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Online buying behavior: a transaction cost economics perspective

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Abstract

Using a transaction cost economics perspective, this paper presents a model for understanding consumers' on-line buying behavior. An empirical study was conducted in Singapore to test the model. The results indicate that consumers' willingness to buy online is negatively associated with their perceived transaction cost, and perceived transaction cost is associated with uncertainty, dependability of online stores and buying frequency. When consumers perceive more dependability of online stores and less uncertainty in online shopping and have more online experiences, they are more likely to buy online. Implications of the results are discussed.

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1. Introduction

The Internet has developed into a dynamic virtual medium for selling and buying information, services and products. The phenomenal growth and rising popularity of the Internet and the World Wide Web (WWW) have attracted consumers and businesses to leverage the benefits and advantages brought on by new technology. The International Data Corporation (IDC) estimated that Internet users in Asia, excluding Japan, will increase from 94 million in 2001 to 291 million by 2006 [1]. Nua.com [2] reported that the number of people online in the Asia/Pacific region has reached 187.24 million as of September 2002.

The Internet exerts an increasingly strong influence on people's everyday life. The growth of interest in the Internet as a shopping and purchasing medium is fascinating for practitioners and researchers alike. Its rapid growth poses intriguing questions for academic research. Some researchers proposed that the consumer's own characteristics play an

important role in his/her propensity to engage in Internet transactions [3,4]. Steinfield and Whitten [5] suggested a greater chance for the combination of the Web plus physical presence to capture business than the Web-only presence because they can provide better pre-purchase and post-sales services to lower consumer transaction costs and build trust in Web stores. Others speculated on the critical role of trust in stimulating consumer purchases over the Internet [3,6,7]. Brynjolfsson and Smith [6] pointed out that branding and trust remain important sources of heterogeneity among Internet retailers.

As a new channel for marketing, the Web is capable of accommodating various kinds of products and services. However, online retailers revealed that people browse the Internet more for information than for buying online [8] and that they feel it is difficult to enjoy shopping online [9]. Johnson [10] pointed out three barriers to online shopping, i.e. purchase failures, security fears, and service frustrations. Hoffman et al. [7] also highlighted that the reason more people have yet to shop online is due to a fundamental lack of faith existing among most businesses and consumers on the Web.

This study examines online buying behavior using transaction cost theory. Specifically, we examine: (1) what

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factors are associated with transaction cost when considering purchasing something online?; and (2) to what extent does each factor affect transaction cost? Results from this study will help determine the applicability of the transaction cost economics (TCE) model in explaining consumers' online buying behavior.

The objectives of this study are:

1. to explain consumer's online buying behavior from the perspective of TCE theory based on three dimensions, i.e., uncertainty, trust and buying frequency;
2. to verify the TCE model by analyzing field data obtained in Singapore; and
3. to examine whether the TCE model is valid for samples collected through two different sources (online ads and emails).

In summary, this study extends previous research in the following ways. First, it expands on the list of antecedent variables affecting transaction cost. Second, previous research has traditionally involved Western samples. By collecting data from Singapore, this research examines the applicability of the TCE model in a non-Western context. Third, the TCE model is examined using data from two sources, thereby providing greater confidence in the results.

2. Literature review

A transaction is a process by which a product or service is transferred across a technologically separable interface [11]. In classic economic theory, it is assumed that information is symmetric in the market and the transaction can be executed without cost. In reality, however, markets are often inefficient. In order to proceed with a transaction, consumers must search for information and monitor the ongoing process to ensure a favorable deal. The costs involved in such transaction-related activities are called transaction costs.

Transaction cost economics (TCE) is most commonly associated with the work of Oliver Williamson [11–14]. Rooted in the economic theory, TCE theoretically explains why a transaction subject favors a particular form of transaction over others. The basic principle of TCE is that people like to conduct transactions in the most economic way. Williamson [14] assumed that firms pursued profit maximization, and that profit maximization required costs minimization. Implicitly, TCE is an equilibrium theory that assumes rationality on the part of owners and/or managers. Williamson described production cost as being similar to the cost of building and running an "ideal" machine, while transaction cost is incurred by departures from perfection, such as friction. In the economic sector, the ideal machine would be a perfectly efficient market [11]. Such a market requires all the information to be available to all parties as well as the presence of perfect competition. Deviations

from the perfectly efficient market result in greater costs to firms when they attempt to buy or sell goods or services. For instance, the lack of information about alternative suppliers may lead firms to pay too high a price for goods, while the lack of information about customers' credit and reputation may result in bad debts. These are elements of transaction cost. Further, Williamson [14] argued that firms want to minimize their transaction costs. Under some circumstances, transaction cost may be lower if the transaction takes place in an open market (market), while under other situations, transaction cost will be lower if managers coordinate the transaction (hierarchy). There are two assumptions underlying the choice between market and hierarchy. They are bounded rationality and opportunism.

Bounded rationality refers to the fact that people have limited memories and limited cognitive processing power [14]. People cannot digest all the information they have and they cannot accurately work out the consequences of the information. For example, no matter how knowledgeable managers are, they are not able to accurately consider all possible alternative courses of action. Meanwhile, they also have to take into account the unpredictable reactions of their competitors. Therefore, reaching an optimal decision may be difficult. As the result, managers tend to satisfy most, rather than all, conditions when making decisions [15].

In contrast, *Opportunism* refers to the possibility that people will act in their own selfinterest [14]. That is, some people may not be entirely honest and truthful about their intentions some of the time, or they may attempt to make use of unexpected circumstances that gives them the chance to make the most off another party in a transaction.

These two assumptions represent somewhat of a departure from standard economic models, but not a terribly dramatic one [14]. People are still assumed to be rational, in the sense that they want to maximize the profits of the firms they manage, but there are limits on their ability to make a truly rational decision to achieve this goal. Likewise, self-interested behavior is assumed in traditional economic theory. Guileful behavior, as Williamson [14] put it as "human nature as we know it", is not unexpected.

The real illuminating power of TCE comes from the three dimensions or variables that are employed to characterize any transaction. They are frequency, uncertainty and asset specificity. Transactions can be rare or frequent; have low or high uncertainty; or involve specific or non-specific assets.

Frequency: The effect of frequency on transaction cost is very strong. A firm is not likely to have strong justification for having "in-house" provisions of a good or service that is rarely used. For example, most firms will not set up their own management consultancy department because of the infrequent usage of such services. If a firm decides to set up its own consultancy service, it would have to try selling its services to others when it is not serving its own firm. But why should we expect such an in-house consultancy service to be able to perform better than professional consultants? In TCE, this firm is expected to outsource its consultancy

needs through the market and hire firms for which cons ultancy is a "core competence" [16].

Uncertainty: Uncertainty causes problems because of bounded rationality, information asymmetries and the danger of opportunism. The issue here is the difficulty to predict possible events that may occur during the course of a transaction. As such, the length of time over which the transaction will happen becomes crucial [14]. Transactions that occur in "spot markets" will have relatively little uncertainty because one does not have to predict the future. In contrast, transactions that involve a commitment over time have more uncertainty built in. For example, there is uncertainty in the transaction when one cannot be sure that the other party will not go out of business or try to renegotiate the contract at some future time during the life of the contract. Here, uncertainty underscores the need of the transacting parties to safeguard the contract to protect themselves. This, in turn, is expected to raise the costs of writing, monitoring and enforcing a contract.

Asset specificity: Asset specificity refers to the lack of ease with which the human capital (employees), physical assets, and facilities specifically tied to the manufacturing of an item can be used by alternative users or put to alternative uses [14]. A central premise of transaction cost theory is that transaction cost increases as transactors make greater asset-specific investments. Increased specialization within a production network cannot be reached without a cost. When transactors make investments in specialization, they will make special effort (i.e., complicated contracts) to design a bilateral, or at least quasi-bilateral, exchange for a considerable period thereafter [14]. As asset specificity increases, due to transactors' fear of opportunism, more complex governance structures (i.e., more complicated contracts) are required to eliminate or attenuate costly bargaining over profits from specialized assets [11]. Transactors then have to put more efforts to achieve more complex governance structures. Thus, transaction costs are presumed to increase with an increase in asset specificity.

TCE has been successfully applied in many domains. Among the well-known examples are TCE applications to forward vertical integration [17], contract typology [18], and collaboration of buyer-seller relationship [19]. In the area of e-commerce, TCE has been applied to explain many issues at the firm or individual level, such as development of Web strategy [5], strategic alliance structuring [20] and the acquisition decision of consumers [21,22]. Since purchasing from online stores can be considered as a choice between the Web and traditional stores, it is reasonable to assume that the consumer will prefer the channel with lower transaction costs. While attracted by convenience of online stores, consumers also perceive a lot of uncertainty on the Internet, which increases their transaction costs. This makes TCE a viable theory for explaining online buying behavior. Specifically, whether a consumer would buy a product through the Internet is determined (at least partially) by the perceived transaction cost of the consumer.

3. Research model and hypotheses

In this study, a TCE model is used to explain consumers' buying behavior on the Internet in terms of three dimensions, namely, uncertainty, trust, and buying frequency. Note that we replaced asset specificity with trust as we felt that in the online environment, the latter is more important (as evident by the surge of research on trust in e-commerce e.g., [23]). Further, trust has been incorporated into the TCE literature by many researchers (e.g., [24,25]). The role of trust in transaction cost theory is important because, to some extent, it reduces transaction cost.

The omission of asset specificity in our model can be justified as follows. Most specific investments to facilitate online buying, such as personalized online shopping services and payment security software, are developed and often provided freely to consumers by online stores. In general, consumers need two kinds of asset specificity in online shopping, namely, physical asset specificity and human asset specificity. Physical asset specificity can be any physical equipment to facilitate consumers' online shopping. The equipment can be a computer or other devices to connect consumers to the Internet, which are not considered as specific asset generally since they can be used for other purposes. Human asset specificity can be any special human expertise needed in online shopping. Along with the increasing acceptance of the Internet, skills and knowledge that consumers developed for online shopping can be used for other activities on the Internet, such as browsing and searching. Thus, in most cases, these two kinds of assets are not some specific investments that consumers make for online shopping only. Hence, asset specificity is not considered in this study but could be examined in future research.

Fig. 1 shows the hypothesized relationship among the three factors of transaction cost and consumers' willingness to shop online.

3.1. Uncertainty

Uncertainty is a principal factor in the TCE theory [14]. It arises from the difficulty in predicting the action of the other party in the transaction, due to opportunism and bounded rationality. From the consumer's point of view, the obvious drawback of online transaction is that it involves more uncertainty than its physical counterpart [9], while too much uncertainty in the purchasing process is taken as potentially harmful to their interests. The TCE theory indicates that an appropriate response to too much uncertainty in the transaction is to quit the transaction [14,26].

In this study, four kinds of uncertainty related to online buying are examined, namely, *branding uncertainty of online stores, performance uncertainty of products, behavioral uncertainty of online stores, and environmental uncertainty of online stores*.

The American Marketing Association defines a brand as "a name, term, sign, symbol or design, or a combination of
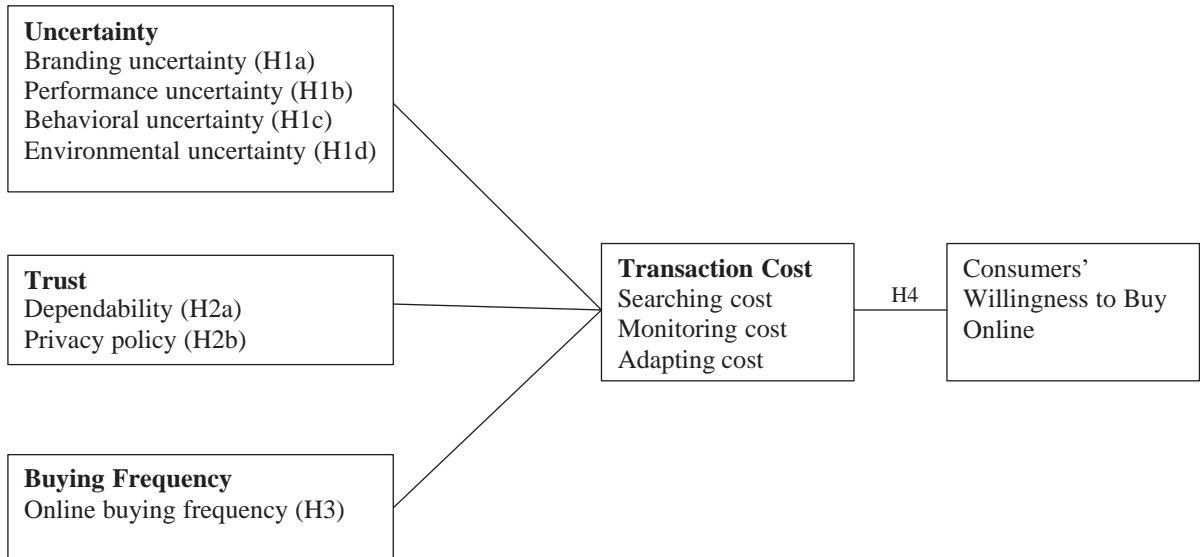
Fig. 1. Research framework.

them, intended to define the goods or services of one seller or a group of sellers and to differentiate them from those of competitors." A strong brand offers consistency, certainty and promise of quality to customers [27]. Hence, *branding uncertainty of online stores* refers to consumers' inability or perceived difficulty in ascertaining the branding of online stores. Consumers put themselves at risk when they make a purchase in an online store that they are not familiar with or even have never heard about. Results from past research in consumers' buying decision making [28,29] indicated that favorable brand and store name positively influence consumers' perceptions of quality and value and consumers' willingness to buy. In online buying, strong branding of online stores is more attractive to consumers as they tend to provide reliable information without the need to try the merchandise [30]. Thus, branding of online stores has certain influence on the decision of customers to buy online as well known brands reassure consumers and reduce transaction cost.

Performance uncertainty of products refers to the difficulty in ascertaining the quality of purchased products. Consumers are likely to wonder if purchased products will meet their expectation upon ordering and whether they will perform well. When consumers shop physically, they can examine a product and then decide whether they will take it home. In the case of online buying, they rely on the quality examination that online stores do for them.

Behavioral uncertainty of online stores refers to the difficulty in ascertaining the actual performance of online stores or their adherence to contractual agreements [11]. After-sale service and timely response to inquiries are of great concern to consumers, for these kinds of services protect their inter-

ests. In the case of online buying, what consumers worry about is that online stores could dismiss their inquiries or requests for help and offer poor aftersales service, thereby increasing transaction cost.

Environmental uncertainty of online stores [17] refers to the difficulty in looking for products online in light of changes of shopping circumstances. For example, any changes made to an online store's Web pages could cause difficulty to consumers searching for products to buy, thereby increasing transaction cost. In general, it follows that:

H1: *Uncertainty is positively related to transaction cost*

H1 can be tested in terms of sub-hypotheses which are stated as follows:

H1a: *Branding uncertainty is positively related to transaction cost.*
H1b: *Performance uncertainty is positively related to transaction cost.*
H1c: *Behavioral uncertainty is positively related to transaction cost.*
H1d: *Environmental uncertainty is positively related to transaction cost.*

3.2. Trust

In this study, trust refers to the belief that needed structural conditions are present to enhance the probability of achieving a favorable outcome in an endeavor like e-commerce [23]. Mistrust results from uncertainty and risk, and tends

to increase transaction cost. It follows that:

H2: *Trust of online stores is negatively related to transaction cost.*

This general hypothesis can be examined in terms of two components of trust: *dependability of online stores* [31] and *privacy policy* [32]. *Dependability* refers to the ability of the online store to provide consumers with outcomes that match what the former has said or promised [31]. In the context of online buying, consumers rely on online stores to perform many activities in the transaction process such as examining product quality and providing after-sale services. If consumers perceive that online stores are less dependable or not trustworthy, they will spend more time and effort in monitoring their orders, and their perceived transaction cost will increase. Note that while dependability may seem related to branding uncertainty, conceptually it is different in that the latter is related primarily to the branding of online stores while the former is related to perceptions of store ability to provide consumers with outcomes that match what was said or promised. Further, dependability is related to integrity [33] and previous research [34,35] suggest that consumers who perceive high dependability of the online store are prone to believe that the online store is well organized and favorable for making purchases. If online stores are dependable or trustworthy, consumers would perceive less risk and lower transaction cost. Therefore, we hypothesized that:

H2a: *The dependability of online stores is negatively related to transaction cost.*

Privacy policy refers to conditions where the organizations disclose their intentions on how they will use their customers' information [32]. In the e-commerce setting, a high level of privacy protection perceived by consumers can counteract the negative effect of relatively high level of uncertainty on the transaction [36] as to make privacy policy an important variable to consider in this study. For consumers, it would be easier to accept the electronic distribution channel when perceived privacy policy to outside parties is detailed. In other words, a detailed privacy policy may reduce uncertainty and increase trust, which in turn would reduce transaction cost. Further, there is some evidence that privacy policy is highly correlated with repeat purchases [37] which usually occur when transaction cost is low. Hence, we suggest that privacy policy is negatively related to transaction cost. It follows that:

H2b: *The degree of detail of privacy policy of online stores is negatively related to transaction cost.*

3.3. Buying frequency

Williamson [14] suggested that the frequency with which transactions recur is one of the critical dimensions for de-scribing transactions. In Internet shopping, buying frequency also has an influence on consumers' perceived transaction cost and their willingness to buy online. The reaction of inexperienced and experienced online consumers to the same level of uncertainty in the transaction process could be different because there is a difference in their tolerance of uncertainty. Hence, the following hypothesis is put forth:

H3: *Buying frequency is negatively related to perceived transaction costs.*

3.4. Transaction cost

Three kinds of transaction costs involved in the online buying process are considered in this study. They are searching costs (time and effort used to search for relevant products or services information and compare prices or other attributes among different online stores), monitoring costs (time and effort used to ensure that the terms of the contract have been met), and adapting costs (time and effort related to changes and customer service and support during the period of contract). Consumers will choose transaction forms that economize on perceived transaction cost [38]. Thus, we hypothesized that:

H4: *Transaction cost is negatively related to consumers' willingness to buy online.*

4. Method

Multi-item indicators derived from past research are used for gathering data to measure the constructs (Table 1). Note that transaction cost is measured using the mean of items measuring search cost, mean of items measuring monitoring cost and mean of items measuring adapting cost as is commonly done in structural equation modeling (SEM) analysis.

A questionnaire was used to collect data for this study. Three rounds of pretests were conducted. The first pretest involved five graduate students and two working professionals. Several changes were made to wordings and layout of the questionnaire and a second pretest was carried out with ten students and four working professionals. Modifications were made based on feedback and the questionnaire was tested with thirty students. As there were no major comments, the questionnaire was deemed ready for collection.

The Internet is used as the data collection tool since this study is aimed at analyzing consumers' online buying behavior via the Internet. The survey was announced through the following three media, namely, newsgroups and hypertext links from Faculty homepage (called online ads in the rest of paper) and personalized email, in order to get a good representative sample of general Internet users in Singapore. Further, the email sample was randomly derived from various mailing lists.

Table 1
Operationalization of variables and their sources

Construct	Item	Source
Branding uncertainty of online stores	Based on online stores' brand name, it is difficult to determine whether online stores: a. offer adequate information about choices available. b. provide sufficient information about services available. c. are easy to contact. d. have a good reputation (dropped). e. have been around for a long time (dropped).	[28,29,39]
Performance uncertainty of products	When shopping online, it is difficult to be assured that: a. the product is reliable (dropped). b. the product will perform as well as it is supposed to. c. the product will perform as well as others.	[22,40] [41,42]
Behavioral uncertainty of online stores	When shopping online, it is difficult to: a. return purchases made online (dropped). b. exchange the defective product. c. get after sale service.	
Environmental uncertainty of online stores	When online stores make changes to their Web page, it is: a. difficult to find the desired product. b. time consuming to find the desired product. When online stores rearrange their merchandise assortment, it is: c. difficult to find the desired product (dropped). d. time consuming to find the desired product (dropped).	[43,57]
Dependability	What is your assessment of the dependability of online stores? a. Online stores can't be relied on (R). b. Online stores are undependable (R). c. Online stores often make false claims (R)(dropped).	[23,31]
Privacy policy	I would like to have the following from an online store: a. a policy statement not to sell personal information. b. a policy statement saying personal information will not be released without consent. c. a policy statement indicating information will be kept confidential.	[32,36]
Buying frequency	On average, how often do you buy online? (1) less than once per month, (2) about once a month, (3) a few times a month, (4) a few times a week, (5) about once a day, (6) several times a day.	[58]
Searching costs	To what extent do you agree with the following statement about the cost related to buying online: a. I spend a lot of time looking for information before buying online: b. I spend a lot of effort getting information that would be helpful in decision-making of online purchase. c. Usually there is so much to do that I wish I had more time to look for information before buying online. d. I usually find myself pressed for time in searching for information before buying online.	[22,44]
Monitoring costs	To what extent do you agree with the following statement about the cost related to buying online: a. I spend a lot of time contacting the online store to check whether products I ordered are processed. b. I spend a lot of effort contacting the online store to check whether products I ordered are processed. c. I spend a lot of time monitoring whether products I ordered are processed. d. I spend a lot of effort monitoring whether products I ordered are processed.	[45,57]
Adapting costs	It takes time and effort to: a. make changes to orders that has been sent to online stores. b. arrange another time to receive products I bought if	[45]

Table 1 (*continued*)

Construct	Item	Source
Willingness to buy online	they are not physically delivered on time as promised. c. deal with any unexpected changes. Please indicate the likelihood that you would buy goods from online stores (Scale: (1) very low, (5) very high) a. the likelihood of purchasing online is: b. the probability that I would consider buying online is: c. my willingness to buy the product online is:	[28]

Note: Dropped = item dropped as the result of confirmatory factor analysis; R = reverse coded. Unless otherwise stated, scale used is (1) strongly disagree to (5) strongly agree.

Note that we did not focused on a particular online store as respondents may not be familiar with it. Further, doing so may result in little variance in measured variables. For example, if we had focused on a specific online store website such as Amazon.com, we may find most respondents indicating very low uncertainty and low transaction cost, thereby making it difficult to test the hypothesis since there is little variance. Instead, we asked respondents to focus on a product category (e.g., books, computer hardware and software) that they are familiar with (i.e., use it as their frame of reference when answering the survey). Java-script programming was used to remind respondents of their frame of reference for each section of the questionnaire. In other words, their choice of product category appeared as a frame of reference at each section of the questionnaire.

We are hence making an assumption that relationships among variables (e.g., uncertainty and transaction costs) will hold regardless of the type of products. This is consistent with Liang and Huang's [22] work as they also combine different product types in their analysis of transaction cost model for consumer acceptance of products in electronic markets.

5. Results

In total, 1171 responses were collected (307 from online ads and 864 from email requests). For the personalized e-mail category, 2938 emails were sent and 864 replied, thus yielding a survey response rate of 29.4%. As shown in Table 2, 64.9% are males, and Chinese comprises the majority (90.6%) of respondents. Majority of respondents (85.2%) are in the age group of 18–35 years. Most respondents are highly educated with 89.4% of them attaining at least a diploma or other higher qualifications.

Before the analysis, a source bias test using the Chi-square statistic was performed. The results of the χ^2 test on demographic profile of respondents (Table 2) indicate that there is a significant source bias in the response sample. The responses from online advertisement are significantly different from those from email in terms of respondents' gender, nationality, age, education background, occupation and personal income except their ethnic group. Hence, we decided to divide the sample into two groups (online ads and email) for data analysis.

5.1. Structural equation modeling

The hypothesized model was analyzed using SEM. Felson and Bohrnstedt's [46] modeling was performed. It provides a test for the significance of any differences found between two kinds of data collected through different means (online ads and email) used in this study. Meanwhile, this method provides more efficient parameter estimates than two single-group models. Before running AMOS, a series of principal component analyses with varimax rotation were conducted to test the validity of the various constructs for two groups of data. Items with a loading lower than .5 were removed. The independent variables loaded into their respective factors. Items measuring transaction cost loaded onto 4 factors (instead of three) with search cost separated into two factors. As the eigenvalue of the fourth factor was marginally above 1.0, we decided to constrain the principal component to three factors. In doing so, the items loaded onto three factors consistent with our three types of transaction cost. The results are shown in Table 3. In addition, reliability analysis was carried out using Cronbach Alpha that is a measure of internal consistency. The results show that all constructs are valid and reliable (Table 4a).

5.2. Testing the measurement model

Two confirmatory factor analysis (CFA) of the measurement model were performed for exogenous variables and endogenous variables, respectively, to ensure that the indicators of both groups were reliable. The GFI and AGFI for the measurement model of exogenous variables were .95 and .92, respectively. The GFI and AGFI for the measurement model of endogenous variables were .93 and .88, respectively. The indices for the measurement model indicate a good fit. The principal approach used to assess the measurement model is the composite reliability and variance-extracted measures for each construct. According to Hair et al. [47], the acceptable values of construct reliability and

Table 2
Demographic profile

Demographic profile	Online Ads	Email	Total	Percent	Chi-square
Gender					df = 1
Male	167	593	760	64.9	Chi-sq = 20.155
Female	140	271	411	35.1	p = .000
Ethnic group					
Chinese	286	775	1061	90.6	df = 5
Malay	4	20	24	2.1	Chi-sq = 7.03.5
Indian	7	25	32	2.7	p = .218
Eurasian	3	3	6	.5	
Other Asian	5	25	30	2.6	
Others	2	16	18	1.5	
Age					
Under 18	4	24	28	2.4	df = 5
18–25	155	402	557	47.5	Chi-sq = 36.256
26–35	137	304	441	37.7	p = .000
36–45	11	87	98	8.4	
46–55		40	40	3.4	
56–65		7	7	.6	
Education					
Primary	0	0	0	0	df = 6
Secondary	3	38	41	3.5	Chi-sq = 98.624
Pre U/junior college	32	49	81	6.9	p = .000
Polytechnic	18	149	167	14.3	
Bachelor	96	406	502	42.9	
Master	127	188	315	26.9	
Doctor	30	30	60	5.1	
Other	1	4	5	.4	
Occupation					
Unemployed		25	25	2.1	df = 3
IT related	60	253	313	26.7	Chi-sq = 139.419
Non IT related	68	392	460	39.3	p = .000
Student	179	194	373	31.9	
Income					
$25000 & Below	221	346	567	48.4	df = 4
$25001–50000	64	372	436	37.3	Chi-sq = 91.210
$50001–70000	11	63	74	6.3	p = .000
$70001–100000	6	33	39	3.3	
$1000001 & More	5	44	49	4.2	
Missing			6	.5	

Note: $N = 307$ (online ads group) and $N = 864$ (Email group).

the variance-extracted measure are above .70 and .50, respectively. Table 4b presents the computations of estimates for the constructs.

5.3. Testing structural model

At the individual path level, the standardized estimation coefficients were estimated. Since both positive relationship and negative relationship are expected in the hypotheses, a two-tailed test of significance is employed. The Squared Multiple Correlation (SMC) of the transaction cost in-

dicates that 80.4% of the variance in transaction cost was explained by performance uncertainty, environmental uncertainty, behavioral uncertainty, dependency, privacy policy and buying frequency in online ads group, while 64.2% of the variance in transaction cost was explained by the same variables in email group. Similarly, 23.2% of the variance in consumers' willingness to buy online was explained by transaction costs in online ads group, while 47.7% of the variance in consumer's willingness to buy online was explained by transaction costs in email group.

Table 3
Principal component analysis

Items	Loadings	
	Online ads	Email
Branding uncertainty		
Offer adequate information about choices available.	.88	.88
Provide sufficient information about services available.	.92	.93
Are easy to contact.	.85	.89
Performance uncertainty		
The product will perform as well as it is supposed to.	.89	.92
The product will perform as well as others.	.88	.91
Behavioral uncertainty		
Exchange the defective product.	.77	.87
Get after sales service.	.80	.81
Environmental uncertainty		
Difficult to find product when Web page is changed.	.83	.80
Time consuming to find product when Web page is changed.	.89	.86
Dependability		
Online stores cannot be relied on (R).		
Online stores are undependable (R).	.93	.92
	.90	.92
Privacy policy		
Not to sell personal information.		
Not to release personal information without consent.	.90	.89
Indicating information will be kept confidential.	.91	.93
	.89	.89
Searching cost		
I spend a lot of time looking for information.		
I spend a lot of effort getting information.	.84	.67
I wish I had more time to look for information.	.83	.65
I usually find myself pressed for time.	.77	.84
	.66	.80
Monitoring cost		
I spend a lot of time contacting the online store.	.85	.78
I spend a lot of effort contacting the online store.	.90	.85
I spent a lot of time monitoring whether products I ordered are processed.	.85	.84
I spent a lot of effort monitoring whether products I ordered are processed.	.82	.79
Adapting cost		
Make changes to the order that was put online.	.69	.72
Arrange another time to receive products.	.86	.84
Deal with unexpected changes.	.81	.80
Willingness to buy online		
The likelihood of purchasing online is:	.86	.88
The probability that I would consider buying online is:	.85	.88
My willingness to buy the product online is:	.84	.84

Note: R = reverse coded.

Table 4

Construct	No. of items	α Value for online ads group	α Value for email group
(a) Reliability analyses			
Branding uncertainty (BU)	3	.89	.89
Performance uncertainty (PU)	2	.79	.89
Environmental uncertainty (EU)	2	.85	.91
Behavioral uncertainty (BehU)	2	.74	.87
Dependability (Depen)	2	.91	.92
Privacy policy (PP)	3	.89	.93
Searching cost (TC1)	4	.78	.82
Monitoring cost (TC2)	4	.90	.90
Adapting cost (TC3)	3	.73	.80
Willingness to buy online (WTB)	3	.84	.90

(b) Computation of composite reliability estimates for the constructs in two groups

Construct	Online ads group		Email group	
	Composite reliability	Variance extracted	Composite reliability	Variance extracted
Branding uncertainty (BU)	.86	.74	.90	.74
Performance uncertainty (PU)	.80	.67	.90	.82
Environmental uncertainty (EU)	.86	.77	.91	.83
Behavioral uncertainty (BehU)	.77	.64	.87	.78
Dependability (Depen)	.90	.87	.92	.85
Privacy policy (PP)	.90	.74	.93	.82
Searching cost (TC1)	.70	.90	.82	.56
Monitoring cost (TC2)	.70	.90	.89	.66
Adapting cost (TC3)	.67	.86	.82	.60
Willingness to buy online (WTB)	.88	.71	.88	.70

$$\text{Composite reliability} = \frac{(\sum standardized\ loadings)^2}{(\sum standardized\ loadings)^2 + \sum indicator\ measurement\ error}$$

$$\text{Variance extracted} = \frac{(\sum standardized\ loadings)^2}{\sum standardized\ loadings^2 + \sum indicator\ measurement\ error}.$$

Because χ^2 is sensitive to larger sample size, the criterion that the χ^2 statistic should be insignificant with a p-value above .05 is not satisfied. According to Joreskog and Sorbom [48] this criterion is rarely satisfied with large sample size. The most widely used overall model fit indices are the goodness of fit index (GFI), the adjusted goodness of fit index (AGFI), the root mean residual (RMR), and the normed fix index (NFI). Threshold values for these indices are above .90, above .80, below .08, and above .90, respectively [49,50]. Another measure that attempts to correct for the tendency of the Chi-square statistic with a sufficiently large model is the root mean square error of approximation (RMSEA), where values ranging from .05 to .08 are deemed acceptable. In this study, values of GFI, AGFI, RMR, NFI, and RMSEA are .91, .87, .06, .92 and .05, respectively. All of them fall within the recommended ranges. The results of the SEM for online ads group and email group are shown in Figs. 2 and 3, respectively.

For simultaneous analysis of online ads group and email group, as hypothesized, performance uncertainty, environmental uncertainty, and behavioral uncertainty have significant positive relationships with transaction cost, while buy-ing frequency has a significant negative relationship with transaction cost ($p < .001$). However, relationships between branding uncertainty and transaction cost, and privacy policy and transaction cost are not significant.

6. Discussion

Results in this study confirm our initial argument that the transaction cost consumers perceive in online transactions has an effect on their willingness to buy online. They suggest that perceived transaction cost in terms of time and effort invested by consumers in online transaction have a negative relationship with consumer's willingness to buy online.

Behavioral uncertainty of online stores has the strongest effect on consumers' perceived transaction cost among the various kinds of uncertainty. The positive relationship between behavioral uncertainty of online stores and perceived transaction cost (H1c) is supported ($\beta = .46$, $p < .001$ in online ads group, and $\beta = .36$, $p < .001$ in email group). Consumers' buying decision is determined by whether their interests as clients can be protected in a transaction
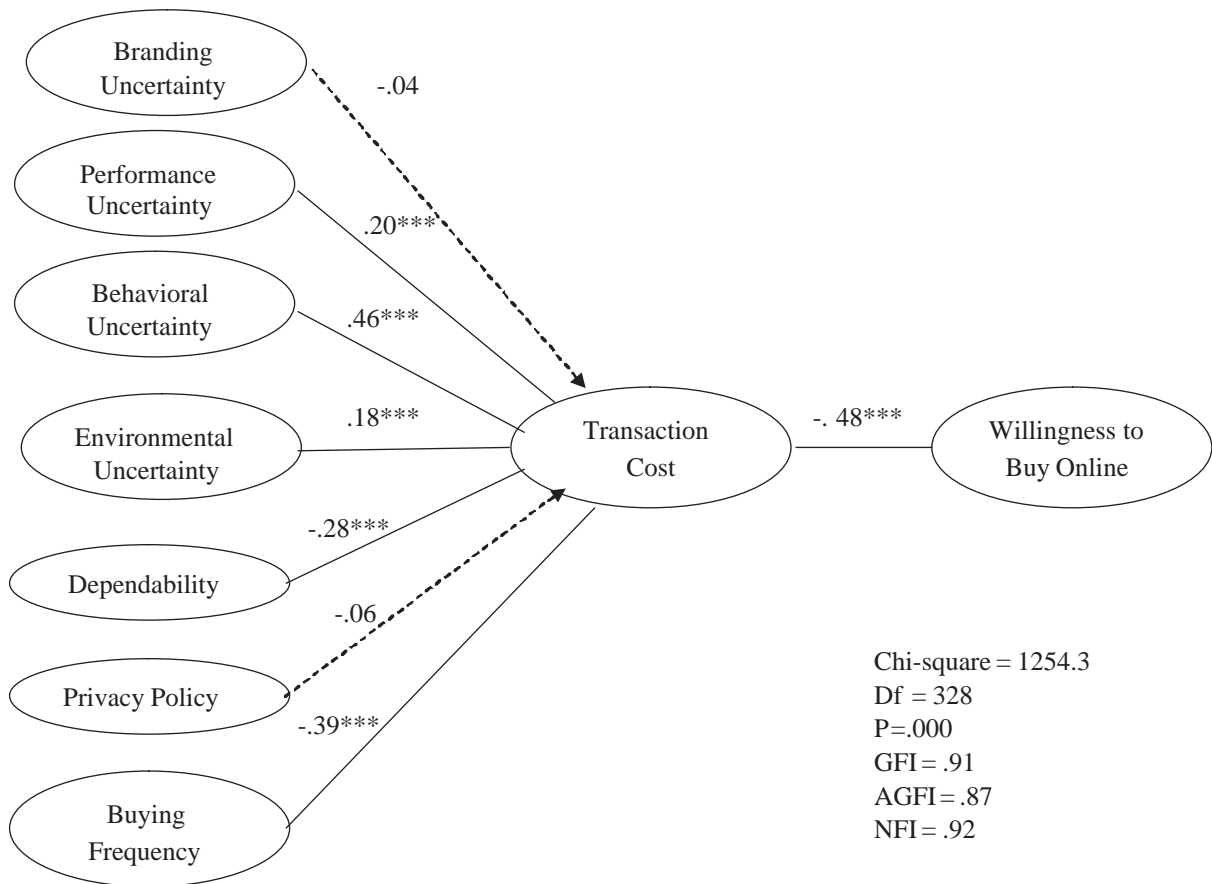
Fig. 2. Structural model for online ads group. ***$p < .001$, **$p < .01$, *$p < .05$.

process (including after sales service). In some cases, since online stores may not have a physical presence, consumers can contact online stores only via email, telephone and fax. This fact prompts consumers to perceive more behavioral uncertainty of online stores than that of traditional stores. They are afraid of getting poor after-sales service and of getting their inquiries or request for help ignored by online stores. Thus, consumers have to spend more time in searching for product and store-related information and monitoring online stores to check if their orders are processed as expected.

Findings show that the performance uncertainty of products has a positive relationship with transaction cost ($\beta = .20$, $p < .001$ in online ads group, and $\beta = .18$, $p < .001$ in email group), which is consistent with past research [22,51]. Consumers often worry about product quality without being able to physically check products prior to purchase. Hence, the difficulty of inspecting products when buying online increases uncertainty and transaction costs.

This study also supported the hypothesis that environmental uncertainty of online stores is positively related to

perceived transaction cost (H1d) ($\beta = .18$, $p < .001$ in online ads group, $\beta = .13$, $p < .001$ in email group), which is consistent with findings of John and Weitz [17]. Usually online stores attract more online consumers by updating their visual storefront. However, they might also lose consumers by doing so, especially those consumers who have few online shopping experiences, because consumers have to invest additional time and effort to get familiar with the new purchasing environment or process.

We hypothesized that branding uncertainty of online stores is positively related to perceived transaction cost (H1a). This hypothesized relationship was not supported by empirical data in this study. This result is surprising since branding helps to minimize transaction cost. One possible reason is that most online stores have not established their online branding and it may not be worthwhile for consumers to spend time and effort ascertaining the truthfulness of information provided by online stores if they generally purchase low cost products online. Another reason is that there may be need for future research to refine the measurement scale for branding uncertainty.
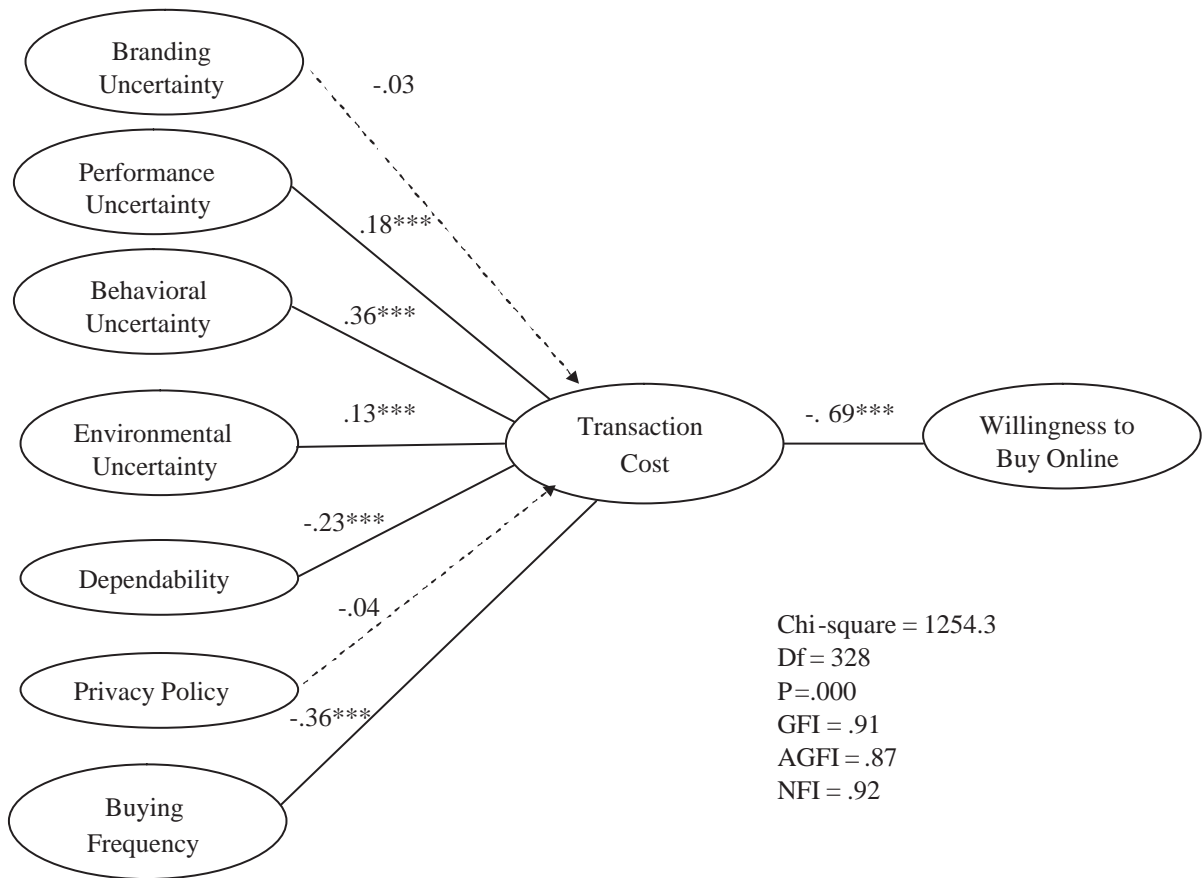
Fig. 3. Structural model for email group. ***$p < .001$, **$p < .01$, *$p < .05$.

The results indicate that the dependability of online stores is negatively related to perceived transaction costs. Hence H2a is supported ($\beta = -.28$, $p < .001$ in online ads group, $\beta = -.23$, $p < .001$ in email group). This finding is consistent with Williamson [11], who suggested that there is a negative relationship between trust and transaction cost. The other component of trust is online stores' privacy policy about personal information. We hypothesized that privacy policy is negatively related to perceived transaction cost (H2b). However, results indicated the relationship is insignificant ($\beta = -.06$, $p > .05$ in online ads group, and $\beta = -.04$, $p > .05$ in email group). One possible reason is that consumers can only passively accept the privacy policy imposed by online stores. Further, if consumers do not pay much attention to privacy policy in the physical world, they may be less likely to worry about privacy policy in the online world due to lack of knowledge or apathy. Another reason is that while detailed privacy policy may increase trust, its effect on transaction cost may be limited.

In our hypothesized model, we suggested that online buying frequency is negatively related to perceived

transaction costs (H3). This hypothesis was supported ($\beta = -.39$, $p < .001$ in online ads group, $\beta = -.36$, $p < .001$ in email group), which is consistent with past findings [14,52,53]. One explanation is the learning effect in online buying. Consumers with high online buying frequency sense less transaction cost then those with low online buying frequency. This may be because consumers get used to the process once they have experience buying online. The learning process reduces transaction cost associated with online buying.

The reaction of inexperienced and experienced online consumers to the same level of uncertainty in the transaction process could be different because there is a difference in their tolerance of uncertainty. Moreover, generally speaking, to customers who have online buying experience, the perceived uncertainty is reduced sharply because of their experience with buying online, whereas customers who do not have online buying experience will perceive much more uncertainties in Internet shopping.

The hypothesis (H4) that perceived transaction cost is negatively related to consumer's willingness to buy on-

line was supported ($\beta = -.48$, $p < .001$ in online group, $\beta = -.69$, $p < .001$ in email group). This result is expected and consistent with TCE theory which stated that consumers will choose transaction methods that economize on transaction cost [11,12]. When making buying decision, consumers will prefer a transaction channel that costs the least among all the available choices. In other words, consumers weigh costs (search, monitoring, adapting costs) and benefits (the value advantage of the best buy) when choosing a shopping channel [19,54]. This consideration will affect their decision to buy online or in physical stores. Thus, if consumers perceive high transaction cost in online buying, they will be less willing to buy online. Further, as search, monitoring and adapting costs change, consumer's willingness to buy online tend to change inversely also.

7. Limitations

This study has several limitations. First, the study is cross-sectional in nature, thereby making it difficult to infer causal relationships between research variables. Future research can use longitudinal study and interviews to collect a richer set of data. Second, as the data were collected online, there is a question of representativeness and generalizability of the sample. This is not a serious limitation as we expect potential online shoppers to have Internet access. Although, we found that data collected using different means (online ads and emails) do differ in some demographic characteristics, the hypotheses testing results are similar. This reinforces the validity of our findings.

Third, as the sample was collected in Singapore, generalizability to other cultures may be limited. However, as TCE theory has been shown to be valid in many domains and cultures, this limitation is not serious. Future research can examine the applicability of our model in other cultures.

8. Conclusion and implications

This study contributes to existing literature in several ways. First, although many research [21,55] have used TCE to explain the rise of global electronic markets and the cost-savings afforded by network-based communication, few have conducted empirical studies using TCE to explain the buying behavior of consumers in electronic commerce. Hence, a contribution of our paper is the development and empirical testing of a consumer choice model based on TCE to examine consumer online buying behavior. Second, our study extends Liang and Huang's [22] work by examining various antecedents that affect transaction cost. We also confirm that transaction cost is negatively related to willingness to buy online. Third, previous research has commonly used samples from Western countries. By examining TCE theory in an Asian context, we have demonstrated its applicability in a non-Western context. Fourth, by examining various types of uncertainty, we show that different types of uncertainty may have different impact on transaction cost. In particular, consumers are concerned about behavioral uncertainty of online stores. Fifth, we used both emails and online ads to collect data for this study. In doing so, we are able to examine the effectiveness of various data collection methods and test the research model using samples collected by different methods. As the results for both groups (emails and online ads) were similar, this study reinforces the robustness of the TCE model in explaining consumer buying behavior in electronic commerce. Using the TCE theory is useful as it provides more substantive understanding of the factors associated with the consumers' willingness to buy online. Given the relatively good overall goodness of fit of the model, we believe that this study is a valuable addition to researchers in their efforts to understand consumer buying behavior on the Internet.

In conclusion, the results show that consumers' online buying decision is negatively associated with their perceived transaction cost, whereas perceived transaction cost is associated with behavioral uncertainty, performance uncertainty, environmental uncertainty, dependability of online stores, and buying frequency. When consumers perceive more dependability of online stores and less uncertainty in online shopping and have more online experiences, they would prefer to shop online. The results confirm the argument by Wigand [52], who proposed the use of TCE theory to interpret consumers' online decision process. According to his framework, consumers' acceptance of electronic channel is affected by transaction cost, while uncertainty and trust affect transaction cost.

This study indicates that behavioral uncertainty of online stores is one of the major factors that affect the transaction cost of online buying. Consumers are also concerned about uncertainty related to products and services provided by online stores. If online stores were to provide some clear exchange or refund policy to minimize the uncertainty perceived by consumers in Internet shopping, consumers would be more likely to buy online. Further, to minimize uncertainty, online stores should make it clear to consumers regarding their terms and conditions on cancellation, payment, delivery and dispute resolution. Managers of online stores should recognize consumers' right to return goods, within a specified time limit, without having to give a reason. Online stores who can provide better after sales services and handle consumers' inquiries and complaints promptly will add credibility to themselves. Building a trusting relationship with consumers is also very important as it would encourage customer loyalty.

A trusting relationship between consumers and online stores facilitates online transaction. Consumers would certainly feel more comfortable to buy in online stores that they trust. There could be two ways to build a trusting relationship with consumers. One is not to make false claim about products and services, while the other is to provide satisfactory after sales services.

According to survey results, online shoppers only compose 34% of Internet users [56]. More than 50% of Internet users have not experienced online shopping yet. Most of them are dissuaded by distrust in online shopping. To attract those potential customers, online stores could give consumers incentives at their first-time purchase, such as free gift or discount. Consumers usually are more willing to try a new thing when they feel motivated. The first successful online buying experience will increase the likelihood that they will continue to buy online in the future.

The following are some recommendations for future research. First, the data fail to support the relationship between branding uncertainty of online stores and transaction cost. One possible reason could be the measurement scales used which can be further refined in future research. Second, trust could be further investigated in future studies. Trust is an important factor in consumers' online buying behavior. Measures that effectively help online stores build trust relationship with their customers need to be investigated.

Third, researchers could further investigate the effect of privacy policy on consumers' online buying behavior. Researchers could employ other measures, such as personal information concerns, to look into the effect of privacy policy on consumers' buying behavior. Fourth, we defined search cost in terms of time and effort to find relevant information when purchasing online. In doing so, we used search effort as an indicator of search cost [22]. As suggested by a reviewer, it is possible that when search cost is low, one may tend to search more. Future research can refine the measures for search cost and investigate the situations where search cost may be distinct and different from search effort. Further, it is possible that lower search cost may lead to frequent search such that *total* search effort increases, although transaction cost associated with each *single* transaction decreases. This distinction between *unit search cost* and *total search cost* may be more important than the distinction between search cost and search effort.

Fifth, the different types of transaction cost can be examined in greater detail. For example, how are each of the transactions costs (searching, monitoring and adapting) affected by consumer choices or how do each affect the outcomes of consumer choices? Are each component of transaction costs affected differently or do they have different effects on consumer choices? Finally, the research model could be further refined to include other variables that may affect transaction cost and consumers' willingness to buy online.

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