

# A Retail Investor's Perspective on the Acceptance of Internet Stock Trading

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## Abstract

*In the digital economy of information and communication technology, several organizations from various industries are jumping onto the bandwagon of offering consumer-oriented electronic commerce applications. In Singapore, Internet Stock Trading has been at the forefront of this trend since 1998. However, to-date, the penetration rate of online trading remains low. As such, this paper attempts to analyze the factors that affect the growth of Internet Stock Trading. We used Taylor and Todd's [72] Decomposed Theory of Planned Behavior (TPB) framework to explain investors' acceptance through their intentions to trade online and to rationalize their intentions in terms of attitudes, subjective norms, perceived behavioral control and other related variables. The model is tested based on 291 responses obtained through personal interviews. The measures and hypotheses were analyzed using Structural Equation Modeling. Results show that attitude and social factors significantly influence investors' intention towards adopting Internet stock trading.*

## 1. Introduction

Advancements in technological development have radically changed the way we work, live and interact. With the emergence of the "Golden Age of the Internet" [29], the Internet is no longer the exclusive domain of computer nerds and academics but has evolved into a potential mode of communication for both companies and individuals. International

With the proliferation of the Internet, more banks and stockbrokerage firms are rapidly offering online financial services. Investors can gain access to various kinds of information on financial planning (e.g. real-time stock prices, portfolio management, etc) and trade, with just a few clicks of the mouse, 24 hours a day. Increasingly, traders are attracted to the allure of online investing rather than to rely solely on their stockbrokers for advice and information [29].

The concept of online stock trading enables stockbrokerages to offer financial services and products (e.g. real-time quotes, research reports, checking of trading status, etc.) via the Internet, and charging a commission as low as \$4.95 per trade. From the customer's perspective, such online trading systems allow them to take financial matters into their own hands at a low cost.

The proliferation of Internet-based stock trading has spurred the development of the Web-Based Broker Model that provides investors access to independent reports for their investment decisions. Investors can trade online by entering the trade via an electronic device (e.g. a PC) which in turn electronically transmits the trade to the market maker to be matched for the lowest bid and ask quotes. The trade is executed and confirmed instantly.

The Web-Based Broker can be further classified into 3 profitable models: (1) the Deep Discount Model, (2) the Mid-tier Model and (3) the Premium Model [79]. Ameritrade is an example of the Deep Discount model which is a cost leader targeted at highly active day traders. It provides fast execution and no-frill services. On the other hand, brokers such as E-trade and Waterhouse embrace the Mid-tier model where a higher pricing is charged in exchange for the provision of more value-added services such as some access to the market reports and online financial planning. They serve the middle market where investors are sensitive to the value of the services relative to the cost. The Premium Model is adopted by brokers such as Charles Schwab. It is commonly used to target at the high-end market where investors are not price sensitive. Brokerages that embrace this model charge premium prices for high quality services. They offer multiple service channels, extensive access to proprietary reports and personal financial consulting services.

### 1.1 Online Stock Trading in Singapore

The growth of online stock trading in Singapore was ignited in 1996 when Phillips Securities introduced the

first online stock trading system: Phillip's On-Line Electronic Mart System (POEMs), a diskette-based system. Investors could trade stocks and access the databases online. However, the orders could not be routed to the Singapore Stock Exchange (SGX) server without a remiser keying in the electronically made orders.

In 1998, an Internet-based stock trading system which was directly linked to the SGX was jointly developed by Lim and Tan Securities Pte. Ltd. and Vickers Ballas Holdings. In addition, value-added services such as live quotes, portfolio management tools, investment research, are easily available with this new system.

In a recent report [14], online stock trading is reported to be less than 10 percent of the total turnover on the Singapore Stock Exchange. This is a rather low take up rate when compared to South Korea where over 60 percent of total stock trading is done online. The glowing estimate of 40% stock trading by 2004 [16] is currently not expected by industry experts [14] unless something is done to market online stock trading to retail investors. The current study aims to study the factors affecting investors' intention to adopt online stock trading. We follow this introduction with a background on the research model and an elaboration of the hypotheses. Next, we discuss the research methodology which is followed by a discussion on the analysis and findings.

## 2. Background

The two frequently used intention-based models are the Technology Acceptance Model (TAM) [25, 77, 78] and the Theory of Planned Behavior Model [3]. Although TAM is the most frequently cited IT acceptance model [77] and is considered to be a powerful and parsimonious model in predicting user intention, it does not help to explain acceptance as it excludes influences from other social and behavioral factors [72, 77]. Venkatesh and Davis [77] have since modified TAM to include these factors. Taylor and Todd's Decomposed Theory of Planned Behavior integrates constructs from the innovation characteristics literature and the Theory of Planned Behavior Model (TPB) [4]. It involves decomposing the attitudinal, normative and control beliefs into specific belief dimensions.

In this model, the normative belief structure is decomposed into relevant referent groups as proposed in earlier studies [13, 59, 69]. This non-monolithic normative structure reflects the influence of reference groups on subjective norm or intentions more accurately [72]. Specifically, the two referent groups in this model are peers and superiors.

The control belief structure is decomposed into two dimensions: self-efficacy and facilitating conditions. The facilitating conditions construct is further broken down into two other dimensions, which include resource facilitating condition and technology facilitating condition. Taylor & Todd [72] hypothesized that self-efficacy is positively related to behavioral intentions and usage [21] while the absence of facilitating factors will inhibit usage.

Similarly, attitudinal beliefs are decomposed into three specific constructs: relative advantage, complexity, and compatibility. Relative advantage has been found to be analogous to perceived usefulness while complexity is similar in notion to perceived ease of use [23, 54]. The set of three decomposed attitudinal beliefs are derived from the Diffusion of Innovations Theory [60] and have been found to be consistently influencing adoption decisions [75] and IT usage [55]. According to Taylor & Todd [72], attitude towards information system usage is positively related to relative advantage and compatibility but negatively associated with complexity.

## 3. Conceptual Model and Hypotheses

We build our research framework based on Taylor and Todd's Decomposed Theory of Planned Behavior (Figure 1). In the current study, we will not examine the intention-behavior relation as a number of empirical studies have showed considerable support for this link [4, 23, 25, 41, 72]. In a meta-analysis, Sheppard, Hartwick and Warshaw [68] found a positive correlation of 0.54 between intention and behavior. Davis et al. [25] also showed that behavioral intention is a good indicator of actual future use even though it can change with time. Further, considering that Internet stock trading in Singapore is still relatively new, it is reasonable for the present study to focus on the behavioral intention to use Internet stock trading in Singapore.

### 3.1 Social Factors

Individuals are affected by the referent groups that they identify with [76]. Peer and superior influences have an impact on the students' decision to use the computing resource facility [72]. Friends and family members are found to influence the adoption of IT applications [15]. Hence we expect friends, colleagues and family to influence the individual's decision to use the Internet stock trading in Singapore. In addition, Chua [20] suggested that consumer-relevant groups such as potential adopters' friends, family, neighbors and colleagues can influence adoption intention significantly. Hence, our first set of hypotheses is:

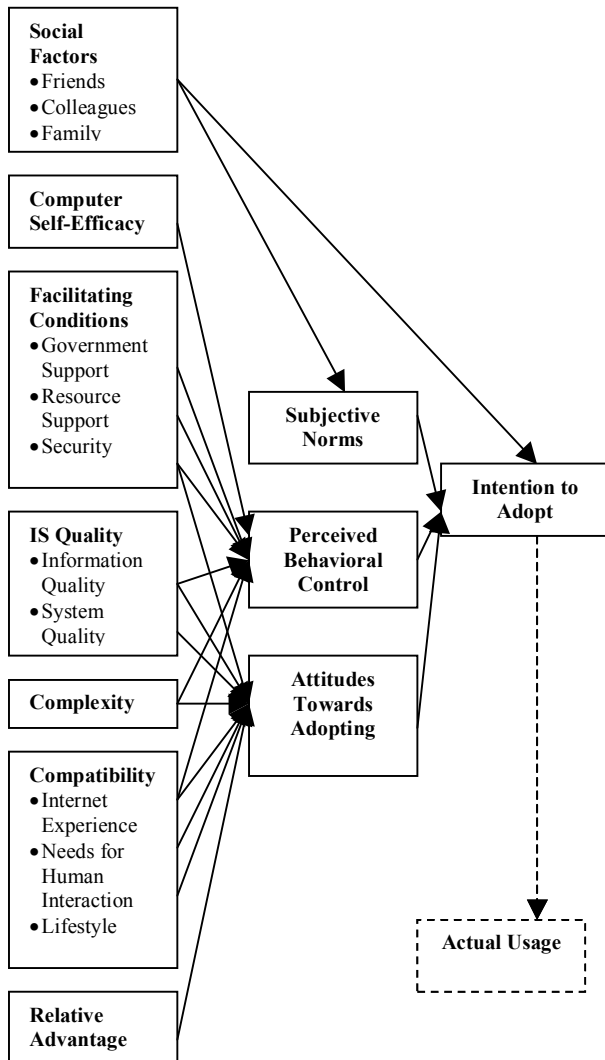
*H1a: For Internet stock trading, social factors are positively related to subjective norms.*

*H1b: Social factors are positively related to intention to adopt Internet stock trading.*

### 3.2 Facilitating Conditions

An environment with the proper facilitating conditions will promote the exhibition of the appropriate behavior [76]. Taylor and Todd [72] suggested that facilitating conditions be made up of 2 aspects, namely, resource facilitating conditions and technological facilitating conditions. In the current study, we redefine facilitating conditions to include government support, resource support and system security. The Singapore government has been a significant driver in diffusion of

technology and innovation [37, 48]. In our interview with some brokers, this view was reaffirmed. Thus, we include government support as one of the conditions that facilitate Internet stock trading.



**Figure 1: Research Model (based on Decomposed Theory of Planned Behavior Model)**

Several studies have suggested that the availability of technological resources serve as another crucial factor that facilitates the diffusion and utilization of technology [19, 35, 49]. Hence, the availability of IT infrastructure is included as the next facilitating conditions. The third facilitating condition in this research concerns security issues of the system. Han & Noh [39] noted that a system with a higher level of security is essential to encourage subjects to use E-commerce more often. Perceptions of insecure electronic transactions on the Internet have been found to be an inhibitor for Internet Stock Trading in Singapore [51]. Online banks and brokerages have to assure investors that sufficient safeguards are in place to ensure secure online transactions [53], thereby increasing users' satisfaction. The proposed hypotheses are:

*H2a: For Internet stock trading, government support is positively related to perceived behavioral control.*

*H2b: For Internet stock trading, resource support is positively related to perceived behavioral control.*

*H2c: For Internet stock trading, security of the system is positively related to perceived behavioral control.*

*H2d: Security of the system is positively related to attitude towards adopting Internet stock trading.*

### 3.3 Computer Self-Efficacy

Computer self-efficacy refers to the individual's perception of his or her ability to use computers to complete a task [21]. Computer self-efficacy has been found to be influential on an individual's expectation of the outcomes of using computers and ultimately affecting his/her decision in using them [35, 41, 76]. Hence, it is expected that individuals who feel less capable of handling a situation may be more resistant towards changes [46]. By the same token, we propose that investors who feel confident conducting their stock investments and using financial services provided by Internet stock trading will perceive the action as within their control. Hence, it follows:

*H3: Computer self-efficacy in using the Internet stock trading system is positively related to perceived behavioral control.*

### 3.4 Relative Advantage

Several studies on the use of Internet services have highlighted relative advantage to be an important determinant influencing adoption decisions [2, 73]. In the financial services industry, the benefits that an individual obtains from the use of the Internet are convenience and easy access to information [53]. In particular, Internet Stock Trading provides many advantages to the investors. It offers 24 hours access to their trading accounts and real time investment advice. With effect from 1<sup>st</sup> October 2000, investors who conduct online stock trading in Singapore will pay 20 percent commission lower than if they were to trade through the brokers. Thus, it is anticipated that investors who perceive conducting stock investment via the Internet as advantageous will have a more positive attitude towards adopting the system. Thus we have:

*H4: Perceived relative advantage in using Internet stock trading is positively related to attitude towards adopting Internet stock trading.*

### 3.5 Complexity

Cooper & Zmud [22] pointed out that a system that requires little technical skills and operational efforts will be more likely to be adopted and in turn generate better performance. Davis et al. [25] reasoned that improvement in system design can help to reduce

learning efforts required and these savings can in turn be channeled to perform other tasks and attain better accomplishment. Users who cannot overcome obstacles in using unfamiliar systems are not likely to be motivated to explore the system further even if the systems provide value added services [51]. Hence, if investors encounter difficulties in learning to conduct online stock trading, they may reject using the system even though it is more beneficial than other modes of trading. As such, we hypothesize:

*H5a: Perceived complexity in using Internet stock trading is negatively related to the attitude towards adopting Internet stock trading.*

*H5b: Perceived complexity in using Internet stock trading is negatively related to perceived behavioral control.*

### 3.6 Compatibility

Individuals consider an innovation to be compatible if it is consistent with his/her values, past experience and needs [28, 42, 60]. Agarwal & Prasad [2], in a study of the usage of the World Wide Web, found that compatibility is a crucial determinant at the initial adoption stage.

Generally, customers emphasize greatly on convenience and prefer choices that allow them to do things their way [56]. In Singapore, Internet stock trading is considered to be a compatible technological innovation as it is consistent with the current emphasis on personal financial management for individuals. It allows investors to manage their investment portfolios according to a desired pace matching their lifestyle. They can access investment information at any time of the day, without the hassle of going through their brokers. Hence, it is expected that the more Internet stock trading matches the values of the investors, the more widely online stock trading will be accepted.

*H6a: Perceived compatibility of Internet stock trading with one's values is positively related to attitude towards adopting Internet stock trading.*

Several researchers have found that past computer experience is associated with the use of computer technology [43, 44, 49, 77]. Most people recognize that the Internet and other communication developments have enhanced their job performance [10]. As a result, they are more comfortable and confident in performing activities such as purchasing products and services via the Internet. Therefore, we hypothesize that investors with Internet experience will be more inclined to trade online.

*H6b: Internet experience is positively related to attitude towards adopting Internet stock trading.*

*H6c: For Internet stock trading, Internet experience is positively related to perceived behavioral control.*

From a retail investor's viewpoint, Internet stock trading is unable to fully substitute the tried and trusted relationship with his stockbrokers [17]. In fact, two years after the launch of online stock trading, the Singapore Stock Exchange reported that as at November 2000, the pool of dealers has increased by 7% over last year figure

to 1104. Similarly, the number of remisiers has grown by 4.6% to 2534 [12]. It is noted that many investors still prefer a personal touch and to rely on their stockbrokers to update them on market developments [13]. Thus, we propose:

*H6d: Needs for human interaction is negatively related to attitude towards adopting of Internet stock trading.*

### 3.7 IS Quality

IS quality affects the success of an information system [7, 26, 65, 70]. Lin & Lu [50] reported that the user's perception of a website is related to IS Quality. The quality measures include information quality and system accessibility. In the context of Internet stock trading, investors who wish to make use of online services are required to surf websites hosted by the respective brokerages. Hence, in our study, we will use the two constructs namely, information quality and system quality, to measure the quality of the information system. Besides, investors are more likely to resist using a system if the response time is slow and the system is perceived to be unreliable [39, 62], and may feel less confident to trade online if the information content is inaccurate. Hence, we hypothesize:

*H7a: Information quality is positively related to attitude towards adopting Internet stock trading.*

*H7b: For Internet stock trading, information quality is positively related to perceived behavioral control.*

*H7c: System quality is positively related to attitude towards adopting Internet stock trading.*

### 3.8 Behavioral Intention

Fishbein and Ajzen [30] proposed that attitudes and subjective norms affect behavioral intention. The theory was later extended to develop the Theory of Planned Behavior [3] by incorporating perceived behavioral control to be the other antecedent of intention to adopt a system.

#### 3.8.1 Attitude

Attitude is an important determinant influencing the intention to adopt the system [24, 72] and has been found to be an influential element for intention behavior in the use of a spreadsheet package [52]. Hartwick and Barki [40] also identified attitude to be an important factor in determining an adopter's intention to continue using the system. As such, we have:

*H8a: Attitude towards adopting Internet stock trading is positively related to intention to adopt Internet stock trading.*

#### 3.8.2 Subjective Norms

The association between subjective norms and behavioral intentions has been shown in several studies. For example, studies in organization settings have shown that subjective norm is a crucial determinant of behavioral intention [24, 25, 55]. Hartwick and Barki [40] also suggested the effect of subjective norms to be more significant in the initial stages of system

implementation. The relationship between subjective norms and behavioral intentions is also consistent with many consumer researches [59, 63, 69]. Since Internet stock trading takes place in a realistic organizational setting, we therefore expect that subjective norms will have a strong influence on the intention to adopt the system.

*H8b: Subjective norms is positively related to intention to adopt Internet stock trading.*

### 3.8.3 Perceived Behavioral Control

Social-psychology research has identified perceived behavioral control to be a significant factor influencing the behavioral intention especially in situation beyond the individual's control [3, 64]. Similarly, in the field of IT research, a positive relation between behavioral intention and perceived behavioral control has also been established [52, 72]. Hence, we suggest:

*H8c: Perceived behavioral control is positively related to intention to adopt the Internet stock trading.*

## 4. Research Methodology

### 4.1 Questionnaire Development

In order to ensure that a comprehensive list of items was included, an extensive review of previous work was conducted. Further, we carried out personal interviews with five dealers and remisiers from three stockbrokerage firms, namely, J.M. Sassoon & Co., Grand Orient Securities Pte. Ltd. and Phillip Securities Pte. Ltd. to obtain a greater insight into online stock trading in Singapore.

The survey questionnaire developed was then pretested with 5 undergraduates and 5 working adults, all of whom have stock trading experiences. Based on their feedback, the questionnaire was further revised to avoid ambiguity and to improve its readability.

### 4.2 Data Collection

The revised questionnaire was administered to a sample of 363 respondents through an interview conducted at the business district area called Raffles Place over the period 13<sup>th</sup> November 2000 to 25<sup>th</sup> November 2000. The Raffles Place has a number of offices. During the lunch hour, the place was usually filled with office people as well as the general public who were there to conduct general banking, stock trading and other businesses. Respondents were sought and interviewed during the lunch period from 11.00 a.m. to 2 p.m.

In total, four interviewers (two males and two females) administered the interviews. This is an attempt to minimize the effect of gender difference on respondents' answers [33]. Only individuals who have had experience investing in the Singapore stock market were asked to participate in the survey. Of the 363 returns, 72 questionnaires were incomplete and were excluded for analysis. This yields a response rate of 80.2%.

## 4.3 Measures for the study

The constructs for the current study were extracted from the rich literature on intention and belief studies supplemented with the information obtained from the interviews with the remisiers. Where relevant, participants were asked to indicate the extent of their agreement or disagreement on a seven-point Likert-type scale ranging from (1) strongly disagree to (7) strongly agree.

## 5. Data Analysis and Findings

The Structural Equation Modeling (SEM) approach was used in the analysis as it provides a holistic analysis by examining the entire series of inter-correlations simultaneously [32]. A factor analysis was first conducted using SPSS 9.0 to ensure that questions not measuring the same dimension were eliminated so as to define the measurement model more accurately. The measurement model and the structural model were then specified based on the extracted factors. A multivariate analysis was conducted to test the hypothesized relationships.

### 5.1 Instrument validation

The preliminary principal components factor analysis conducted using the varimax rotation method yielded 13 optimal factors after variables with a loading of less than 0.5 and an Eigen value smaller than 1 were excluded [38]. A reliability analysis was performed using Cronbach's Alpha. Only the resource support construct with a Cronbach's alpha of 0.664 (see Table 1) did not exceed the recommended 0.7 [57, 58] but it was considered to be minimally acceptable [27]. Although the results indicate that all the measurements were reliable and valid, the items were subjected to another round of confirmatory factor analysis using AMOS 4.0. This is to allow uni-dimensionality, which cannot be assessed using Cronbach's Alpha, to be examined [5, 66]

Three criteria were used to evaluate the measurement model in terms of construct validity and construct reliability. Firstly, factor loadings greater than 0.5 are considered very significant [38]. Secondly, the composite reliability for each construct has to exceed the threshold of 0.7 [57, 58]. Thirdly, the extracted variance for all constructs should be greater than 0.5 [32].

The measurement model obtained met all these criteria except for the construct reliability of resource support ( $r=0.675$ ) which was below the recommended 0.7 (see Table 1). However, it fell within the marginally acceptable band suggested by Devellis [27]. Further as the factor loadings for the two indicators of resource support were significant [38], this construct was retained and the measurement model was not revised.

## 5.2 Overall Model Fit

The overall model fit has a  $\chi^2$  value of 1332.706. Both the  $\chi^2/df$  value of 2.255 and Root Mean Square Error of Approximation (RSMEA) of 0.066 met the requirements for a good fit. However, the remaining indices goodness of fit (GFI), adjusted goodness of fit (AGFI), Normed Fit Index (NFI) and Tucker-Lewis Index (TLI) did not meet the minimum requirements for a good fit suggested by Chin and Todd [18] and Hair et al. [38]. As the original model did not provide a good fit, we revised the model based on changes suggested by the modification indices and theoretical reasoning as outlined in Table 2.

An analysis of the revised structural model showed that there was an improvement in the model fit. All indices satisfied the threshold value except for GFI (0.866) which was below the recommended 0.9 level. However, according to Hair et al. [38], the GFI obtained was considered to be marginally acceptable. Moreover, the model had a high degree of freedom (577) relative to a sample size of 291 and with the relatively small number of parameters (126), there was a tendency for GFI to be downward bias [34]. Hence, the revised model justified a good overall fit. Table 3 compares the fit between the null and the revised model.

**Table 1: Composite Reliability Analysis and Variance Extracted**

ELEMENT	CONSTRUCT	CRONBACH'S ALPHA	RELIABILITY	VARIANCE EXTRACTED
$\xi_1$	Social Factors	0.850	0.863	0.685
$\xi_3$	Needs for Human Interaction	0.889	0.890	0.802
$\xi_4$	Internet Experience	0.946	0.946	0.780
$\xi_5$	Computer Self-Efficacy	0.886	0.889	0.801
$\xi_6$	Complexity	0.900	0.908	0.834
$\xi_8$	Government Support	0.861	0.860	0.673
$\xi_9$	Resource Support	0.664	0.675	0.516
$\xi_{10}$	Security	0.912	0.913	0.779
$\xi_{11}$	Information Quality	0.918	0.909	0.670
$\xi_{12}$	System Quality	0.732	0.730	0.575
$\eta_1$	Attitude	0.831	0.786	0.648
$\eta_2$	Subjective Norms	0.911	0.910	0.835
$\eta_3$	Perceived Behavioral Control	0.910	0.893	0.736
$\eta_4$	Behavioral Intention	0.734	0.723	0.604

The results showed that the structural equations accounted for 55.5% of the variance for attitude and 58.6% of perceived behavioral control. 27.6% of the variance of social norms was explained by social factors while 32% of behavioral intention was accounted by attitude, social norms, social factors and perceived behavioral control. The variances accounted by the constructs for the current study were lower than those attained by Taylor & Todd [72].

**Table 2: Theoretical Evidence for Revision of Model**

NEW R'SHIP	THEORETICAL EVIDENCE
$\xi_3 \leftrightarrow \xi_4$	According to Rogers [60], compatibility comprises three dimensions: needs, experience and value. Hence, they are related.
$\xi_3 \leftrightarrow \xi_6$	In his study, Loh & Ong [51] implied that an investor who found the system too complex to use would not trade through it even though it can perform value added services.
$\xi_3 \leftrightarrow \xi_8$	Igbaria et al. [45] indicated that facilitating conditions such as organization support is essential in addressing users' needs and concerns. In our study, government support is equivalent to a form of organization support.
$\xi_3 \leftrightarrow \xi_{12}$	Teo et al. [73] suggested that compatibility would cause the adopter to feel more secured and viewed the system as reliable and hence less risky. The users would be encouraged to perform their jobs electronically.
$\xi_4 \leftrightarrow \xi_5$	Hill et al. [41] found that prior experience with computer was significantly correlated with efficacy beliefs. This is consistent with the findings by Bandura [8] and Igbaria & Iivari [46].
$\xi_5 \leftrightarrow \xi_6$	In their studies, Bandura [8] and Igbaria & Iivari [46] had shown that self-efficacy is positively related to ease of use.
$\xi_5 \leftrightarrow \xi_8$	Igbaria & Iivari [46] explained that higher organizational support would enhance individual ability to complete a task. In our study, government's commitment in encouraging Internet stock trading is conceptually similar to the organization support.
$\xi_6 \leftrightarrow \xi_9$	Igbaria et al. [44] indicated that inadequate resource support provided by relevant organizations would cause users to deem the system as complex, resulting in low usage.
$\xi_6 \leftrightarrow \xi_{11}$	The study by Lin & Lu [50] showed that response time affects perceived ease. In Delone & Mclean [26], response time is a dimension of information quality.
$\xi_8 \leftrightarrow \xi_{10}$	Teo et al. [41] indicated that the Singapore government supports IT innovation. They commented that one way the government has shown its support in e-commerce is by improving the security technology.
$\xi_8 \leftrightarrow \xi_{11}$	Loh & Ong [51] had found a significant positive relationship between the need for the Internet content regulation and quality of information sources.
$\xi_{10} \leftrightarrow \xi_{11}$	In their study, Han & Noh [39] implied that better security technologies will lead customers to perceive that the system are stable and convenient to use (e.g. information retrieval).
$\xi_{10} \leftrightarrow \xi_{12}$	
$\xi_{11} \leftrightarrow \xi_{12}$	Delone & Mclean [26] explained that information quality and system quality are dimensions of IS quality and they are interrelated.
$\zeta_1 \leftrightarrow \zeta_2$	Ajzen & Madden [4] conceptualized that Attitude, Social Norms and Perceived Behavioral Control were inter-correlated.
$\zeta_1 \leftrightarrow \zeta_3$	
$\zeta_2 \leftrightarrow \zeta_3$	

**Table 3: Overall Model Fit Measures**

GOODNESS-OF-FIT MEASURES	NULL MODEL ( $\chi^2 = 1332.706$ , $df = 591$ )	REVISED MODEL ( $\chi^2 = 864.01$ , $df = 577$ )
<i>Absolute Fit Measures</i>		
GFI	0.802	0.866
RSMEA	0.066	0.041
<i>Incremental Fit Measures</i>		
AGFI	0.765	0.837
NFI	0.846	0.901
TLI	0.895	0.958
<i>Parsimonious Measures</i>		
$\chi^2/df$	2.255	1.497

## 6. Hypothesis Testing

Hypothesis 4 and 6a were not tested as the two constructs, relative advantage and compatibility did not meet the criteria of factor analysis and were therefore eliminated from subsequent analysis. Table 4 shows the standardized path coefficients of the endogenous constructs and the exogenous variables and Figure 2 provides the graphical representation of the results of hypothesis testing.

### Social Factors

Social factors had a significant, positive relationship with social norms ( $\gamma_{21} = 0.525$ ,  $p < 0.05$ ). Hence, Hypothesis 1 was supported, thus corroborating the results from Bearden et al.'s [9] study.

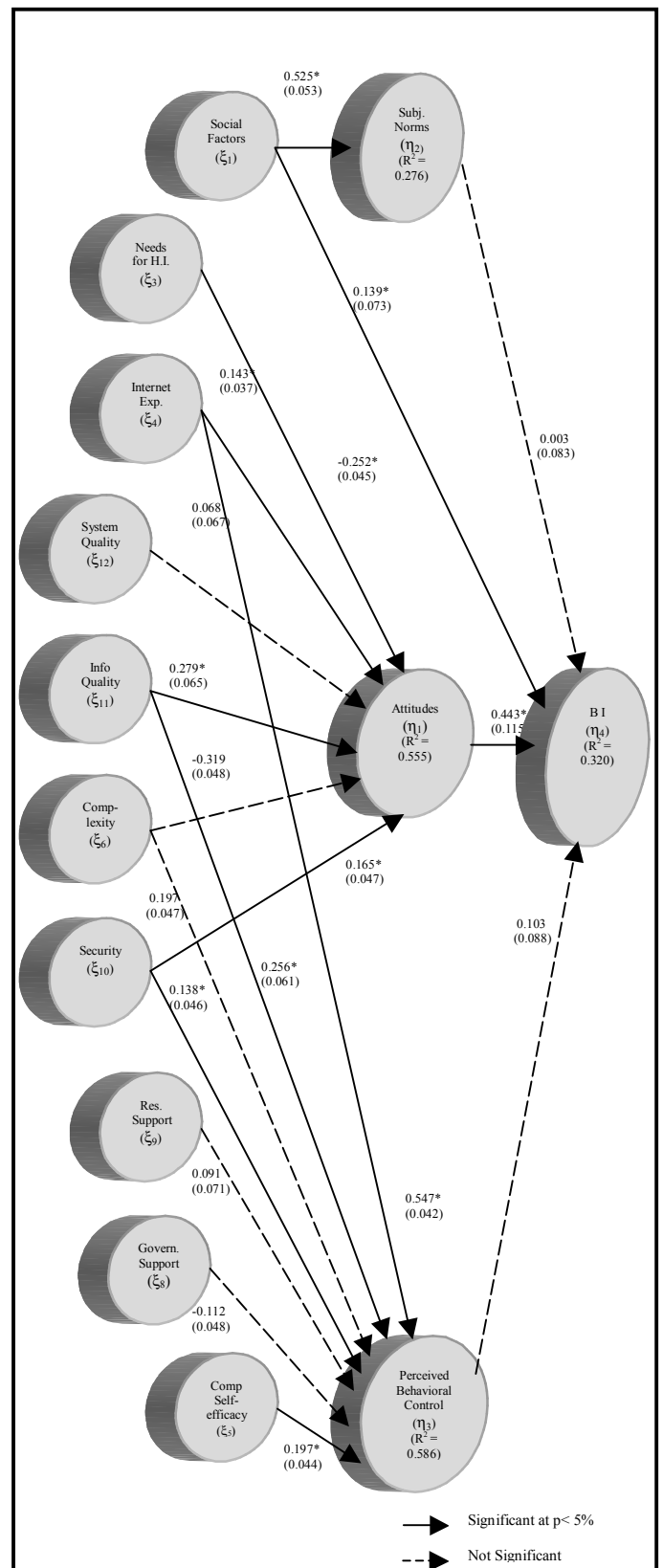
### Facilitating Conditions

The link between government support and perceived behavioral control was observed to be negative but insignificant ( $\gamma_{38} = -0.112$ ,  $p > 0.05$ ). Hypothesis 2a is rejected. While the Singapore government has put in a lot of effort in promoting e-commerce, investors do not feel that the efforts were targeted especially at enhancing online trading.

Resource support was found to have a small, positive but insignificant effect ( $\gamma_{39} = 0.091$ ,  $p > 0.05$ ) on perceived behavioral control. Hypothesis 2b was rejected. This may be the result of consolidation among firms in the stock brokering industry. With a bigger customer base, more stockbrokerages are implementing Internet stock trading services, providing investors with ample opportunities to try alternative modes of share trading. Furthermore, in order to encourage investors to trade online, many firms such as POEMs and DMG & Partners are waiving initial entrance fees required for opening an Internet trading accounts with them. It is also common among stockbrokerage firms to set up cybercafes for the public to do online trade.

Security had a significant positive relationship ( $\gamma_{310} = 0.138$ ,  $p < 0.05$ ) with perceived behavioral control, thus supporting Hypothesis 2c. Investors may feel that security threats are beyond their control. They are also worried that sensitive information may be stolen if there are inadequate security measures [51]. In a Technographics Report by Forrester, concern over the

privacy of information passed over the Internet was found to affect the amount of time and money people spend online. This may imply that insufficient secure safeguards result in a lack of confidence in online trading



**Figure 2: Results of the Tested Model**

**Table 4: Standardized Path Coefficients**

Variables	Endogenous Constructs				
		$\eta_1$ Attitude	$\eta_2$ SN	$\eta_3$ PBC	$\eta_4$ BI
Social Factors	$\xi_1$		0.525*		0.139*
Needs for Human Interaction	$\xi_3$	-0.252*			
Internet Experience	$\xi_4$	0.142*		0.547*	
Computer Self-Efficacy	$\xi_5$			0.197*	
Complexity	$\xi_6$	0.319		0.197	
Government Support	$\xi_8$			-0.112	
Resource Support	$\xi_9$			0.091	
Security Information	$\xi_{10}$	0.165*		0.138*	
Quality System	$\xi_{11}$	0.279*		0.256*	
Attitude	$\xi_{12}$	0.068			
Subjective Norms (SN)	$\eta_1$				0.443*
Perceived Behavioral Control (PBC)	$\eta_2$				0.003
Behavioral Intention (BI)	$\eta_3$				0.103
$R^2$		0.555	0.276	0.586	0.320

\*  $p < 0.05$

among traders. A system with a higher level of security is therefore essential to encourage subjects to use E-commerce more often [39].

Similar to Loh & Ong [51], the path from security to attitude was observed to be statistically significant ( $\gamma_{10} = 0.165$ ,  $p < 0.05$ ), hence providing support for Hypothesis 2d. The verdict is perhaps indicative that security concerns remain a major stumbling block for Internet stock trading.

#### Computer Self-Efficacy and Complexity

Interestingly, Internet experience was found to have the strongest effect on perceived behavioral control. Similar to Taylor & Todd [72], Hypothesis 3, which stated that self-efficacy ( $\gamma_{34} = 0.197$ ,  $p < 0.05$ ) will significantly influence perceived behavioral control, was supported.

Hypothesis 5a, which stated that perceived complexity is negatively related to attitude towards adopting Internet stock trading, was not supported ( $\gamma_{16} = 0.319$ ,  $p > 0.05$ ). This is unexpected, as prior studies [47, 51, 52,] showed that perceived complexity is a significant attitudinal barrier particularly at the initial adoption stage [24, 54].

However, as users require substantial use of the system before they are able to formulate their attitude about the system [1] and as the online trading phenomenon is currently still in the infancy stage where majority of the investors are either novice users or non-adopters, it is possible that investors were unable to assess the perception of the system complexity accurately.

Hypothesis 5b was not supported. The relationship between perceived behavioral control and perceived complexity was not statistically significant ( $\gamma_{35} = 0.197$ ,  $p > 0.05$ ). This weak link is anticipated as most investors are unable to assess the complexity of the system given the limited exposure [1] and therefore are unlikely to be able to gauge their ability in using the system based on ease of use.

#### Compatibility

Consistent with Hypothesis 6b, Internet experience was positively related to attitude ( $\gamma_{14} = 0.142$ ,  $p < 0.05$ ). This conformed to Igarria et al.'s [45] study whereby computer experience was found to be a significant determinant for attitudes towards end-user computing. One plausible explanation for the observed positive link is that investors who are Internet savvy may have already acquired adequate experiences in online information search and are able to handle minor problems while retrieving investment related information from respective e-brokerage websites.

Hypothesis 6c, which postulated that compatibility with Internet experience is positively related to perceived behavioral control, was supported ( $\gamma_{33} = 0.547$ ,  $p < 0.05$ ). Investors appeared to be Internet savvy and were confident surfing the net and hence felt that they had good control when they trade online.

The standardized weights for the path between needs for human interaction and behavioral intention was significantly negative ( $\gamma_{13} = -0.252$ ,  $p < 0.05$ ), thus providing support for Hypothesis 6d. Stockbrokers had insisted that human interaction is much preferred by investors [11] and our finding provides yet another support for this comment.

#### IS Quality

A positive and significant relationship was found between information quality and attitude towards adopting Internet stock trading ( $\gamma_{111} = 0.279$ ,  $p < 0.05$ ), thus supporting Hypothesis 7a. Information quality enhances perceived usefulness which in turn improves user perceptions [50]. In the context of Internet stock trading, such an observation is expected. The chief aim of investors putting their money in the stock market is the hope of making their money grows. Therefore, investors will favor a system that provides them with timely and accurate market information that enables them to trade more effectively and profitably.

Hypothesis 7b that stated information quality is positively related to perceived behavioral control is supported ( $\gamma_{311} = 0.256$ ,  $p < 0.05$ ). High information quality is less likely to confuse the users. Investors are therefore likely to be more confident in executing their trades via the Internet as they can rely extensively on relevant and up-to-date investment information retrieved from the Internet.

System quality did not have a direct effect on the attitude towards Internet stock trading ( $\gamma_{112} = 0.068$ ,  $p > 0.05$ ). Hypothesis 7c was rejected. Investors may have taken the current good system quality for granted as the

servers are probably not overly taxed due to the relatively low number of order fulfillments. Further, the e-brokerages may also have provided high maintenance for the systems, therefore accounting for the rather infrequent system breakdowns.

### **Behavioral Intention**

As suggested by the standardized weights, social factors ( $\gamma_{41} = 0.139$ ,  $p < 0.05$ ) and attitude towards adopting Internet stock trading system ( $\beta_{41} = 0.443$ ,  $p < 0.05$ ) were positively related to intention towards adopting Internet stock trading system, hence providing support for Hypotheses 8a and 8c. In addition, the path coefficients showed that attitude was a more significant determinant of behavioral intention relative to social factors. Referent groups are an information source for potential adopters. This is consistent with the Roger's [60] Diffusion of Innovation Theory framework which indicated that interpersonal channel is an effective means to create awareness.

However, in the context on Internet stock trading, the investment activities are very personal and individual. Although investors may turn to their social groups for opinions relating to the mode of trading, their decision to trade online seemed to be affected significantly by social pressure as indicated by insignificant path linking social norms to behavioral intention ( $\beta_{42} = 0.003$ ,  $p > 0.05$ ) [25].

Contrary to Taylor and Todd [72], perceived behavioral control ( $\beta_{43} = 0.103$ ,  $p > 0.05$ ) was found to have no direct effect on intention to adopt Internet stock trading system. The result was expected as an analysis of Hypothesis 2 showed that intention to trade via Internet, to a great extent, was not contingent on the facilitating conditions [68]. In other words, the decision to conduct Internet stock trading is voluntary, not mandatory.

## **7. Conclusion**

The study provides further evidence on the use of the Decomposed TPB framework in understanding IT innovation acceptance by users. It confirms the postulation by Bagozzi, [6] and Shimp and Kavas [69] that uni-dimensional belief structures will not be consistently related to attitude, subjective norms or perceived behavioral control. Hence, it is better to use multidimensional belief constructs in the study as it provides a more comprehensive understanding of the facilitators and inhibitors affecting adoption intention with respect to Internet stock trading. The results also suggest that there is no standard set of perceptions that is applicable to all forms of technology. The choice of factors to be examined is contingent upon the nature of the technology. In addition, by concentrating on distinct beliefs, the model is made more relevant to managers as they can design the systems and devise their implementation strategies based on the identified factors.

Our results suggest that stockbrokerage firms and perhaps the government may need to take a more active role in marketing online stock trading to retail investors. They need to address investors' concerns, especially with

regard to the trading interface and security issues. The need for a human interface remains a major impediment towards the adoption rate of Internet stock trading in Singapore. Many investors reckon that online systems are impersonal and lack the human touch. Perhaps, one solution is to incorporate click-to-voice technology into the systems whereby dealers can assume the role of customer service officers. In this way, users may feel more confident trading via the Internet as they can always seek immediate online investment advice from the dealers.

Another obstacle to Internet stock trading is security. A majority of the investors are concerned about privacy issues and having their accounts tampered with, which may result in huge financial loss. Hence, firms must show investors that they are constantly upgrading their systems with the latest security technology. They must choose security solutions that are reputed and certified so as to boost the confidence of the investors. In addition, the brokerages may need to inform the public of the security precautions they have taken as well as to educate them on security measures that the investors must take to create a more secured trading environment.

With the effort put in by the government, Singapore has recently been ranked the most IT-savvy country in a global survey of 75 countries conducted by the World Economic Forum and Harvard University [71]. However, it seems that something is still lacking in the area of online stock trading. Perhaps the government need to take more specific actions to encourage a higher level of online stock trading to complement its emphasis on e-lifestyle. For example, it can set regulations that provide some form of insurance to minimize online investors' security risks. As in credit cards, the government can stipulate a law putting a cap on the amount that an investor will risk losing should his account be hacked into and the remaining loss borne by stockbrokerage firms. This rule acts in two folds. Firstly, "limited loss" may alleviate investors' fears towards security threats and investors may thus have a greater sense of security when trading online. Secondly, firms will be more obliged to improve their system security so as to minimize their loss, which in turn facilitates Internet stock trading.

The current study offers several interesting insights to Internet stock trading in Singapore. However, it also has some limitations. Firstly, the survey questions were written in English. While efforts were taken to ensure that translation of the survey was accurate, it is possible that the essence of the questions may not be accurately reflected when interviewers translated them into other languages when surveying non-English speaking respondents. The respondents were randomly selected from the lunch crowd found at the business district. While these respondents were people who were interested in stock trading, they may not be people who use any Internet stock trading. Given that we were interested in the perception of intention to adopt, we were comfortable that these people may not have currently used Internet stock trading. Another study

could be conducted which specifically targets people who use Internet stock trading systems to obtain their perceptions on these issues. Secondly, other facilitating variables affecting investors' intention to adopt online stock trading may not have been included in the present study. Future research can expand the current research framework to include these variables. More interestingly, a comparative study using the South Korean population can be conducted to explore reasons for the high level of online trading usage in South Korea.

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