Shopping mode choice: Physical store shopping versus e-shopping

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ABSTRACT

This study aims to explore how consumers evaluate these time attributes; i.e., the value of time, when they are facing a shopping mode choice between physical store shopping and e-shopping. For this purpose, it conducts an experiment to acquire data on respondents' stated preference choices between physical bookstore shopping and online bookstore shopping. It is finally found that the value of delivery time for a purchased book from an online bookstore to a consumer is approximately $0.53 per day, which means an online bookstore will have to lower a book's price by $0.53 to attract a physical bookstore shopper if the delivery is delayed for one day. It is also found that in terms of monetary values, avoiding a shopping trip produces far more benefits than bearing waiting for the delivery of books for an online purchase.

1. Introduction

In the past decade, the way people shop has dramatically changed. Besides shopping at physical stores, with the aid of information and communication technologies (ICT), consumers are able to shop via the Internet. This new type of shopping mode, coming in different names like e-shopping, online shopping, network shopping, Internet shopping, or Web-based shopping, featuring in freeing consumers from having to personally visit physical stores, is anticipated to greatly change people's everyday lives.

Such a high anticipation towards e-shopping has provoked multitudinous studies on this topic. Most of the existing literature, however, has focused on the advantages and disadvantages of Internet marketing (Pallab, 1996; Forsythe and Shi, 2003; Lee and Tan, 2003). In addition, much of it has concerned consumers' motivation (e.g., Rohm and Swaminathan, 2004), attitude (e.g., Liao and Cheung, 2001), satisfaction (e.g., Evanschitzky et al., 2004), intention (e.g., Teo and Yu, 2005), etc., towards e-shopping. They mostly highlight the psychological constructs that dominate consumers' e-shopping behavior, and try to correlate these constructs by formulating empirical models based on certain behavioral theories. Some of these widely used theories include the theory of reasoned action (TRA) (e.g., Shih, 2004), the technology acceptance model (TAM) (e.g., O'Cass and Fenech, 2003; Shih, 2004; Ahn et al., 2004; Shang et al., 2005), the theory of planned behavior (TPB) (e.g., Shim et al., 2001), and the innovation diffusion theory (IDT) (e.g., Eastin, 2002). Such a psychological perspective has been widely adopted in the marketing and information management areas in particular.

Comparatively, very little of the existing literature has concerned about how consumers make the choice between e-shopping versus store shopping (Lee and Tan, 2003; Farag et al., 2007). One of the reasons for this may be attributed to the intricate nature of the shopping activity. It has been widely recognized that shopping activity is conducted not only for the goal of goods acquisition. The appeal of traditional store shopping is multifarious, including social interaction, entertainment, movement, and trip chaining (Mokhtarian, 2004). Much of the appeal cannot be easily displaced by e-shopping.
making traditional store shopping still quite competitive over e-shopping. In a conceptual analysis of the transportation impacts of B2C e-commerce, Mokhtarian (2004) reviewed the comparative advantages of store shopping and e-shopping, and conclude that neither type uniformly dominated the other.

Because of such an intricate nature of shopping behavior and the relative dominances of e-shopping versus store shopping, modeling the relationships between these two shopping modes has been not an easy task. The referable literature on this issue, from Koppelman et al. (1991) who modeled consumers’ choices between store shopping, catalog shopping and teleshopping, Lee and Tan (2003) who developed an economic model of consumer choice between on-line and in-store shopping, to Farag et al. (2007), who applied the structural equation modeling (SEM) technique to model the relationships between e-shopping and store shopping, is appreciably limited. This motivates this study to address the choice behavior between e-shopping versus store shopping rather than e-shopping alone.

Another noticeable point at issue is how ICT leads to changes in the allocation of individuals’ time and money resources. It is generally believed that the ongoing advancement of ICT is leading to a reorganization of activities in time and space (Lenz and Nobis, 2007). The ‘fragmentation’ concept introduced by Helen Couclelis means the interruption of one activity by another and the subsequent continuation of the former enabled by the use of ICT (Lenz and Nobis, 2007). This then leads to increased transport demand, as activities are no longer imperatively bound to particular times and/or particular places (Lenz and Nobis, 2007). For instance, e-shopping could lift the time and space constraints of the shopping process, leading ultimately to a fragmentation of the shopping activity in time and space (Couclelis, 2004; Farag et al., 2007). Such a ‘fragmentation’ of activities should end up leading individuals to reallocate their time and money resources, and eventually change the way they value time. This motivates this study to address the role time and cost attributes play in consumers’ shopping mode choice behavior.

For shopping activities, two fragments of time may be worth exploring further. First, e-shopping frees consumers from having to go in person to the shopping place, and as a result saves them travel time. Second, e-shopping requires consumers to wait for the product delivery after online purchases, and as a result generates waiting time for delivery (or product delivery time). Since e-shopping can lead consumers to reallocate their time and money resources, it should be important to explore how much consumers are willing to pay for the abridgement of such travel time and product delivery time. Then the trade-off relationship between time and money, or ‘the value of time (VOT)’ to be more precise, becomes one of the main concerns of this study.

In short, the purpose of this study is to examine how consumers evaluate their time resource, travel time and waiting time for product delivery in particular, when they are facing a shopping mode choice between store shopping and e-shopping. That is to say this study will consider the competition between store shopping and e-shopping by examining their relative advantages in some specific time and cost attributes, and then derive the values of time from these time and cost attributes.

The rest of the paper is structured as follows. In the next section, I review the key attributes of shopping modes, those associated with time and money expenses (cost) in particular, by examining a regular shopping process. In Section 3, based on these time and cost attributes, I build a shopping mode choice model, and design a stated preference experiment to collect the data. In Section 4, with the data collected, I estimate the coefficients of time and cost variables in the model and calculate the values of time. Finally, my summary and conclusions are given in Section 5.

2. Literature reviews on the attributes of shopping mode

Shopping is a process, composed of a set of distinct components linked together in a particular sequence (Peterson et al., 1997), and the choice of shopping mode is among them. Typical elements of the shopping process include desire, information gathering/receiving, trial/experience, evaluation, selection, transaction, delivery/possession, display/use, and return (Mokhtarian, 2004), and the choice of shopping mode can play a role in each element of the shopping process.

Of these elements, information gathering, transaction/purchase and delivery may be the three more noticeable ones for the shopping mode choice between e-shopping and store shopping (e.g., see Rotem-Mindali and Salomon, 2007). However, involving these three elements in the shopping process seems enough to perplex the issue. For example, Farag et al. (2007) note a hybrid form is evolving across these three elements, and cite that empirical research shows that nowadays many individuals tend to start their shopping process with an information search on the Internet before they go to the store, and many others to search for a product online, check it out in-store, and finally buy it online. Nevertheless, this study still tries to extract the attributes associated with time and cost expenses for further empirical use by examining the comparative advantages of e-shopping and store shopping according to these three major elements.

2.1. Information gathering/shopping

One of the most noticeable differences between e-shopping and store shopping is attributed to travel. Specifically, if a consumer decides to go to physical stores to gather information on products; i.e., conduct shopping activity, he/she has to spend travel time and travel cost to reach the shopping places. This will not be the case, on the other hand, if he/she chooses e-shopping. Money and time are two essential types of resources consumers possess. Wastes on travel cost and travel time have direct impacts on the amount of their resources, and thus diminish consumers’ utility. Additionally, according
to DeSerpa (1971) and Truong and Hensher (1985), travel time brings about disutility to individuals. In other words, besides wasting the time resource, traveling itself can also make consumers feel uncomfortable. In this regard, doing e-shopping freeing from traveling seems very inviting to consumers.

In the meantime, a number of empirical results have showed that for shopping trips, the importance of travel cost and travel time may be overstressed. For example,

1. Shopping trips are mostly chained with other out-of-home activities. Specifically, shopping is often not the only purpose as consumers go out. For example, Bhat (1996) found that about 18% of his sample conducted shopping activities on the way home from work. Jou and Mahmassani (1997) also found that about a third of commuters in their sample made at least one stop on the way home from work, and that nearly one-fifth of those stops were for shopping. In such cases, the travel cost and travel time attributed to the shopping activities could be very small.

2. Physical stores, large shopping malls in particular, have dispersed spatially in recent years. Consumers also seem willing to go farther to a mall with more comfortable shopping environment and with more diversified and cheaper products (Gould and Golob, 1997).

3. People have desire for movement; sometimes they simply want to get out and go somewhere. In this context, travel is desired for its own sake (Mokhtarian and Salomon, 2001). As Mokhtarian (2004) notes, “it is likely that a number of shopping trips are ‘invented’ in order to ‘justify’ (often subconsciously) an urge simply to get out and go somewhere”.

Furthermore, individuals these days spend their time more and more in in-home activities. The widespread of cable TV and broadcast bands has even worsened this situation. This in turn should arouse their willingness to go out for shopping at a tolerable amount of travel cost and travel time. In Taiwan, such a situation is even more noticeable for lack of recreational outdoors facilities. A large number of people in Taiwan enjoy going out and doing their shopping off weekdays, even though the transportation system is far from efficient. It then is worthwhile exploring how consumers in Taiwan evaluate the travel time associated with their shopping trips.

As consumers reach shopping places, they start gathering information, or shopping. A number of studies have pointed out that shopping activities also serve social motives (Salomon and Koppelman, 1988), and provide recreational and psychological gratification (Tauber, 1972; Bellenger and Korgaonkar, 1980; Marmorstein et al., 1992). Today large shopping malls and department stores are even facilitated with cinema, coffee shops, food halls, etc, making shopping activities even more recreational. To enjoy such shopping pleasure, store shopping is obviously more attractive to consumers than e-shopping. What’s more, information obtained from direct experience of multisensory stimulation of physical stores and products is also superior to that of e-shopping.

Nevertheless, online retailers have still been trying to raise online shoppers’ arousal and pleasure by improving their information quality (Menon and Kahn, 2002; Liang and Lai, 2002). Some online retailers even start to turn their attention to the layout of their virtual stores (Vrechopoulos et al., 2004). Even so, in terms of information quality, store shopping is generally considered superior to e-shopping.

On the other hand, thanks to the powerful accessibility of telecommunication, consumers can easily reach worldwide information over the Internet. Much of the online information is interconnected by hyperlinks, and some of it even functions with audio and video effects. Such an information novelty kept consumers exploring the shopping sites, whereas the information complexity had the potential to induce impulse purchases (Huang, 2000). In terms of information quantity, therefore, e-shopping is considered superior to store shopping. Lee et al. (2003) noted that the economic value on Internet information would become larger than at present since Internet information usage is increasing.

Today the amount of information consumers received over the Internet is so huge that it even causes information overload problem (Jacoby, 1984). Specifically, over the Internet, consumers receive more messages competing for their attention than they can handle and this causes the feeling of overload to them (Edmunds and Morris, 2000). To reduce such information overload, and search depth as well, Lin (2006) proposes a 0–1 programming models to find the optimal Website structure for users surfing in the Website.

Shopping is defined as the acquisition of information before purchase (Manski and Salomon, 1987). Shopping online doesn’t guarantee a purchase online (Forsythe and Shi, 2003). After shopping, consumers have to decide either to purchase, to exit, or continue shopping (Salomon and Koppelman, 1988). Once they decide to purchase, they have to face the transaction and product delivery problems, as will be discussed below.

2.2. Purchase/transaction

Online stores sell products generally at lower prices than physical stores do. At least the savings of overhead and maintenance of store fronts enable them to do so. Even though in some cases online stores explicitly add the delivery cost onto the price, the ultimate selling price is mostly still lower than that of physical stores. Besides, by the aid of intelligent agents for information searching on the Internet, consumers generally can easily find an online store offering the same product with a lower price than physical stores. As Koyuncu and Bhattacharya (2004) pointed out, consumers prefer to buy more from the

1 Unless in some special cases where travel is desired for its own sake and constitutes the activity, as pointed out by Mokhtarian and Salomon (2001).
Internet since e-shopping provides better prices. Grewal et al. (2003) concluded that the transparency of price information over the Internet enables closure of the traditional information asymmetry that exists between the buyers, and is likely to lead to a dramatic reduction in the use of differential pricing by marketers.

The most worrying problem with online purchases is about transaction. Consumers mostly pay by credit cards for their online purchases, and this inevitably raises concern about transaction security problem. Many studies; e.g., Liao and Cheung (2001), Chen et al. (2004), and Luarn and Lin (2004), have found that transaction security is one of the significant factors affecting consumers’ willingness to adopt online purchase. Koyuncu and Bhattacharya (2004) also pointed out that the risk for online payments is one of the reasons that cause consumers to opt to purchase less from the Internet. The findings of Forsythe and Shi (2003) were even more specific. They found that although online shoppers perceive several risks in e-shopping, these perceived risks may not significantly influence online patronage behaviors among current online shoppers in an extensive and systematic way; instead, perceived risk is likely to have a greater impact on potential patronage behaviors of Internet browsers than on current shoppers.

In most cases, consumers’ misgivings about transaction security are more psychological than practical. Specifically, even though most of the online transactions are now well secured by encryption techniques such as SSL (secure socket layer), many people still do not trust them. Unfortunately, such distrust in online retailers has formed a major barrier to the adoption of e-shopping (Wang et al., 2003; Luarn and Lin, 2004).

2.3. Delivery

After paying for the product, consumers can generally receive it immediately if they purchase it at a physical store, except for some special items such as furniture, which needs home delivery service. By e-shopping, however, consumers will have to wait for the product delivery, unless the product is downloadable like software and music (MP3), or certain kinds of services such as online banking and online consultation. A delay of delivery not only causes late satisfaction from the product consumers have purchased, but also creates uncertainty about the goods because consumers will find it difficult predicting the quality of the product (Liu and Wei, 2003). Koyuncu and Bhattacharya (2004) also found that longer delivery time is one of the reasons that cause consumers to opt to purchase less from the Internet.

Besides late satisfaction and uncertainty, consumers also have to cope with some other problems caused by the delivery. For example, consumers have to arrange the date and time for the delivery such that they will not miss the package; they have to bother to make a rearrangement if anything about the product received goes wrong (e.g., wrong product delivered, flawed product, etc.). All these cause inconvenience to consumers to some degree.

To overcome such an inconvenience caused by home delivery, online retailers in Taiwan started introducing a so-called ’online purchase, convenience stores picking-up’ service several years ago. This kind of picking-up service enables consumers to place a purchase order over the Internet, and then pick up the product ordered at a nearby convenience store appointed by consumers. Taiwan has the Asia Pacific’s and perhaps the world’s highest density of convenience stores per person: 0.000357 stores per person or one store per 2800 people (ACNielsen, 2005), making such a service practicable. Consumers can even choose not to pay for the product until they pick it up at the convenience store. Such a service has been well received in Taiwan, but is still limited to certain types of products such as those not perishable or small in size.

2.4. Discussions

Table 1 summarizes the attributes of shopping modes discussed above. According to Salomon and Koppelman (1988), some of the attributes may serve economic function, and some psychological function. Psychological function is generally fulfilled with consumers’ perceptions of and feelings toward shopping modes. For instance, consumers’ feelings toward travel disutility, shopping environment, and transaction security, as mentioned previously, are all under the psychological function. To capture these effects, the measurement of consumers’ motivation, attitude, satisfaction, and intention becomes crucial. Such a psychological aspect, however, is not this study’s primary concern.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| Information Gathering/shopping | • Travel cost  
|                            | • Travel time  
|                            | • More shopping fun  
|                            | • Less information uncertainty  
| Purchase/transaction       | • Higher purchase price  
|                            | • Less distrust feelings caused by transaction  
| Delivery                   | • No waiting time for delivery  
|                            | • Less inconvenience caused by delivery  
|                            | • No travel cost  
|                            | • No travel time  
|                            | • Less shopping fun  
|                            | • More information uncertainty  

*: Economic function, ☐: psychological function.
On the other hand, economic function is generally fulfilled by the expenses of money and time. In economics theory, individuals attempt to maximize their utility subject to limited amount of money (income) and time resources. Any expenses of money and time relevant to consumers’ shopping activities; e.g., travel time or waiting time for product delivery, will surely have direct impacts on the amount of their time and money resources, and be expected to have major effects on their utility levels and the subsequent shopping mode choices. Moreover, since the Internet has caused major changes to individuals in their allocation of time (Couclelis, 2004; Farag et al. 2007), it is very important to examine how individuals value time as they now have a new alternative option, i.e., e-shopping, to choose.

The attributes summarized in Table 1 does surely not cover all the aspects of shopping modes, those on psychological function in particular. Some psychological variables such as ‘perceived usefulness’, ‘perceived ease of use’, ‘subjective norm’, ‘compatibility’, etc., stemming from models like TRA, TAM and IDT, have proven to have influences on consumers’ e-shopping behavior (see Chang et al. 2005) on the literature review in this aspect). This study, however, intends to focus only on the variables for economic function. The omission of those psychological variables inevitably causes deficient estimation of parameters. Such deficiencies, however, can be moderated by using techniques like stated preference, as will be discussed in the following section.

Specifically, this study concentrates its attention on four attributes associated with time and/or monetary expenses, which are: (1) travel cost spent to reach a shopping place; (2) travel time spent to reach a shopping place; (3) purchase price for a product; and (4) waiting time for the product delivery (or ‘delivery time’ in a short form). The time and cost spent on information gathering (shopping) is excluded from our considerations because, as mentioned above, shopping can be very recreational or social. Sometimes people may enjoy their shopping and want to do it longer; e.g., buying garments at a department store, but sometimes they do not and just want to get it done as fast as they can; e.g., buying newspapers.

It is worth noting that consumers’ demand for a shopping mode can be seen as a kind of ‘derived demand’ originating from their direct demand for shopping activities. In other words, consumers demand for a shopping mode mostly not because they really need it, but because they want to conduct shopping activities. Shopping modes act mainly as channels for transmitting activity information to consumers (Salomon and Koppelman, 1988). It is for this reason that the target of such a direct demand; i.e., the product consumers shop, tends to play a pivotal role in dominating consumers’ shopping choices.

To examine consumers’ indirect demand, shopping mode choices, such a pivotal role product classes play can easily dilute the influence of the attributes of shopping modes themselves. For example, store shopping generally prevails over e-shopping when it comes to shopping products like automobiles, real estates or life assurance, and e-shopping generally prevails over store shopping when it comes to products like music and software. To eliminate the influence of product classes in order to be able to stand the attributes of shopping modes out, most authors would focus on a single product class as they examine consumers’ choices between shopping modes, and this study is among them. Some authors, Eastin (2002) and Liu and Wei (2003) for example, who try to include the effect of product classes build separate models for each product class and then compare the modeling results between them, a rather compromising approach to taking care of the effect of product classes.

3. Methods

After determining the four attributes of concern, this study starts to build the shopping mode choice model, and collect the data needed for model estimation.

3.1. Model building

The choice model this study uses to describe consumers’ shopping mode choice behavior is the binary Logit (Ben-Akiva and Lerman, 1985), which can briefly be expressed as

\[
P_i = \frac{e^{V_i}}{\sum_j e^{V_j}}
\]  

(1)

where \(P_i\) is the probability of choosing shopping mode \(i\) (either store shopping or e-shopping), and \(V_i\) the indirect utility function for shopping mode \(i\). In the case that indirect utility function only includes the four attributes of shopping modes this study concerns, \(V_i\) can be specified as

\[
V_i = \alpha_i + \beta_1 TCOST_i + \beta_2 TTIME_i + \beta_3 PRICE_i + \beta_4 DTIME_i + \varepsilon
\]  

(2)

where \(TCOST\) is the travel cost, \(TTIME\) the travel time, \(PRICE\) the purchase price, \(DTIME\) the product delivery time, \(\beta\) the parameter, and \(\varepsilon\) the error term. \(\beta\) is also defined as the partial utility individuals gain from the variable. For example, \(\beta_1\) is the partial utility individuals gain from the travel cost variable, which means as travel cost increases by a unit, say a dollar, the utility level will increase by \(\beta_1\) (the sign of \(\beta_1\) is expected to be negative).

Likewise, \(\beta_2\) is the partial utility individuals gain from the travel time variable, which means as travel time increases by a unit, say a minute, the utility level will increase by \(\beta_2\) (the sign of \(\beta_2\) is also expected to be negative). From \(\beta_1\) and \(\beta_2\), one can calculate the value of travel time (VOTT) as

\[
\text{VOTT} = \frac{\beta_2}{\beta_1} \hspace{1cm} \text{(\$/min)}
\]  

(3)
In the same manner, from $\beta_1$ and $\beta_4$, one can calculate the value of delivery time (VODT) as

$$VODT = \frac{\beta_4}{\beta_1} \text{ (\$/day)}$$  

By doing so, we are able to explore how consumers value the travel time and the product delivery time.

We can also extend the model by adding the effects of personal characteristics variables (PERSONAL), which are mostly specified as dummies, as demonstrated below:

$$V_i = \alpha_i + \beta_1 TCOST_i + \beta_2 TTIME_i + \beta_3 PRICE_i + \beta_4 DTIME_i + \sum_k \gamma_k PERSONAL_k^i + \epsilon$$  

Such a specification method to extend the model application will not change the VOTT and VODT.

As for product characteristics, this study attempts to focus on a single class of product, namely books, to simplify the model specification. We choose books primarily for two reasons:

(1) Focus on a single product class can diminish the influence of product characteristics, as mentioned previously, such that the effect of the attributes of shopping modes can emerge. In addition, for any specific book, that consumers purchase at a physical store does not seem to have any difference from that at an online store. This would help further remove the effect of product characteristics from the model.

(2) According to a consecutive online survey in Taiwan (Yam, 2002), books are the kind of products that are most frequently purchased online. This would help assure that the respondents participating in the experiment will not be too unfamiliar with online bookstores.

3.2. Design of stated preference experiment

This study uses stated preference experiment to collect data on respondents’ choices between simulated shopping mode alternatives. In the experiment, respondents are instructed to choose between two simulated alternatives; one is e-shopping and the other store shopping. Each simulated alternative is formed by combining four types of time and cost attributes: (1) travel cost to a bookstore; (2) travel time to a bookstore; (3) purchase price of a book; and (4) delivery time of a purchased book, at different levels. Each attribute is designed to have three levels, low, mid, and high, as shown in Table 2, with the exception of some special cases. To be more specific, for e-shopping alternatives, the travel cost and travel time are both set to have only one level; i.e., 0, for consumers do not have to spend them for doing e-shopping. For store shopping alternatives, the delivery time is set to have only one level; i.e., 0, for consumers mostly receive books immediately after their purchases.

As a result, the combinations of attributes and levels produce nine alternatives for e-shopping, and 27 alternatives for store shopping. We present three choice questions, each of which is composed of one e-shopping alternative and one store shopping alternative, in each questionnaire. Respondents have to choose one from every two alternatives for three times. By doing so, each questionnaire could produce three stated preference samples.

Stated preference technique has widely been applied in the travel demand analysis and marketing areas, even though it has been criticized for not being realistic; i.e., people may not necessarily do what they say. Actually, stated preference technique has proven to be particularly useful in the context of identifying estimates of relative utility weights, as well as estimating the tradeoff ratios (values of time) in the utility function (Kroes and Sheldon, 1988). In other words, researchers are generally concerned only about a limited number of variables if they use stated preference technique, and this inevitably causes omission of variables and deficient estimation of parameters. Nevertheless, the tradeoff ratios estimated, the value of product delivery time this study intends to estimate, for example, would still be reliable.

3.3. Data collection and sample characteristics

This study uses personal interview with questionnaire to collect the choice data. The interview was conducted in 2002 at large bookstores in Taiwan. The targeted objects were those who were shopping for books at physical bookstores. The respondents then were chosen randomly from these objects and invited to participate in the interview.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Levels</th>
<th>Low</th>
<th>Mid</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel cost (NT$)(^a,c)</td>
<td>0</td>
<td>30</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Travel time (min)(^a)</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Delivery time (days)(^b)</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Price (NT$)(^c)</td>
<td>200</td>
<td>250</td>
<td>300</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Levels for travel cost and travel time are applicable only for store shopping alternatives.

\(^b\) Levels for delivery time are applicable only for e-shopping alternatives.

\(^c\) NT$1 = US$0.029 in 2002 when the survey was conducted.
Each questionnaire comprises four parts. The first one is about respondents’ past experiences in bookstore shopping and Internet use. The second is about the data revealed by respondents about their trips to the bookstores where they are doing book shopping then. The third is a stated preference experiment, as described above. The fourth is about respondents’ personal characteristics.

Finally, a total of 300 effective revealed preference samples are collected. These 300 samples then produce 900 effective stated preference ones, because each respondent has to make three stated preference choices in a questionnaire. Of these 300 revealed preference samples, the distribution of gender is fairly reasonable for nearly equal ratios of male and female. The distribution of age, however, tends toward younger generations; more than a half (50.3%) fall in the 20–30 year-old, and nearly three quarters (74.3%) in the 20–40 year-old. Moreover, the ratio of samples frequently using the Internet is 79.3%, having online purchase experience 32.0%, but having online bookstore purchase experience only 17.0%. Such a sample structure is actually quite close to those from some large-scale surveys conducted by such noted organizations in Taiwan as Yam (http://survey.yam.com/) and FIND (http://www.find.org.tw/find/home.aspx).

Table 3 summarizes the revealed preference data on samples’ physical bookstore shopping trips then and there. It shows that for a one-way trip to bookstores, sample average travel time is 25.4 minutes and average travel cost is US$0.55. We did not ask respondents in the questionnaire if their bookstore shopping trips were just one of the many chained or not, or about how many trips were chained if they were. For an unchained in-town shopping trip in Taiwan, such travel time and travel cost seem comparatively large. On the other hand, the average discount rate for their purchased books is 19%, which is a fairly reasonable one in Taiwan.

Moreover, although respondents were all interviewed at physical bookstores, they were also asked to answer questions about e-shopping for books according to their knowledge. The most important one was about how many days the delivery would take if they purchased the books online instead. Table 3 shows the average days for delivery are 5.48, which seems quite able to reflect the general level of real cases.

4. Results

The choice model this study uses is the binary Logit, as shown in Eqs. (1) and (5). In the process of model estimation, however, we find respondents with and without e-shopping experience exhibit extremely different shopping mode choice patterns. This drives us to separate the model estimation with respect to these two groups of samples.

Moreover, among the four attributes concerned, the purchase price variable stays insignificant for both groups, though much effort has been made. The reason for this may be that the purchase price of a book in our experiment is set too low, making the price difference between alternatives insignificant to respondents.

4.1. Model estimation results

The final estimation results of our shopping mode choice models for both groups of samples are shown in Table 4. For those with e-shopping experience, the coefficients of travel cost, travel time, and delivery time are all negative and significant. For those without e-shopping experience, however, the coefficient of travel time is not significant, though those of travel cost and delivery time are still negative and significant. This may be because those with e-shopping experience care much more about the time resource (so that they tend to adopt e-shopping to save time) as compared to those without. This can also be proved out by comparing coefficients of delivery time between respondents with and without e-shopping experience. The respective coefficients, −0.450 and −0.201, indicate that the unit disutility (−0.450) of delivery time to those with e-shopping experience is more than twice as much as that (−0.201) to those without.

On the other hand, the unit disutility of the monetary attribute; i.e., travel cost, for both groups of respondents are fairly close (−1.728 vs. −1.336). This is because money can be saved for future use, so the value of it generally has no uncertainty and tends to be uniform. As for time, it cannot be saved for future use, making its value depends greatly on the occasions where consumers are spending it.

4.2. Tradeoff between time and cost attributes

From the results of Table 4, we can calculate the values of time by applying Eq. (3) and (4), as illustrated below.
**Table 4**

Estimation results of shopping mode choice model

<table>
<thead>
<tr>
<th>Variables</th>
<th>With e-shopping experience (n = 288)</th>
<th>Without e-shopping experience (n = 612)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constants</td>
<td>0.555 (0.433)</td>
<td>-0.968 (0.065)</td>
</tr>
<tr>
<td>Travel cost (US$)</td>
<td>-0.589 (0.010)</td>
<td>-0.455 (0.002)</td>
</tr>
<tr>
<td>Travel time (h)</td>
<td>-3.116 (0.008)</td>
<td>-0.201 (0.001)</td>
</tr>
<tr>
<td>Delivery time (days)</td>
<td>-0.450 (0.000)</td>
<td>-0.825 (0.000)</td>
</tr>
<tr>
<td>Age less than 20(^{b})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender male(^{a})</td>
<td>0.976 (0.010)</td>
<td>-0.825 (0.000)</td>
</tr>
<tr>
<td>Frequency of bookstore shopping frequent(^{c})</td>
<td>1.712 (0.001)</td>
<td>1.266 (0.000)</td>
</tr>
<tr>
<td>Frequency of bookstore shopping not very frequent(^{c})</td>
<td>1.143 (0.014)</td>
<td>0.773 (0.002)</td>
</tr>
<tr>
<td>Frequency of book purchase frequent(^{d})</td>
<td>-0.994 (0.030)</td>
<td>-0.930 (0.007)</td>
</tr>
<tr>
<td>Frequency of book purchase not very frequent(^{d})</td>
<td>-0.365 (0.319)</td>
<td>-0.825 (0.000)</td>
</tr>
</tbody>
</table>

\(^{a}\) Gender is on the basis of 'female'.

\(^{b}\) Age is on the basis of those 'more than 40-year-old'.

\(^{c}\) Frequency of bookstore shopping is on the basis of those 'never'.

\(^{d}\) Frequency of book purchase is on the basis of those 'never'.

4.2.1. Value of travel time (VOTT)

For those with e-shopping experience, the value of travel time is

\[
VOTT = -3.116 - 0.589 = 5.29 \text{ (US$/h)}
\]

Though values of travel time obtained from general travel demand analysis depends greatly on the types of travel time attributes, such as walk time, wait time, in-vehicle time, etc (see Wardman (2001) for his review of British evidence), this value still fall in a reasonable range as compared to them.

4.2.2. Value of delivery time (VODT)

For those with e-shopping experience, the value of delivery time is

\[
VODT_e = -0.450 - 0.589 = 0.76 \text{ (US$/day)}
\]

For those without e-shopping experience, it is

\[
VODT_{ne} = -0.201 - 0.455 = 0.44 \text{ (US$/day)}
\]

For total samples, the average value of product delivery time is approximately 0.53 (US$/day). We could not find any corresponding value in the literature for comparison with ours though. It is also inappropriate to compare VODT with VOTT. As stated previously, travel time cannot be saved, so its value depends greatly on the occasions where individuals are spending it. Specifically, travel time is generally considered a waste of individuals’ time resource (e.g., car drivers can hardly do anything else while driving), and is therefore often highly valued (individuals are willing to pay more to shorten their travel time). On the contrary, individuals can almost do anything they want while waiting for the delivery of the books purchased. That is to say waiting for a delivery of books may not be considered a waste of time. For this reason, it is not surprising that VODT is outrageously lower than VOTT.

Nevertheless, an average value of $0.53 per day for delivery time implies that an online bookstore will have to lower its book price by $0.53 to attract a store shopper, if the delivery is delayed for one day. For a 5-day-delivery, a bookstore has to lower its price by $2.65 to attract a store shopper. Such a value seems quite reasonable, and is very important for bookstores’ pricing strategy.

Mokhtarian (2004) once cited Gould’s comments (Gould, 1998, p. 151) by saying that “the travel time saved by shopping from home must be balanced against the offsetting time spent waiting for home delivery.” According to the empirical results from this study, the average travel time revealed to a bookstore is 25.4 min, as shown in Table 3, which generates a monetary value of US$2.24 (=25.4/60 × 5.29), and the average travel cost revealed to a bookstore is US$0.55, also shown in Table 3. Thus a trip to a bookstore and back will cost a monetary value of US$5.58 (=2.24 + 0.55) × 2). This is equivalent to say that if a book is purchased online instead, a consumer will save US$5.58 for avoiding a trip to a bookstore. In that event, however, he will have to wait for the delivery of purchased books for 5.48 days on an average, as shown in Table 3, which generates a monetary value of US$2.90 (=5.48 × 0.53). It then is very interesting to find that in terms of monetary values, avoiding a shopping trip (to save US$5.58) produces far more benefits than bearing waiting for the delivery of purchased books (at a cost of US$2.90).

Such an empirical result turns out not supporting Gould’s comments, though. Nevertheless, the result also did not consider the possibility where a book shopping trip is only one of many chained ones. According to Gould (1998), shopping trips linked to trips for other purposes can make the marginal cost of store shopping negligible, and contribute to making store shopping the preferred alternative in many instances. In any event, it suggests more evidence be required in further studies.
5. Conclusions

Based on the theory that ICT can bring about a ‘fragmentation’ of activities, which ends up leading individuals to reallocate their time and money resources, this study examined the time and cost attributes of shopping modes, and explored the tradeoff between these two attributes, i.e., the value of time, by assuming that consumers were faced with a shopping mode choice between physical store shopping and e-shopping. The final estimated value of time include two types: the value of travel time to shopping places, bookstores as far as this study concerned, and the value of waiting time for the delivery of purchased products, books.

The primary contribution of this study is the fulfillment of an applicable methodology by which the tradeoff between two important types of the attributes of shopping modes, time and cost, can be estimated. Such a methodology can serve as a reference tool for researchers to examine the effect of ICT on individuals’ valuation of the time resource, which responds to the concern of much literature, such as Couclelis (2004), Farag et al. (2007) and Lenz and Nobis (2007), about the fragmentation of the activity in time and space caused by ICT. The findings from empirical study also make contributions. For example, it is finally found that in terms of monetary values, avoiding a shopping trip to a bookstore produces far more benefits than bearing waiting for the delivery of online purchased books. This finding disagrees with the judgment of Mokhtarian (2004) and Gould (1998) in which they believe that the benefit from saving travel time can be balanced against the offsetting time spent waiting for delivery.

Of course consumers’ concern toward e-shopping is not only about time and cost. Some psychological aspects, such as information uncertainty and transaction security, have been playing an important role in dominating consumers’ e-shopping behavior, and have been even more widely discussed in the literature. However, as ICT continues to advance, in speed and security in particular, it is generally believed that online information will be to a great extent improving both in quantity and quality in the near future. By that time, consumers’ negative perceptions towards e-shopping, such as information uncertainty and transaction security, may fade away. If this is going to be true, then consumers’ psychological concern over e-shopping may gradually be disappearing in the future.

On the other hand, the economic concern over the travel problem; i.e., travel time and travel cost, about physical store shopping, and product delivery problem about e-shopping will ever exist. This makes the value of travel time (US$5.29 per h) and value of delivery time (US$0.53 per day) this study estimates worth noting. Moreover, this study also found that purchasing online to save travel time and travel cost, which is worth an average monetary value of US$5.58, for avoiding a shopping trip can be very inviting to consumers, even though it is at the cost of waiting for a delivery of purchased products, which is worth an average monetary value of US$2.90.

In spite of these noticeable findings, this study is still subject to some limitations. First, the value of product delivery time seems to highly depend on the types of products consumers shop and purchase. After all, waiting for a delivery of books may have less impact on consumers’ daily lives, but waiting for a delivery of a personal computer may greatly affect consumers’ routines; both should result in different values on product delivery time. This study, however, did not consider the variation in product classes. Second, this study did not consider the situation where a book shopping trip is only one of many chained ones, resulting in the possibility of overestimating the monetary value of US$5.58 for saving a bookstore shopping trip. Especially some empirical evidence has shown that work trips are often chained with shopping ones; e.g., Bhat (1996) and Jou and Mahmassani (1997) and this may lessen the disutility caused by the travel time for shopping. Third, the empirical data this study collected were stated preference rather than revealed preference. Although stated preference technique has proven to be particularly useful in the context of estimating the values of time, whether respondents can adequately evaluate a set of simulated alternative options by expressing their preferences properly on the measurement scales are still in doubt (Kroes and Sheldon, 1988). For this, many authors have suggested methods of combining stated preference and revealed preference data in order to gain their combined strengths (e.g., Morikawa et al., 1991; Swait et al. 1994). All these limitations require further amendment in the future.

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