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# An Empirical Study on Consumer Acceptance of Digital Products and Physical Products in Electronic Markets

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## Abstract

Although E-Commerce has marketability as well as usefulness, there are few empirical studies on consumer acceptance using the transaction cost theory. This paper suggests that consumer product acceptance is determined by the difference of transaction cost. And the uncertainty and asset specificity which determine the transaction cost can affect the consumer acceptance of products. In addition, we focus on the different characteristics of digital and physical products in electronic markets.

We found that transaction cost, uncertainty, and asset specificity have a significant effect on consumer product acceptance of digital products, while only transaction costs and uncertainty have a significant effect on consumer product acceptance of physical products. In consequence we provide companies to some guidelines of strategic planning for the development of products in electronic markets.

## 1. Introduction

Recently electronic markets have reduced time and costs, and provided opportunities by creating new values, such as a cyber marketing channel. Physical products were the only goods available for marketing in the early stage of electronic markets. However, the importance of marketing for digital products has been increasing in that demands on digital products have been increasing dramatically in information-oriented society.

The main reason to take notice of digital products is that the purchasing process of digital products differs from that of physical products. And digital products have different economical characteristics from physical products; Reproduction cost and distribution cost are almost zero, and then the price of digital products can continue to fall. Furthermore, the price of digital products may be set high according to the value that customers feel as the products could be customized and personalized to meet the desire of customers [24][32]. That suggests that customer acceptance of products could be different according to the characteristics of products.

Previous studies said that consumers preferred a purchase in the market where transaction costs were low. And the asset specificity and uncertainty of products and a process affected transaction costs [23] [25] [30] [38]. However, since the advent of the Internet, those studies were not enough to explain consumer's purchase with economic terms in electronic markets. Some researchers have studied the purchase of physical products with a viewpoint of transaction cost in electronic markets [4] [5] [10] [23] [25] [29] [30]. But studies on adoption of digital products in electronic markets have hardly been performed. Therefore, this study aims to find that the influence of asset specificity and uncertainty of physical products is different from that of digital products in electronic markets based on the transaction cost theory. Furthermore, it is going to verify whether consumers' product acceptance is distinguishable regarding the different characteristics of physical and digital products.

This study contributes for firms to realize economic incentives and different characteristics of physical and digital products in electronic markets. It causes firms to be able to cut down costs, not just seeking low price strategies but overall cost reduction strategies. Thus, the study also contributes to suggest some guidelines of differentiation strategies for firms to develop new products for meeting consumers' needs.

This paper is structured as follows. The next section shows the transaction cost theory. In the third section, we develop hypotheses through reviewing previous studies on consumer purchase process regarding each products group; physical products group and digital products group. Section four describes the measurement and methodology, followed by empirical results in Section five. Section six discusses main findings, and Section seven concludes this study.

## 2. Transaction Cost Theory

The transaction cost theory has been developed as a useful framework to explain business administration such as management strategy, marketing, and organizational theory [1] [7] [12] [19] [20] [28] [37]. The transaction

cost means the cost of negotiating, monitoring, and enforcing accompanied by an exchange between two parts. Williamson[38] said that the transaction cost has been formed, because opportunism occurs by the limited rationality that human beings have. Moreover, the transaction cost is produced according to properties of assets such as products and services as the object of exchange, and it is caused by conditions such as uncertainty, information impactedness, and atmosphere of transactions.

Particularly, the asset specificity is an important concept among some factors to affect transaction cost. If assets are specific, the possibility to be exposed to opportunism is high. The transaction of the assets is hard, and then a high transaction cost is produced. Whether non-specific or specific assets are decided by the impossibility of relocating the assets without sacrificing their value. The asset specificity refers to the degree to which durable investments, that are undertaken in support of particular transactions, the transaction-specific skills and assets that are utilized in the production processes and provision of services for particular customers, such as human (e.g., people who have specific technology or knowledge), physical (e.g., specific facilities), site (e.g., geographical proximity), and temporal asset specificity (e.g., specific time) [23] [25] [38].

Uncertainty, presented with the second property by affecting transaction costs, means that the impossibility of forecasting problems and accidents occurred in the middle of transactions. It causes transaction costs, since decision-making is difficult because people cannot forecast future problems. It can be divided into two, the uncertainty of a transactions itself occurred in the transactions process and the uncertainty of a product itself. Researchers insisted that the more complicated the transactions and the product explanations are, the more the uncertainty and transaction costs have increased [23] [25] [38].

### 3. Hypotheses

#### 3.1 Physical Products, Transaction Cost, and Consumer Acceptance

Studies on the transaction cost theory have been performed in both electronic markets and traditional markets. Most studies showed that the transaction cost of physical products in electronic markets became lower compared to traditional markets [4] [5] [10] [25] [39].

Williamson [39] insisted that electronic markets have a low transaction cost, but high risks in the process of transactions. That is, a price and search costs of products become lower in electronic markets, whereas the process of decision-making has been complicated because of the risk of the fall of product's value in the middle of transactions, and the cost related to a physical transfer from a seller to a buyer and the cost for participating markets.

Malone et al. [25] suggested that electronic markets have been more efficient since as information technology

is improved, it simplifies a complicated product explanation and decreases asset specificity in electronic markets.

Clemons et al. [10] showed firms make decisions on minimizing the risks and costs of producing products. That is, improved information technology causes the firms to reduce costs of exchanging and processing information by the reduction of coordination costs. And it makes the possibility of information usage and processing capability increase.

Bakos [4] [5] proposed the hypothesis on reduced price in electronic markets. He suggested that the Internet have attracted thousands of buyers and customers to electronic markets and then electronic marketplaces have been generated. And the search cost of the electronic marketplaces has been getting lower and lower.

Liang & Huang [23] studied that consumer acceptance based on the transaction cost theory applied for electronic markets. They suggested that consumers move to the electronic markets which have a low transaction cost. Because consumers' product acceptance is influenced by transaction cost consisted of the uncertainty and the asset specificity. This study also showed that some products, such as books and flowers are more suitable for marketing on the web than any other physical products.

As discussed above, in electronic markets, the problems or risks occurred in the process of the transactions have decreased and the properties of products have been explained as enough as buyers can select the product because of improved the availability of information technologies. And then the uncertainty of the transaction and the product becomes lower. Besides, asset specificity has become lower since it is not necessary for customers to stick to the specific time or the specific site. As a result, the transaction cost decreases [26] [40]. Therefore, consumer acceptance of physical products in electronic markets will increase. Accordingly, this discussion leads to the following hypotheses.

*Hypothesis 1:* The consumer acceptance of physical products increases in electronic markets. Because the transaction cost of the products becomes low as uncertainty and asset specificity have decreased.

*Hypothesis 1-1:* The transaction cost of physical products becomes low as uncertainty and asset specificity of them have decreased in electronic markets.

*Hypothesis 1-2:* The consumer acceptance of physical products increases as the transaction cost of the products becomes low in electronic markets.

*Hypothesis 1-3:* The consumer acceptance of physical products increases as uncertainty and asset specificity of the products becomes low in electronic markets.

#### 3.2 Digital Products, Transaction Cost, and Consumer Acceptance

As discussed the chapter 3.1, transaction costs has decreased gradually in electronic markets. However, these results maybe just applying for physical products. Could the same result be expected for digital products? Because

they have different characteristics from physical products [31].

Products mean the things firms are going to sell, that is, physical things in narrow meaning. In a broad sense, however, products mean the tangible and intangible things satisfying human desire and providing functional, social, and psychological benefits and utilities. Therefore, products are all things including products, services, and ideas that can be acquired through exchange [24]. Physical products are music CDs, shavers, groceries, the clothing which exist in the traditional store and are able to touch directly, whereas digital products have not physical forms such as software, traveling information, an electronic books, information of stocks, and MP3 files [6] [21] [31].

Digital products can satisfy consumer demands by providing customized products and services quickly, and can become the source of inventing values by making knowledge as products through information technology [3] [11] [13] [14] [15]. Bakos & Brynjolfsson [6] insisted that digital products can create new opportunities through contents re-package strategies such as licensing, rental, a differentiated prices and using cost per unit. Thus, the asset specificity of digital products will be increased by providing specific products to a customer because of the characteristics of digital products that can be customized and personalized in electronic markets. For example, customized and personalized digital products are software by version, traveling information, education information, and stocks information for an each customer.

For digital products, software offers enough product information and gives an opportunity of using a trial version [6]. Therefore, the uncertainty of digital products is considered to be low in terms of the characteristics of these digital products. That is, the uncertainty of digital products becomes lower by providing enough product information and also transactions are simple in electronic markets, and the transaction costs are decreasing.

Digital products have the following advantages. Firstly, the products are not extinguished (indestructibility). Secondly, the products are very likely to be changeable easily (transmutability). And thirdly, the products are reproduced easily (reproductibility) [31]. It costs very much to produce the first digital product. But it does not cost much to reproduce it because marginal cost is almost zero. The transactions of digital products are expanded to various fields such as online newspaper, digital image, music, software, all kinds of information services and games through the Internet. Some studies suggested that transactions of digital products in Internet business is getting more and more active, even though the market size of digital products is far small comparing to that of a physical product at the moment [6] [21] [31].

It was presented that a price of digital products was low in study of Strader & Shaw [29] which studied a cost difference between traditional markets and electronic markets. Some physical products have advantages in a product price, search cost and a sales tax section on the buyer side and in advertising cost and indirect cost on the seller side, whereas digital products have advantages in

almost all fields such as marketing cost, overhead cost, inventory cost, product cost and distribution cost in electronic markets. Strader & Shaw [29] suggested consistent results that the price of digital products and search cost in electronic markets is lower than that in traditional markets.

As discussed above, the asset specificity of digital products will increase by offering customized products and services quickly and expanding benefits and values that an each customer feels. And then consumer acceptance of digital products increases. The uncertainty of digital products will be low in that customers can easily get all the information of products and even experience them in advance through the Internet. However, the transaction cost of digital products will hardly increase because added costs to expand benefits and values are lower than that of physical products and firms are able to apply various price strategies to the transaction of digital products [3] [6] [11] [13] [14] [15]. Accordingly, consumer acceptance of digital products will still increase. The following hypothesis summarizes the above discussion.

*Hypothesis 2:* The consumer acceptance of digital products increases in electronic markets. Because the transaction cost of them becomes low even though uncertainty has decreased but asset specificity has increased.

*Hypothesis 2-1:* The transaction cost of digital products becomes low even though uncertainty has decreased but asset specificity has increased in electronic markets

*Hypothesis 2-2:* The consumer acceptance of digital products increases as transaction cost of them becomes low in electronic markets.

*Hypothesis 2-3:* The consumer acceptance of digital products increases as uncertainty has decreased but asset specificity has increased in electronic markets.

## **4. Research Methodology**

### **4.1 Sample and Data Collection**

The subjects were individuals (male and female) who have purchasing power in an electronic market and have experience that they have ever used the Internet. The sample was consisted of 238 undergraduate students who were taking Internet business course, 72 graduate students (business persons are 44 among them), and 77 businessmen including I firm and S firm. The data collection was performed during two months from May to June in 2000. Eventually, 340 responses were obtained.

Out of the 340 responses, 57 had to be excluded because 47 of them had incomplete data and 10 of them reported that they had never experience in purchasing in electronic markets. As a consequence, 287 questionnaires remained as the samples for this study.

### **4.2 Physical Products and Digital Products**

According to Kim [21], for physical products, books

and cards were ranked at the highest, and then PC and computer parts and software were ranked high in electronic markets. For digital products, Kim [21] also suggested several widely used products such as traveling information services, reservation of hotels or performances, information services on stocks, education services, electronic books that could be read through the Internet, games and MP3 files in electronic markets. Therefore, this study selected ten physical and digital products considering the study of Kim [21] and the characteristics of the products. The physical products selected in this study were books, music CDs, household electric appliances, life goods, shoes and clothes, and gift goods and the digital products were software, traveling and reservation information services, educational information services, and information services on stocks.

### 4.3. Measurement of Variables

Consumer acceptance was measured by one item on a five-point scale. This item was developed by relying on the measure of Liang & Huang [23]. Transaction cost was measured by seven items on a five-point scale. These measures were adopted from the work of Williamson [37] [38] and Malone et al [25]. Uncertainty was measured by two items on a five-point scale. These items were developed by relying on the measures of Williamson [38], Malone et al [25], and Liang & Huang [23]. Asset specificity was measured by five items on a five-point scale. These measures were adopted from the work of Williamson [37] [38], Malone et al [25] and Liang & Huang [23].

<Table 1> Measurement of variables

Construct	Items	Operationalization
Consumer Acceptance	Decision on purchasing products	(Liang & Huang,1998)
Transaction Cost	Search Cost	(Williamson, 1975), (Williamson, 1981), (Malone <i>et al.</i> , 1987)
	Comparison Cost	
	Examination Cost	
	Negotiation Cost	
	Order/Pay Cost	
	Transportation Cost	
	Post-Service Cost	
Uncertainty	Product Uncertainty	(Williamson, 1981), (Malone <i>et al.</i> , 1987), (Liang & Huang, 1998)
	Process Uncertainty	
Asset Specificity	Site Asset Specificity	(Williamson, 1981), (Malone <i>et al.</i> , 1987), (Liang & Huang, 1998)
	Physical Asset Specificity	
	Human Asset Specificity	
	Brand Asset Specificity	
	Time Asset Specificity	

The reliability of these items was confirmed, since the Cronbach's alpha of transaction cost, uncertainty, and asset specificity were estimated as 0.82, 0.78, and 0.84 respectively. Further, the validity of these items was confirmed by factor analysis.

### 4.4 Method of Analysis

Data analysis was conducted using a structural equation modeling to evaluate research model and understand the relationship of four variables such as consumer product acceptance, transaction cost, uncertainty, and asset specificity. Structural equation modeling has many advantages over path analysis or regression analysis especially when the observed

variables contain measurement errors and the interesting relationship is among the latent (unobservable) variables [7].

To analyze the difference of the relationships of four variables according to the characteristics of products, this study divided products into two product groups, such as a physical product group and a digital product group and evaluated the research model with each products group.

## 5. Results

### 5.1 Hypothesis 1 Test

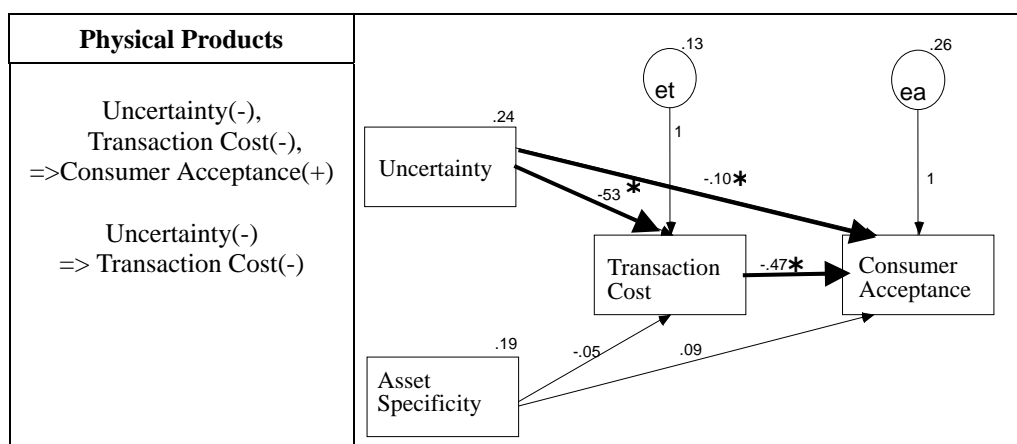
Consumer acceptance of physical products in electronic markets was evaluated. Table 2 showed coefficients of variables and Figure 1 suggested the result

of consumer acceptance of physical products.

<Table 2> Coefficient matrix of consumer acceptance of physical products

	Transaction Cost	Uncertainty	Asset Specificity	Squared Multiple Correlations
Consumer Acceptance	<b>-0.470*</b>	<b>-0.102*</b>	.092	<b>18%</b>
Transaction Cost		<b>-0.529*</b>	-.051	<b>29%</b>

\*p<0.05; \*\*p<0.01.



\*p<0.05; \*\*p<0.01.

<Figure 1> Consumer Acceptance Model of Physical Products

Structural equation modeling was conducted using AMOS to test the fit between research models (Figure 1) and data set. There is no single recommended measure of model fitness. Therefore, a variety of measures are suggested [8] [16] [18]. Since chi-square statistics is very sensitive to both sample size and distribution of observed variables, several fit measures must be considered simultaneously.

In general, the goodness-of-fit is satisfactory when chi-square is not significant, the Goodness of Fit Index (GFI) is greater than 0.9, the Adjusted Goodness of Fit Index (AGFI) is greater than 0.8, and the Root Mean Square Residual (RMSR) is lower than 0.1 [18]. Overall, the various goodness-of-fit statistics indicate that the model shows a good fit with the data. In our dataset, the value of GFI is 0.996, the AGFI is 0.96 and the RMSR is 0.007 respectively.

As for the physical products, uncertainty (-0.529) significantly influences transaction cost indirectly but

asset specificity insignificantly leads to transaction cost. Transaction cost (-0.470) and uncertainty (-0.102) significantly influence consumer acceptance of physical products directly, whereas the direct influence of asset specificity on consumer product acceptance is not significant. That is, transaction cost and uncertainty are significant variables for consumer to accept physical products. Therefore, Hypothesis 1-2 is supported and Hypothesis 1-1 and Hypothesis 1-3 are partially supported.

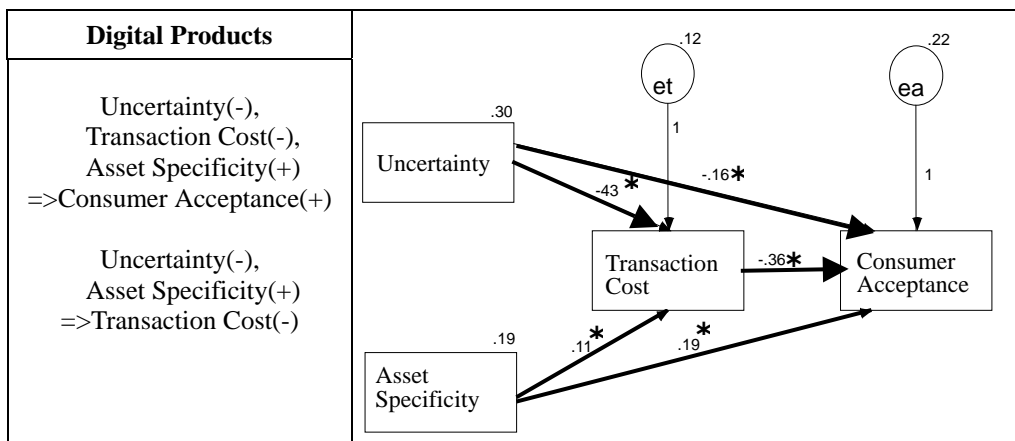
## 5.2 Hypothesis 2 Test

Consumer acceptance of digital products in an electronic market was evaluated. Table 3 showed coefficients of variables and Figure 2 suggested the result of consumer acceptance of digital products.

<Table 3> Coefficient matrix of consumer acceptance model for digital products

	Transaction Cost	Uncertainty	Asset Specificity	Squared Multiple Correlations
Consumer Acceptance	<b>-.364*</b>	<b>-.163*</b>	<b>.194*</b>	<b>19%</b>
Transaction Cost		<b>-.433*</b>	<b>.107*</b>	<b>32%</b>

\*p<0.05; \*\*p<0.01.



\*p<0.05; \*\*p<0.01.

<Figure 2> Consumer Acceptance Model of Digital Products

Overall, the various goodness-of-fit statistics indicate that the model shows a good fit with the data. In our dataset, the value of GFI is 0.997, the AGFI is 0.974 and the RMSR is 0.006 respectively.

As for the digital products, uncertainty (-0.433) significantly influences transaction cost but asset specificity (0.107) significantly leads to transaction cost indirectly though the strength is marginal. Transaction cost (-0.364), uncertainty (-0.163) and asset specificity (0.194) significantly influence consumer acceptance of digital products directly. Therefore, all Hypothesis 2-1 to 2-3 are supported.

## 6. Discussion

The verification of the hypotheses about digital products showed that uncertainty, asset specificity, and transaction cost are critical variables to cause consumers to accept them. The uncertainty and asset specificity have indirect influence on transaction cost, and this accords with transaction cost theory of Williamson [39]. For digital products, the indirect effect of asset specificity on transaction cost decreases the strength that transaction cost has effect on consumer products acceptance, whereas

the consumer acceptance of digital products was higher than that of physical products because of the direct influence of asset specificity on consumer products acceptance.

However, the verification of the hypotheses about physical products showed that the influence of asset specificity on consumer products acceptance is not significant. It could be interpreted that asset specificity is relatively small, and the physical products were not able to affect consumer acceptance because of standardization and simplification of products in an electronic market.

## 7. Conclusions

Based on the transaction cost theory, this study suggested a consumer acceptance model of physical and digital products in electronic markets and verified the relationship of transaction cost, uncertainty, asset specificity, and consumer acceptance. The study showed that transaction cost is a critical factor for consumers to accept products even in electronic markets.

The consumer acceptance was different according to two products groups. For digital products, there were negative(-) effect of transaction cost, negative(-) effect of

uncertainty and positive(+) effect of asset specificity on consumer acceptance. However, for physical products, transaction cost and uncertainty had negative(-) effect on consumer acceptance. That is, the study showed that the transaction cost of digital products is different in a degree of asset specificity and uncertainty. The uncertainty of digital products could decrease as providing product information more; for example order and delivery information or payment information in electronic markets. Transaction costs have become low since uncertainty is decreased. Eventually, the consumer acceptance of digital products goes up. Furthermore, the asset specificity of digital products could increase by personalization and customization in electronic markets. That means that consumers are willing to accept customized own products because digital products can give high value toward specific users.

Therefore, companies should develop new product lines considering the characteristics of digital products. In order to sell digital products efficiently in electronic markets, it will be necessary to establish strategies that manage uncertainty and asset specificity related to products.

This paper suggests that firms could recognize digital products newly considering the characteristics of the products. That is, the paper suggests that the asset specificity of digital products is a critical factor and a way that increases consumer acceptance of digital products in electronic markets. Secondly, the consumer acceptance model contributes to provide some guidelines of product development and strategic planning for digital products.

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