periods.

3. Through what channel are daily deals shared on Twitter?

Users can generate tweets through a variety of channels such as the Twitter website, Tweet Button tools, mobile websites, mobile applications, and SMS. We investigate through which channels users are primarily involved in Twitter Sharing, in order to identify a target market for businesses to concentrate their marketing efforts.

4. Is the daily deal sharing on Twitter correlated with the actual sales performance of the deal?

We verify whether any positive correlation exists between Twitter Sharing and the actual sales performance of the daily deal business. A recent study [13] performed an analysis using the number of Facebook 'Like's on Groupon deals, and claims that social sharing does have a positive relationship with the daily deal sales. Here we investigate the impact of Twitter Sharing on Groupon sales, and validate whether social sharing on Twitter also has a positive relationship with the daily deal sales result.

4. DATA COLLECTION

To address the research problems, we crawled the publicly available data from Twitter, Groupon, and LivingSocial. In this section, we discuss the details of the collected data and the methods to collect the data.

4.1 Twitter Data

For our analysis, we collected a sample of tweets that contain the URL link 'groupon.com/deals/'. We built a Twitter crawler using the streaming Application Programming Interface (API) provided by Twitter¹, and collected the tweet stream in real-time from September 3rd 2011 to January 31st 2012. We could only collect partial data on September 27th due to a technical difficulty². The filter method of Twitter Streaming API returns public statuses that match the designated keyword. Results are given in the JSON (JavaScript Object Notation) format, and we parsed out the necessary data including the id, text, created date/time, location of the tweet as well as the hashtag, mention, and URL contained in the tweet, if there exists any. A Groupon deal is represented by a unique id following the URL address such as "http://www.groupon.com/deals/<deal_id>". Thus we were able to identify and collect the tweets which contained links to Groupon daily deals. In total we collected 87,027 tweets written in English.

4.2 Groupon Data

In order to study the landscape of the daily deal links shared through Twitter, we collect daily deal information from Groupon, the biggest daily deal site in the United States. Groupon also provides its own API³ for developers to easily access and retrieve deal information. Detailed information about a deal could be obtained by specifying the unique id associated with the deal. We collected the information of all the deals that were referenced by at least one of the tweets collected throughout the 5 months period. The results are given in either JSON or XML format, and we parsed out deal id, the original price, discount rate, discounted value, category, location, time zone, start and end date of the deal, the total number of the deals sold, as well as whether the deal is available in a limited quantity or not. Some daily deal information was no longer available after the sales, but the number was fairly negligible (less than 2% of the total number of collected tweets). After removing the corrupted URL links, we collected 26,804 deals referenced by the tweets during the 5 months period.

4.3 LivingSocial Data

We use LivingSocial data to study whether the number of times a deal is shared on Twitter and the actual sales volume of the deal are correlated with one another. We collected the sales volume data, or the purchase quantity of a certain deal, for LivingSocial deals. We also recorded the number of times the deals were shared via Twitter. In analyzing the correlation we use LivingSocial data instead of Groupon data for following reason. Groupon stopped providing the precise number of purchase quantities as of October 2011, because of the external attempts to estimate its total sales. Instead Groupon provides an approximated purchase quantity, such as '1000+' and '5000+', causing inaccuracy in our analysis. Unlike Twitter or Groupon, LivingSocial does not provide any

API for developers. Therefore we had to crawl the html pages of LivingSocial deals in which the necessary data were contained. A LivingSocial deal is represented by a URL address followed by a city id and a unique deal id such as "http://www.livingsocial.com/cities/<city_id>/deals/<deal_id>". In total we collected 1,069 LivingSocial daily deals from 12 different cities in the United States.

5. DAILY DEAL SHARING ON TWITTER

In this section, we discuss the results of the analysis on the collected tweets containing the daily deal URL links. We explain the overall trends of daily deal sharing on Twitter, including what kind of deals are shared when and how.

5.1 What Kind of Daily Deals are Shared on Twitter?

5.1.1 Daily deal distribution by Twitter Sharing Frequency

We collected 87,027 tweets containing URL links of 26,804 different daily deals over a 5 months period. Figure 2 shows the distribution of the daily deals by the number of tweets that referenced the deal. A deal that was shared most often through Twitter was referenced in 913 different tweets. This is an extreme case since 99.7% (26,736) of the daily deals were shared less than 50 times on Twitter. Focusing on the 99.7% of our sample, we draw a histogram of the set of daily deals that were shared through Twitter at least once and less than 50 times as well as the complementary cumulative distribution curve of the daily deals.

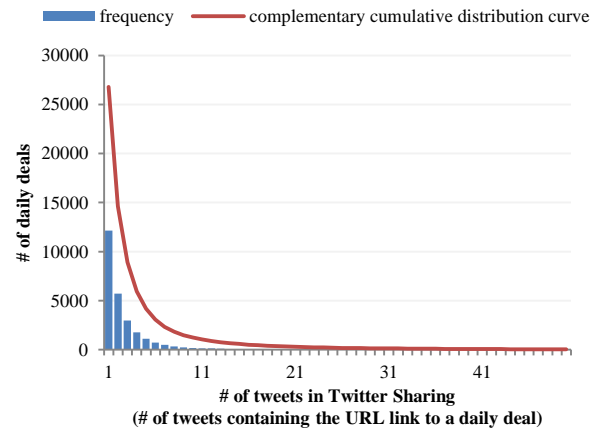


Figure 2. Daily Deal Distribution by Number of Referencing Tweets

The bar describes the frequency, and the line is a complementary cumulative distribution curve. We can observe a power law distribution ($y = 64760x^{-1.796}$, $R^2 = 0.987$), with the number of daily deals varying as a power of the number of tweets containing the URL link to a daily deal. Power-law distributions are observed in an extraordinarily diverse range of phenomena [8]. The distribution denotes that there are many daily deals that are shared in only a few tweets, and a few daily deals that are shared in many tweets.

We did not plot the daily deals that were shared through Twitter more than 50 times for a better visualization of the power law effect; the rest not shown on the graph, which account for 0.3% of the entire sample also follows the long tail distribution pattern. Only 70 out of the 26,804 daily deals were shared in Twitter more than 50 times, and 23 deals were shared more than 100 times.

¹ <https://dev.twitter.com/>

² A modification was made to the data transfer protocol of Twitter Streaming API on September 29th 2011, and we had to make corresponding changes to our crawler.

³ <http://www.groupon.com/pages/api>

Table 1. Summary of the Top 10 Most Frequently Shared Deals

Deal id	# of Tweets	General Category	Specific Category	Available in Limited Quantity	Redemption Location	Discounted Price (\$)	Discount Rate (%)	Description
gx-aa-national	913	Shopping	Clothing Sales	TRUE	Multiple Locations	25	50	American Apparel Discount Coupon
gx-nat-old-navy-us	775	Shopping	Clothing Sales	TRUE	Multiple Locations	10	50	Old Navy Discount Coupon
gx-nat-old-navy-social	587	Shopping	Clothing Sales	TRUE	Multiple Locations	10	50	Old Navy Discount Coupon
gx-nat-old-navy-new-york-ny	368	Shopping	Clothing Sales	TRUE	Multiple Locations	10	50	Old Navy Discount Coupon
the-body-shop-national-1	349	Shopping	Department Stores	TRUE	Multiple Locations	20	50	Body Shop Store Discount Coupon
lionsgate-one-for-the-money	342	Arts & Entertainment	Movie Theaters	TRUE	Multiple Locations	6	60	Movie Discount Coupon
gx-gt-donorschooseorg	236	Professional Services	Charity	TRUE	Multiple Locations	10	80	Charity Donation
ga-f-rose-tours	229	Travel	Cruises	TRUE	Miami	829	40	Backstreet Boys Cruise
beer-and-wine-hobby-1	222	Food & Drinks	Home Brewing	TRUE	Boston	35	50	Wine & Beer Brewing
the-meat-house-boston	218	Food & Drinks	Grocery Stores	FALSE	Multiple Locations	10	50	Premium Meat Butcher Shop

We now observe if there are any distinguishable features that characterize the daily deals at the upper tail, or the deals that are shared extremely often on Twitter. Table 1 shows a list of the top 10 deals that were most frequently referenced in the tweets. Before discussing the characteristics of the top deals, let us describe how the columns are defined. Each daily deal belongs to a general category and a specific category predefined by Groupon. Some of the deals are available in a limited quantity and some are not. Most of the deals on daily deal sites are local deals that are only available at one specific location, while some of the deals, including the online deals, are available at multiple locations around the nation. For all deals, the original price and the discounted price along with the discount rate information are provided. Brief descriptions of the deals are presented in the table.

Several common characteristics could be observed among the top 10 deals. First, all but one deal are limited in quantity. The goal of selling products or services in a limited quantity is to boost up customers' interests in the product and motivate them to consume a product by creating a sense of urgency. Previous researches claim that such marketing tactic, also known as scarcity marketing or exclusivity marketing [17][18], is effective. This strategy is used by many companies, one of them being Groupon. An observation of the top deals suggests the need to examine whether the degree of Twitter Sharing of the deal differs upon the limited availability of the deal, which will be discussed in Section 5.1.4.

Second, the top 7 deals offer discounts that can be redeemed at multiple locations. For example, the most frequently referenced deal corresponds to a voucher that could be used in American Apparel, a clothing brand in the United States. The voucher was valid at all U.S. stores or at the online store, attracting a large number of users to make purchases and post tweets. This leads to a need to examine the difference in the degree of Twitter Sharing depending on the availability of the deals in multiple locations. Furthermore, a breakdown of the daily deals shared on Twitter by location would help businesses to understand the user involvement in social sharing across different cities and time zone. We conduct analysis to address these questions and present the results in Section 5.1.3.

Third, the top 5 deals belong to the shopping category. Users may exhibit dissimilar Twitter sharing behavior for deals from different categories due to varying demands across different categories. A breakdown of the daily deals shared on Twitter by category would help one understand the different extent to which people are interested in sharing the information. We conduct frequency analysis of the tweets containing the daily deals across different categories in Section 5.1.2.

Now we take a look at the price and discount rate of the top deals. The prices of the top deals vary from 6 to 829 dollars, and no generalization could be made in terms of price. In economics, it is argued that the number of consumers interested in acquiring the product rises as the price falls by the law of demand. In other words, the demand of customers are said to be price elastic. However, a recent study [13] argues that this does not apply to the case of daily deals; the demands of daily deal customers are shown to be price inelastic because daily deals already offer large discounts. We expect that the price or the discount rate of a deal would not be related to the degree to which it is shared on Twitter, under the assumption that Twitter Sharing closely reflects the user demand. We find it necessary to conduct a quantitative analysis to verify whether the assumption is true, and discuss the analysis results in Section 5.1.5.

Other interesting facts from the data worth noting are as follows: The 7th most frequently shared daily deal on the list was a charity event, encouraging people to donate funds to an online charity organization named *DonorsChoose.org*. At times, daily deal sites team up with non-profit organizations to promote nationwide charity drives and to raise public awareness. Our data reveals that the links to such charity events are frequently shared on Twitter, indicating that the explanation for information sharing is partially rooted in altruistic purpose. Another interesting fact could be observed from the 9th deal on the list. Interestingly, many Twitter users shared URL links to this deal despite the fact that it was a local deal. An additional examination of the tweet contents revealed that this was largely due to a giveaway event hosted by the local marketer. A previous study [15] argues that one of the reasons why Twitter users remain subscribed to businesses and corporates is because they enjoy the giveaways and other events offered on Twitter by the businesses. Our data also shows that the giveaways and other events have the power to increase public participation on Twitter.

5.1.2 Daily Deal Distribution by Category

In this section, we present a frequency distribution of the Groupon deals shared on Twitter across different categories. All the deals fall into one of the 18 general categories predefined by Groupon: 'Arts & Entertainment', 'Automotive', 'Beauty & Spas', 'Education', 'Financial Services', 'Food & Drink', 'Health & Fitness', 'Home Services', 'Legal Services', 'Nightlife', 'Pets', 'Professional Services', 'Public Services & Government', 'Real Estate', 'Religious Organization', 'Restaurants', 'Shopping', and 'Travel'. By collecting all the tweets that contain the links to the daily deals and the corresponding daily deal information, we were able to observe the different degree to which the deals of different categories were being shared on Twitter.

Figure 3 illustrates the distribution of the deals across different categories. The plot shows the frequency of Twitter Sharing for the 12 most frequently referenced deal categories. The shaded bar indicates the number of tweets that contain the deals in the corresponding category. The white bar shows the number of deals in a corresponding category that were referenced in at least one tweet. For example, there were 15,703 tweets that contained URL links to 4,789 different Groupon daily deals within the ‘Arts & Entertainment’ category.

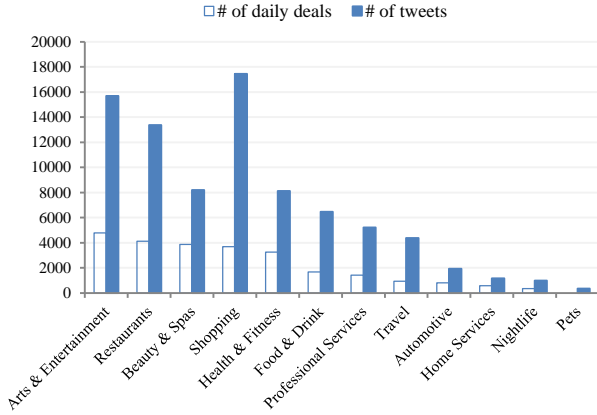


Figure 3. Daily Deal Distribution by Category

As shown above, the number of tweets varies across different product categories. Deals that belong to ‘Shopping’, ‘Arts & Entertainment’, and ‘Restaurants’ categories are most frequently shared on Twitter, followed by ‘Health & Fitness’, ‘Beauty & Spas’, and ‘Food & Drinks’. The graph illustrates that the number of tweets and the number of deals are proportionally distributed across different categories, except for a notable peak in the ‘Shopping’ category. While a majority of the deals shared on Twitter belongs to ‘Arts & Entertainment’ category, the most frequently tweeted deals belong to ‘Shopping’ category. A possible explanation for this is that while most of the ‘Shopping’ deals (62.3%) are offered online or in multiple locations, a large number of ‘Arts & Entertainment’ deals (92.4%) are redeemed at local sites. A prior observation showed that a majority of the most frequently shared deals were the ones available online or in multiple locations. In the following subsections, we verify whether the distributions of the tweets differ depending on the redemption location and the availability limits of the deals.

5.1.3 Redemption Location vs. Frequency of Tweets

In Sections 5.1.1 and 5.1.2, we observed that a majority of the most frequently shared deals were either available in multiple locations or available online. We perform statistical analysis to check whether the Twitter sharing frequency differs depending on the redemption location.

As shown in advance the daily deals are non-normally distributed, and exhibits a power-law degree distribution. Thus we use the Mann-Whitney test, a non-parametric statistical hypothesis test, to evaluate the dissimilarity between a distribution of a group of local deals and a distribution of a group of non-local deals. Our null and alternate hypotheses are as follows:

H_0 = The distributions for local deals and non-local deals are same.

H_a = The distribution for local deals and non-local deals are different.

Table 2. Mann-Whitney Test Results for Assessing the Effect of Redemption Location on Twitter Sharing Frequency

Ranks			
Redemption Location	N	Mean Rank	Sum of Ranks
Local Deals	22381	13322.24	298165046.0
Non-Local Deals	4423	13808.63	61075564.00
Total	26804		
Test Statistics			
Redemption Location			No. of Twitter Sharing
Mann-Whitney U			47699275.00
Wilcoxon W			298165046.0
Z			-4.037
Asymptotic Significance (2-tailed)			0.00

The test rejects the null hypothesis that there is no difference between the two distributions ($p=0.00$). The mean rank is higher for the group of non-local deals. Thereby, at a 0.01 significance level, we conclude that the non-local deals are shared through Twitter more frequently compared to the local deals.

5.1.4 Limited Quantity Availability vs. Frequency of Twitter Sharing

Similarly, we observed that 9 out of the top 10 most frequently shared deals were limited in quantity. According to the commodity theory that deals with the psychological effects of scarcity and exclusivity [17][18], scarcity enhances the desirability of anything that can be possessed. Thus we expect a difference between the limited deals and non-limited deals.

H_0 = The distributions for limited deals and non-limited deals are same.

H_a = The distribution for limited deals and non-limited deals are different.

Table 3. Mann-Whitney Test Results for Assessing the Effect of Limited Availability on Twitter Sharing Frequency

Ranks			
Quantity Availability	N	Mean Rank	Sum of Ranks
Non-Limited Deals	6554	13525.18	88644037.0
Limited Deals	20250	13362.79	270596573.0
Total	26804		
Test Statistics			
Quantity Availability			No. of Twitter Sharing
Mann-Whitney U			65555198.00
Wilcoxon W			270596573.0
Z			-1.560
Asymptotic Significance (2-tailed)			0.119

We again use the Mann-Whitney test to check the validity of this idea that the distributions of the limited and non-limited deals would be different. The test yields a p-value of 0.119, indicating that there is not enough evidence to reject the null hypothesis. A one-tailed test would yield a marginally significant p-value with a conclusion that the limited deals are actually less frequently shared on Twitter. This may be because of the possibility of limited deals being sold out earlier in time, causing a smaller number of URL links to be shared through Twitter. An additional control variable, which represents whether the product was sold out early or not, needs to be examined. It would be an interesting direction for future work to incorporate the control variable. In conclusion, there is not enough evidence to support the claim that the limited deals would lead to more Twitter Sharing, on the contrary to our expectation.

5.1.5 Price vs. Number of Tweets

If the law of demand holds for the daily deal instances, one may hypothesize that the demand of users would be elastic to price and discount rate of the deals. However, since the discounts are already very big in many daily deals, the demand is likely to be inelastic to price and discount rates of the daily deals. A previous study [13] supports this argument by analyzing the impact of the number of Facebook ‘Like’s on the sales quantity of a Groupon deal. If Twitter reflects the demands of the general public, the number of tweets on a deal would not be dependent on price or discount rates as well. In order to verify this, we examine whether any correlation exists between the two measures. For the analysis, we removed 331 charity-related deals, because the elasticity of demand for charitable donations is different from that of the normal demands.

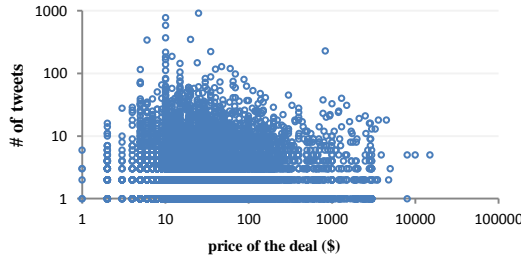


Figure 4. Price of Deal vs. # of Tweets

From the above graph, we can see that most of the deals (92%) shared through Twitter fall in the price range between \$1~\$100. And as expected, there exists no correlation between the price of the deal and the number of times a deal is referenced in Twitter with a Pearson’s r of 0.005. This confirms the idea that the demands of customers are price inelastic in the case of daily deals.

5.1.6 Discount Rate vs. Frequency of Twitter Sharing

Just because that user demands are price inelastic, it does not mean that they are insensitive to the rate of discount. We check whether there exists any correlation between the discount rate of the deal and the number of times a deal is referenced in Twitter.

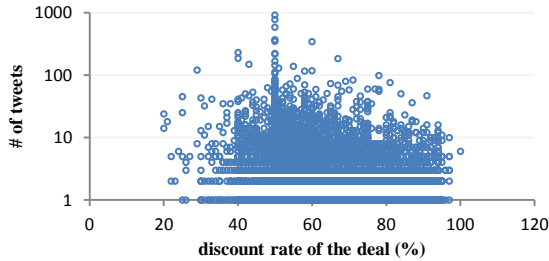


Figure 5. Discount Rate of Deal vs. # of Tweets

Note that 70% of the deals shared through Twitter fall in the discount range between 40% and 60%. Once again, we do not observe any correlation between the two measures with a Pearson’s r of 0.032, indicating that daily deal customers are also not sensitive to the discount rates.

5.2 When are Daily Deals Shared on Twitter?

The valuable information embedded within tweets is the temporal and spatial data. We are given the information about when and where the tweets were written. With the availability of the temporal information, we are able to monitor the Twitter Sharing activity at an hourly and daily level. In this section, we examine if any temporal pattern can be observed in daily Twitter Sharing

activity and study if the users are prone to engage in the activity more frequently on certain hours of the day or on certain days of the week.

5.2.1 Hour of the Day vs. Twitter Sharing Frequency

We explore the hourly dynamics of the Twitter sharing based on the 87,027 tweets containing the daily deal URL links. For each tweet, we are given the exact date and time at which the tweet was composed. Time information is provided in Greenwich Mean Time (GMT), which is an absolute time reference. Since we are also given the time zone information of each tweet, we first convert GMT into local time then create a graph showing the Twitter Sharing volume for each hour of the day.

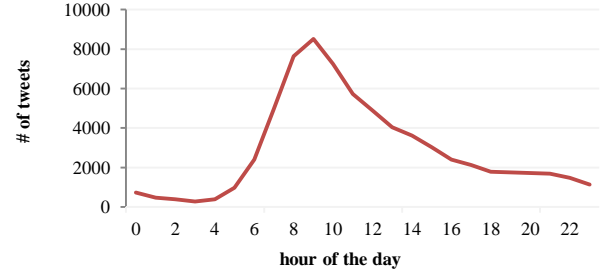


Figure 6. Daily Deal Sharing Frequency on Twitter

Figure 6 illustrates that daily deal sharing occurs most frequently between 8 AM to 10 AM. Sharing is most active in the morning and slows down as the day goes by. It is an interesting fact to notice because in general, most tweeting activity takes place around noon with its peak at 1 PM [4]. We provide a possible explanation for our observation. Previous researches show that a majority of people check their emails in the morning [9]. Also, Groupon sends daily deal information through subscribers’ email accounts as shown in Figure 1(a), usually around 7 AM to 9 AM in the morning [9]. Upon retrieval of the email, users can enter the Groupon site and share the information through Twitter. This implies that the emailing marketing tactics of Groupon is effective in promoting the daily deals to the public. Furthermore, it implies that the daily deal checking and sharing are morning habits for many individuals.

The temporal patterns of daily deal sharing may vary across different categories, so in the following figure we show a breakdown of the Twitter sharing frequency for the top 10 categories.

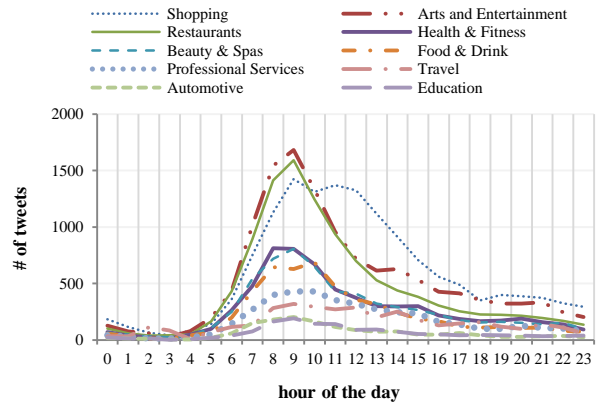


Figure 7. Daily Deal Sharing Frequency on Twitter By Category

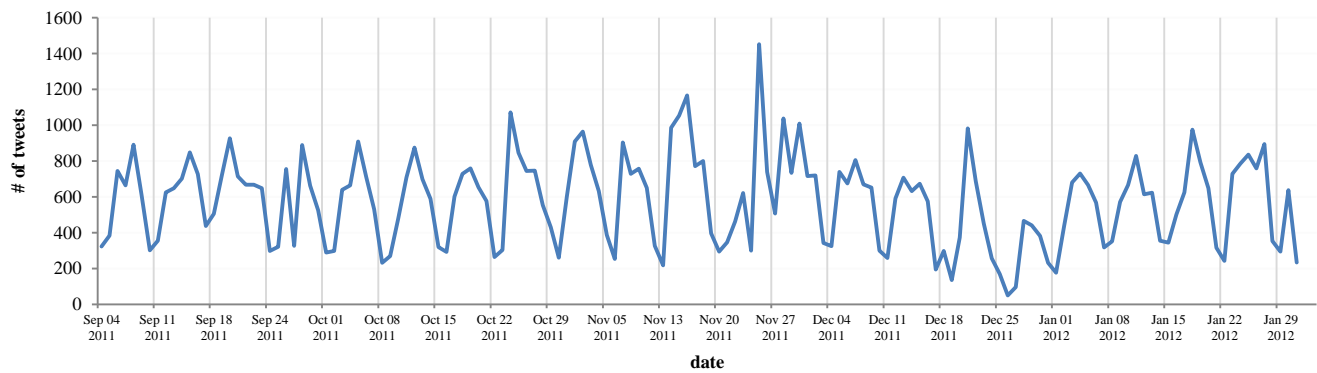


Figure 8. Time Series of Daily Deal Sharing Frequency on Twitter

Figure 7 shows once again that daily deals that belong to ‘Shopping’, ‘Arts & Entertainment’, and ‘Restaurant’ categories are most frequently shared through Twitter. Across all categories, the peak takes place in the morning, between 8 AM and 10 AM.

5.2.2 Day of the Week vs. # of Tweets

Figure 8 is the time series plot of the daily deal sharing volume from Sep 4th, 2011 to January 29th, 2012. The figure clearly shows that there is a recurring rhythm in the daily deal sharing pattern; we can observe noticeable peaks during the middle of the week and troughs on the weekends. The vertical guidelines indicate Sundays, and the least number of daily deals are shared through Twitter on Sundays. Tweets containing daily deal URL links are predominant on Wednesdays, followed by a quick drop on Saturdays. The following histogram shows the distribution of the tweets across different days in a week.

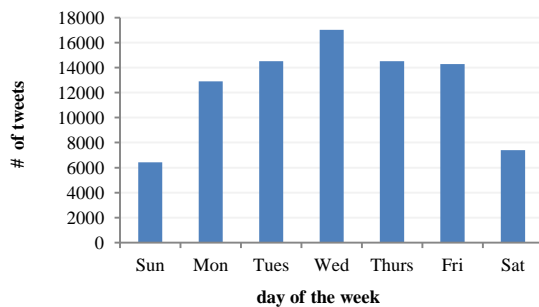


Figure 9. Daily Deal Sharing Frequency on Twitter

According to a prior research, tweeting is mainly a weekday activity [5], and we see that the same applies to the daily deal sharing on Twitter. Another interesting observation made from the time series is a glitch on Nov 24th, 2011, the Thanksgiving Day, and a relatively less active daily deal sharing behavior during the last week of December 2011, between Christmas and the New Years. This implies that people are less interested in sharing daily deals during the holidays.

5.3 Through Which Channels are Daily Deals Shared on Twitter?

Users can post tweets through a variety of channels including the Twitter website, mobile applications, SMS, etc. In this section we examine through which means the users access Twitter and share daily deal information. Figure 10 shows the distribution of the number of tweets shared through different channels.

Interestingly, more than three-quarters (77.45%) of the tweets containing the daily deal URLs were accessed via Tweet Buttons. Tweet Button is a web tool that can be placed on any website to facilitate link sharing via Twitter. Upon click, Tweet Button leads users to the Twitter post interface with the textbox prepopulated with the URL link to the website, as shown in Figure 1(c). Groupon also has Tweet Buttons on their pages to encourage users to share deal information with others on Twitter, as shown in Figure 1(b). The analysis result reveals that a majority of the users share daily deal links through Tweet Buttons, implying that the feature does contribute in users’ sharing of daily deal information with each other.

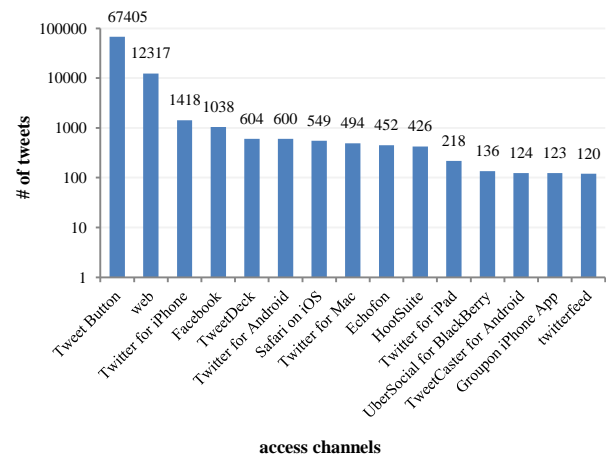


Figure 10. Tweet Distribution across Different Access Channels

The second most widely used medium through which tweets are published is the original Twitter website, followed by numerous mobile apps including Twitter for iPhone, TweetDeck, Twitter for Android, Echofon, etc. Twitter is also reached through different social networking sites like Facebook. Other devices like tablet computers are also used.

6. IMPACT OF TWITTER ON DAILY DEAL SALES

In the previous section, we performed an extensive overview of the daily deal sharing pattern on Twitter. Understanding of the types of daily deals propagated on Twitter, temporal dynamics of the daily deals shared on Twitter, and the access channel through which the daily deal tweets are shared are important aspects of

daily deal consumer behavior, under the assumption that Twitter plays a positive role in the promotion of daily deals. In this section, we show that daily deal sharing on Twitter is very strongly related to the sales performance of the daily deal business through analysis of LivingSocial data. The reason why we used LivingSocial data instead of Groupon data is explained in Section 4.3. In order to verify that the bigger the number of tweets referencing a daily deal, the bigger the sales of a daily deal, we run a correlation analysis between the two variables.

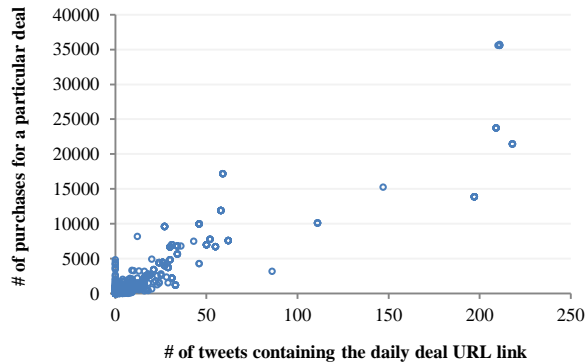


Figure 11. Correlation between the # of Tweets Containing the Daily Deal URL Link and the Quantity of the Daily Deal Sold

Using the random sample of LivingSocial data, we find that the number of tweets that reference a certain deal and the quantity of the deal sold (i.e. the number of purchases for a particular deal) are very strongly correlated as shown in Figure 11, with the Pearson's r of 0.902994. Although correlation alone cannot show causality, it can instigate that there is causality, since causation cannot occur without correlation. Our observation of a strong correlation between Twitter Sharing and daily deal sales provides an evidence of the potential influence of Twitter Sharing on the sales.

7. IMPLICATIONS

In this work, we studied the daily deal sharing phenomenon on Twitter with a special focus on the sharing of URL links referencing the daily deal pages. To the best of our knowledge, this study is the first attempt to provide a comprehensive overview of the daily deal sharing phenomenon on Twitter, and its potential impact on the sales performance of the daily deals service providers.

Through the analysis of a large amount of data collected over a 5 months period we observe the following interesting facts:

- 1) The demand of the public for the daily deals is different from the demand for other products or services in general; for daily deals, the demand is inelastic in terms of price and discount rate of the deal. Also, the effectiveness of the scarcity marketing, or selling products in a limited quantity, is not visible in our dataset.
- 2) We verify that products offered in multiple locations appeal to a larger number of crowds. A majority of the daily deals in 'Shopping' category (62.3%) are the ones that can be redeemed at multiple locations. Hence the products that belong to 'Shopping' category are of a big interest to Twitter users.
- 3) In contrast to the tweeting pattern in general, daily deal sharing occurs most often in the morning between 8 AM to

10 AM. This can possibly be due to the power of email marketing. It is also shown that most tweets containing daily deal URL information are spread through Tweet Button, a web tool provided by Twitter to facilitate the sharing of hyperlinks to websites. Daily deal sharing takes place most frequently during the weekdays, especially on Wednesdays and Thursdays, and less frequently during the weekends.

- 4) Daily deal sharing via Twitter is positively correlated with the sales volume of a deal, and the correlation is very strong. This means that the larger the number of tweets containing URL links to a specific deal, the larger the amount of the deal sold. It shows that Twitter has the potential to contribute to the improved sales performance of the daily deal services.

Many of these facts can provide insights to not just the daily deal businesses, including the retailers, but also to many other types of businesses. For example, daily deal marketing plans can be scheduled on Twitter at specific hours of the day or days of the week to obtain maximum exposure and to encourage more users to engage in active eWOM marketing. We show that Twitter can serve the role as a marketing platform, with a greater synergy effect when integrated with other sources for information such as email. In future work, we plan to analyze the network effects in dissemination of daily deal information by further examining the social interactions among individuals.

8. CONCLUSIONS

In this research, we crawl and analyze a large-scale Twitter data to explore the daily deal consumer behavior. By examining the sharing of tweets containing the URL links to the daily deals, we discover the consumers' demand for the daily deals. Daily deal consumers are shown to be insensitive to price and discount rate unlike the consumers in general. Daily deal sharing on Twitter occurs most often in the morning around the middle of the week, and the deals offered in multiple locations tend to be shared frequently. Tweet Button feature is useful in encouraging consumers to engage in eWOM activities. We also provide evidence of the potential contribution of Twitter in improving the daily deal sales performance. These findings shed light on the significance of Twitter as a marketing platform, providing key insights for businesses to consider in formulating social marketing strategies. Effective social marketing strategies will benefit not only the businesses but also the consumers.

9. ACKNOWLEDGMENTS

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