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User Acceptance of E-Commerce Technology: A Meta-Analytic Comparison of Competing Models

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USER ACCEPTANCE OF E-COMMERCE TECHNOLOGY: A META-ANALYTIC COMPARISON OF COMPETING MODELS

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Abstract

The Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) are widely used in the information systems (IS) literature to explain and predict user technology acceptance behavior. Although these models have been utilized separately in the earlier studies, to increase the richness and predictive power of their studies, scholars have combined both theories in more recent studies. However, few studies have compared these models directly using the same empirical data. The justification for using various hybrid models is mostly anecdotal and convenient rather than based on strong theoretical arguments. Thus the question remains: when studying user technology acceptance behavior, which model offers the best fit to empirical evidence? This study compares four different models (TAM, TPB and two combined TAM-TPB) in terms of their predictive power and model fit to empirical data using meta-analysis methodology. The data for this study is gathered from meta-analytic calculations of 32 studies found in the technology acceptance literature. Our findings demonstrate that when used separately TAM and TPB models offers not only theoretical parsimony and clarity, but also better fit with empirical data than the two combined TAM-TPB models. Implications of our findings are discussed and future research directions are presented.

Keywords: Internet, Electronic Commerce, Technology Acceptance Model, Theory of Planned Behavior, Meta-Analysis

1 INTRODUCTION

Technology acceptance has been one of the significant research streams in the information systems (IS) literature. Researchers utilized a variety of theoretical frameworks to understand the determinants of individual's technology acceptance behavior, including the Technology Acceptance Model (Davis, 1989; Davis et al., 1989; Mathieson, 1991; Taylor & Todd, 1995b), Theory of Reasoned Action (Davis, 1989; Davis et al., 1989), Diffusion of Innovation (Karahanna et al., 1999; Moore & Benbasat, 1991),Theory of Planned Behavior (Mathieson, 1991; Taylor & Todd, 1995b), Domestication framework (Silverstone & Haddon, 1996), and Hospitality metaphor (Ciborra, 2002).

The Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB) have been two of the widely utilized models in the IS literature. In the early years of the theories, studies used TAM and TPB separately to compare their explanatory power (Mathieson, 1991; Taylor & Todd, 1995b). However, as the theories gained popularity in the literature, researchers combined them to have a richer understanding of technology acceptance behavior. Many hybrid models of TPB and TAM were proposed and tested in the literature (Hu & Dinev, 2005; Hsu & Chiu, 2004; Pavlou & Fygenson, 2006; Taylor & Todd, 1995a; Venkatesh & Davis; 2000; Venkatesh et al., 2003), yet almost each study utilized a different nomological network for the theoretical constructs. For instance, in some studies ease of use is considered as an antecedent of behavioral control (Hu & Dinev, 2005; Pavlou & Fygenson, 2006), whereas in others, this construct has on relationship with behavioral control (Taylor & Todd, 1995a, 1995b). Similarly, some IS scholars used subjective norm as a moderator between perceived usefulness and intentions (Hu & Dinev, 2005) and the others used perceived usefulness as a moderator between subjective norm and intentions (Venkatesh & Davis, 2000).

The direction in the IS literature toward using more complex models to predict individual's technology acceptance has been the motivation of the study. Our purpose is to examine the different theoretical frameworks used in the literature in term of their explanatory power and model fit. Therefore, an important contribution of this study would be our attempt to examine the trade-off between parsimony and explanatory power of different models utilized in the technology acceptance research stream. This paper differs from previous studies in one significant way. The data used in our analyses were obtained from meta-analysis of technology acceptance studies in the literature. First, we used meta-analytic calculations to correct the focal relations for sampling error and measurement error. Then, we used the corrected correlations to test different path analytic models. This meta-analytic structural equation modelling approach is one of the recent methodologies utilized in the literature to compare competing models (Geyskens et al., 2006; Harrison et al., 2006).

The rest of the paper is arranged as follows. In the next section, we present a brief review of TPB and TAM. Despite the availability of different theoretical lenses, we choose to examine TPB and TAM because majority of the studies based on these models are quantitative, making it possible to collect the necessary data for conducting meta-analysis. In section 3, we discuss the data collection and research methods used in the study. In section 4, we present the results of our analysis. In the final section, we discuss the implications and limitations of the study and present our conclusions.

2 THEORETICAL BACKGROUND

2.1 Theory of Planned Behavior

The Theory of Planned Behavior (TPB) (Ajzen, 1988) was introduced as an extension of the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). Both TPB and TRA have similar objectives: to understand the human behavior through identifying and analyzing the determinants of behavioral intentions (Ajzen, 1988; Fishbein & Ajzen, 1975). Ajzen introduced TPB in an attempt to provide a

better conceptual framework of behavior by addressing TRA's problem of incomplete volitional control (Ajzen 1988; Ajzen & Madden 1986). The Theory of Planned Behavior (Figure 1- Model 2) postulates that the Actual Behavior is the weighted functions of Behavioral Intention and Perceived Behavioral Control. In turn, Behavioral Intention is the weighted function of Attitude toward the Behavior (Attitude), Subjective Norm, and Perceived Behavioral Control. Table 1 presents brief descriptions of the constructs used in TPB.

Construct	Definition
Behavioral Intention	Refers to individual's intention to perform a behavior and is a function of Attitude, Subjective Norm and Perceived Behavioral Control
Attitude	Refers to individual's positive or negative evaluation of the behavior (Ajzen, 1988)
Subjective Norm	Refers to individual's "perception of social pressure to perform or not to perform the behavior" (Ajzen, 1988, p.132)
Perceived Behavioral Control	Refers to the "perceived ease or difficulty of performing the behavior and reflects past experience as well as anticipated impediments and obstacles" (Ajzen, 1988, p.132)

Table 1. Definitions of predictors of behavior in the Theory of Planned Behavior.

Given the popularity of TPB in social sciences, IS scholars quickly adopted the framework into the technology adoption context. Especially, TPB's ability to capture social and control factors through Subjective Norm and Perceived Behavioral Control has been clearly emphasized in the IS literature (Pavlou & Fygenson, 2006; Mathieson, 1991; Taylor & Todd, 1995b; Venkatesh et al, 2003). TPB has been used in many studies and considered as a powerful predictor of individual's technology acceptance behavior (Chau & Hu, 2001; Harrison et al., 1997; Mathieson, 1991; Taylor & Todd, 1995b). The early studies that compared TAM and TPB reported that both frameworks have similar explanatory power (Mathieson, 1991; Taylor & Todd, 1995b). Later in the literature, IS scholars combined TPB with TAM in an attempt to answer several criticisms of TAM (Hu & Dinev, 2005; Pavlou & Fygenson, 2006; Taylor & Todd, 1995a; Venkatesh & Davis, 2000; Venkatesh et al., 2003).

2.2 Technology Acceptance Model

Similar to TPB, TAM is also introduced as an extension of TRA (Davis, 1986; Davis, 1989; Davis et al., 1989). However, rather than being a generic model for individual behavior in social environment, TAM has a clear focus on technology acceptance behavior of computer users. The main purpose of TAM is to examine how external factors such as system characteristics, documentation, and training affect internal beliefs, attitudes, and intentions (Davis, 1989). TAM (Figure 1-Model 1) postulates that two beliefs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), are important determinants of technology acceptance (Davis et al., 1989). Table 2 presents brief descriptions of the constructs used in TAM.

Construct	Definition
Behavioral Intention	Refers to individual's intention to perform a behavior and is a function of Attitude and Perceived Usefulness
Attitude	Refers to individual's positive or negative evaluation of the behavior and is a function of Perceived Usefulness and Perceived Ease of Use
Perceived Usefulness	Refers to individual's beliefs that using a particular system would enhance his or her job performance
Perceived Ease of Use	Refers to individual's beliefs that using a particular system would be free of effort

Table 2. Definitions of predictors of behavior in the Technology Acceptance Model.

TAM has been widely used in the IS literature to examine user behavior in the context of various information technologies, including personal computer (Taylor & Todd, 1995a,b), computer application (Davis, 1989; Davis et al. 1989; Mathieson, 1991), and Internet (Agarwal & Prasad, 1998; Gefen & Straub, 2000; Pavlou & Fygenson, 2006; Van der Heijden, 2004). One research stream aimed at expanding the model with constructs such as Trust (Gefen et al., 2003; Pavlou & Fygenson, 2006), Perceived Risk (Pavlou, 2003) and Perceived Enjoyment/Playfulness (Agarwal & Karahanna, 2000; Van der Heijden, 2004). Another research stream investigated moderating variables including experience (Taylor & Todd, 1995a; Venkatesh & Morris, 2000; Venkatesh et al. 2003), gender (Venkatesh & Morris, 2000; Venkatesh et al. 2003), voluntariness (Agarwal & Prasad, 1997; Davis et al. 1989; Venkatesh et al. 2003) and age (Venkatesh et al. 2003). In these studies, the moderating factors are reported to have significant effect on individual's technology acceptance. Similarly, a recent meta-analysis of TAM reported the significance of these various moderating factors (King & He, 2006).

2.3 Hybrid Models for Technology Acceptance

Over the period of more than a decade since their initial publication, both TBP and TAM models have gained broad acceptance in the IS research community and inspired strong interests. Both theories are rigorously tested in various technology contexts in different settings and considered as powerful predictors of use technology acceptance behavior. When utilized separately, they have similar predictive power in explaining individual's intention and actual behavior (Mathieson, 1991; Taylor & Todd, 1995b). In general, TAM is considered a more parsimonious model compared to TPB since it has fewer predictors. However, scholars argued that this parsimony has been provided at the expense of losing finer understandings of individual behavior. In particular, the lack of social variables and behavioral controls in TAM has been criticized (Mathieson, 1991; Taylor & Todd, 1995b).

Considering these differences between the models, many IS scholars combined TAM and TPB to increase the explanatory power of their studies and offer greater insight into what makes a user to use or not use a specific technology in a specific social and organizational settings. In an early attempt, Venkatesh and Davis (2000) extended TAM by including Social Norm. They based their arguments on both social information processing and TRA which basically underline the important effects of referents in shaping individual's behaviors. Similarly, Venkatesh and Morris (2000) used TAM with SN model to study the moderating effect of gender on technology acceptance. They postulated that a significant amount of work outside the IS literature reports the importance of social factors on behavior, and thus the moderating effect of gender would better understood with the inclusion of SN into TAM.

Later in the literature, IS scholars included PBC into TAM as well. In fact, the inclusion of PBC is a significant step toward a richer theoretical understanding since in technology adoption context the availability of technology or technical capabilities of the individual can have considerable effect on behavior (Taylor & Todd, 1995b; Venkatesh et al., 2003). Venkatesh et al. (2003) proposed a unified theory of technology acceptance in which TAM and TPB constructs jointly determine individual's intention and behavior. In a later attempt, Hu and Dinev (2005) presented a different hybrid model to predict the use of anti-spyware programs by individuals. In their model, PU and PEOU are determinants of SN and PBC, respectively. They postulated that the group norms (captured by SN) are formed only if the action itself is considered as useful at the first place. Similarly, they argued that individuals have more behavioral control when they perceive that the technology is easy to use. This last argument has also been postulated by Pavlou and Fygenson's (2006) hybrid model for predicting individual's electronic commerce adoption.

2.4 Are Bigger Models Necessarily Better?

According to the most recent study (Venkatesh et al., 2003), there are a number of papers that have attempted to compare between TAM, TPB, and hybrid models. Although both TAM and TPB is considered to have similar predictive powers, there is no consistent result in the literature regarding which model in fact better explains behavior. Based on purely statistical comparison, Mathieson (1991) reported that TAM is superior to TPB, and Taylor and Todd (1995b) reported that TPB is superior to TAM. Venkatesh et al. (2003) presented a more comprehensive analysis by comparing TAM, TPB and combined TAM-TPB in mandatory and volunteer settings. In both settings, TPB had the lowest explanatory power. In mandatory settings TAM was better than combined model, whereas, in volunteer settings, combined model was better than TAM.

There are clear indications that the hybrid models are getting a strong traction in recent IS publications with ever increasing complexity in terms of the number of model constructs and antecedents added to the original TAM or TPM framework. However, the empirical evidence that supports such expansion is quite mixed, as discussed above. What has exacerbated the debate between parsimony and comprehensiveness is the fact that almost all the comparisons were conducted using the same data set by the authors and different statistical procedures and statistics were often used across different studies. We argue that the ability of ascertaining the better fit model using one data set is limited due to small sample size in each individual studies and the uniqueness of the data set itself in term of the quality of data and the profiles of the respondents. In this study, we use the meta-analysis methodology that allows researcher to combine the data samples from many published studies to calculate statistics that are based on the characteristics of all the data samples combined. In doing so, we hope to be able to compare TAM, TPB, and a couple of the hybrid models directly with each other using the same combined data set and the same statistical indicators produced by the same statistical procedure. We choose to compare TAM instead of TAM2 (Venkatesh and Davis, 2000) because TAM2 model represents a hybrid model that takes social influence into consideration. On the other hand, we did not use TAM2 as one of the hybrid models because the nomological network proposed in the model (SN as an antecedent of PU) is used in fewer studies compared to the nomological network of the hybrid models we choose to analyze.

3 METHODS

3.1 Meta-Analytic Procedure

Studies in social sciences are exposed to several flaws. Especially, sampling error and measurement error are always present in non-experimental studies (Hunter & Schmidt, 2004). Since the scientific interest lies in estimation of true effects of underlying phenomenon rather than inaccurate descriptions of imperfect studies (Rubin, 1990), psychometric meta-analysis gained righteous popularity for promoting theoretical advancements. Meta-analyses overcome the weaknesses of a single study through estimating accurate construct-level relationships by taking into account statistical and measurement artifacts (Hunter & Schmidt, 2004). Although it is mathematically possible to correct for several systematic and unsystematic errors, in many cases researchers are limited with the amount of information provided in studies.

Another advantage of meta-analyses is the opportunity to integrate results across studies and investigate relationships between different constructs, although no individual study has included all constructs. Therefore, meta-analyses are considered as powerful statistical tools for testing interrelated theories and providing a more complete understanding (Viswesvaran & Ones, 1995).

3.2 Literature Search

Giving the extraordinary growth of e-commerce in the last two decades, and considering that the type of technology has a significant moderating effect on individual use behavior (King & He, 2006), we chose a particular technology context, Internet use by individuals, to test the alternative models of technology acceptance. However, since individuals use the Internet for different purposes, we further refined our context of research as using Internet to purchase a product or service, that is, e-commerce. E-commerce has been a popular topic in the IS literature (Chang et al, 2005; Saeed et al., 2003), thus providing us a potentially large pool of recent studies that use either TAM or TBP or one of the hybrid models for understanding user on-line purchasing behavior.

Using the Institute for Scientific Information's Web of Science database, we gathered the studies that used the theory of planned behavior (Ajzen, 1991) and the technology acceptance model (Davis et al., 1989). This initial sample is narrowed down by keyword search within the abstracts and titles of the studies. The keywords used are "online", "e-commerce", "electronic commerce", "web", and "Internet". To minimize the effect of publication bias, dissertation studies are also included in the literature search. For this purpose, we utilized ProQuest Digital Dissertations database.

3.3 Data Set

We used the following selection criteria to create the final data set for the meta-analytic calculations: 1) a study should have at least two of the TPB or TAM constructs and investigate users' behavior, intention or attitude towards purchasing product/service on the Internet, 2) the study should report the data required for the meta-analytic calculations (i.e., correlations, squared correlation or regression coefficients), 3) when the study reports results for multiple independent samples, each sample is considered as a separate study, 4) when the study uses more than one indicator for the same construct (e.g., subjective norm among friends and subjective norms among families), the average correlation is calculated as described in Hunter and Schmidt (2004), 5) dissertations that were published in a journal are dropped from the data set, 6) studies that have considerably larger samples (n >1000) are identified as outliers and dropped from the sample. The final sample consists of 32 individual data points from 22 journal articles and 4 dissertations. The studies in our sample are not listed in the reference section due to space limitations; however, these references are available upon request from the first author.

3.4 Meta-Analytic Calculations

A coding schema was created to include sample sizes, correlations between constructs under investigation, and reliabilities of these constructs. Since in most studies the type of behavior and constructs included in the research model were clearly stated, the coding task required minimum level of judgmental decision. After coding the final data-set, we followed the procedures recommended by Hunter and Schmidt (1990, 2004) to correct for sampling error and error of measurement. First, the sample size weighted mean correlations were computed. Then, these correlations were corrected for error of measurement using reliability data when provided. When reliability data were not available, average reliability of the construct is used. Using average reliability figures is a common method in the literature and also reported as a viable technique by Hunter and Schmidt (1990, 2004). Table 3 presents the results from the meta-analytic calculations.

Relation	k	N	r	ρ	sd_ρ	CI_L	CI_U	% variance account for
BI → B	4	1,131	.48	.53	.16	.21	.85	13
PBC → B	3	744	.37	.42	.19	.04	.80	12
A → BI	12	3,201	.60	.68	.20	.28	1.0	7
SN → BI	11	3,856	.40	.47	.18	.11	.83	12

PBC → BI	7	2,070	.43	.49	.14	.21	.76	18
PU → BI	19	3,666	.48	.54	.15	.24	.84	14
PU → A	8	1,321	.47	.53	.30	.00	1.0	4
PEOU → A	7	1,082	.50	.57	.28	.00	1.0	5
PEOU → PU	18	3,576	.53	.61	.24	.13	1.0	7

k=number of data points; N=total sample size; r= sample size weighted mean correlation; ρ=estimate of corrected correlation; sd $_\rho$=estimated standard deviation of corrected correlation; CI_L=lower bound of credibility interval; CI_U=upper bound of credibility interval; % variance account for=percentage of observed variance account for sampling error and measurement error

Table 3. Meta-analytic results for the focal relationships.

3.5 Path Analytic Model

Using this combined data set and meta-statistics generated, we conducted path analysis using LISREL software to compare the explanatory power and fit of four different models (Figure 1). Model 1 and Model 2 represent original TAM and TPB models, whereas Model 3 and Model 4 represent hybrid TAM and TPB models. Table 4 presents some of the representative studies in the IS literature that are based on these models.

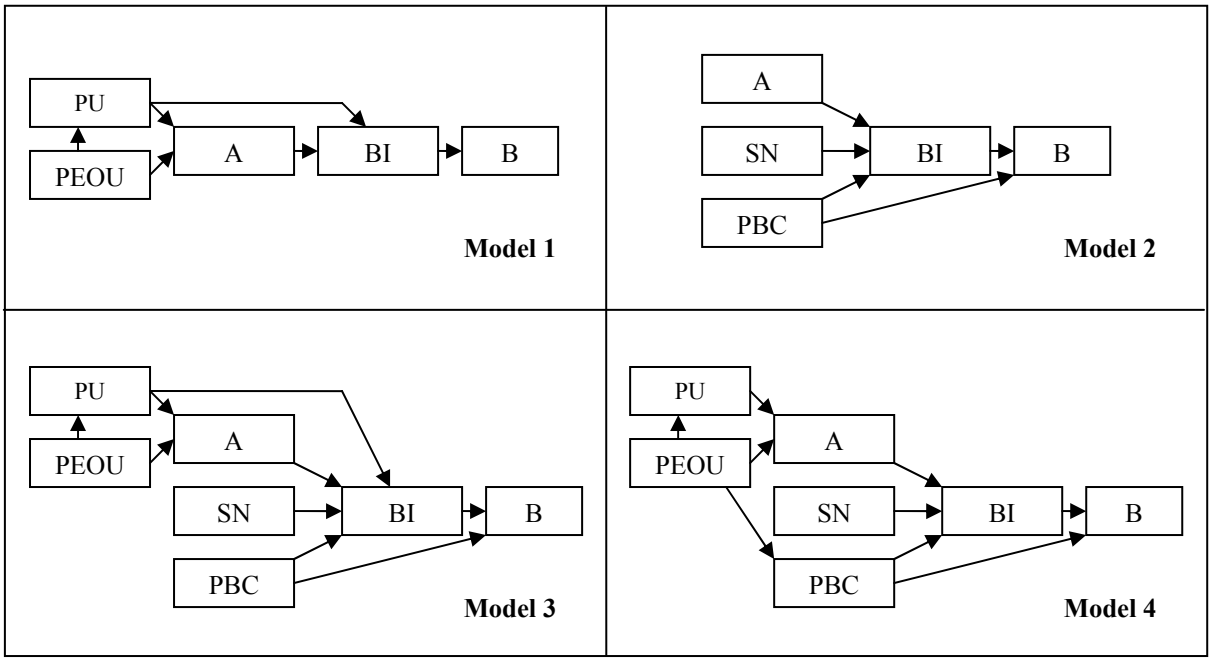

Figure 1. Models compared in the study.

Since LISREL requires the full correlation table of all the relations, we conducted additional meta-analyses to estimate the correlations between the remaining relations. Table 5 presents the meta-analytic correlation matrix representing a total of 21 individual meta-analyses. Although the studies in our sample have expanded the core models in Figure 1 with additional constructs such as perceived enjoyment, perceived satisfaction, and perceived risk, the existence of these additional constructs do not have any effect on our analyses since meta-analytic calculations utilize the bivariate correlations between the constructs under investigation,. That is, the path models created using meta-analytic correlations automatically factor out the influence of additional constructs used in these studies.

Model	Underlying Theory	Representative IS Studies based on this Model	Comments
1	Technology Acceptance Model (Davis et al., 1989)	Davis et al. (1989) Mathieson (1991) Taylor and Todd (1995b)	The studies in this group used TAM constructs without combining the TPB constructs.
2	Theory of Planned Behavior (Ajzen, 1988)	Mathieson (1991) Harrison et al. (1997) Taylor and Todd (1995b)	The studies in this group used TPB constructs without combining the TAM constructs
3	TAM + TPB	Karahanna et al. (1999) Taylor and Todd (1995a) Venkatesh and Morris (2000)	The studies in this group used a combined TAM and TPB model. In these studies, PU and PEOU do not have a direct effect on SN and PBC, and vice versa.
4	TAM + TPB	Hu and Dinev (2005) Pavlou and Fygenson (2006)	The studies in this group used a combined TAM and TPB in which TAM constructs (i.e., PU and PEOU) are proposed as antecedents of SN and/or PBC.

Table 4. Description of the four models tested in the study.

	B	BI	A	SN	PBC	PU	PEOU
B	1						
BI	0.53	1					
A	0.49	0.68	1				
SN	0.23	0.47	0.56	1			
PBC	0.42	0.49	0.42	0.45	1		
PU	0.34	0.54	0.53	0.46	0.61	1	
PEOU	0.21	0.42	0.57	0.30	0.61	0.61	1

Table 5. Meta-analytic correlation matrix.

4 RESULTS

Table 6 presents the results of the path analysis. The strength of the models can be analyzed based on a number of statistics, including strength of individual paths, the variance explained (R^2) on the endogenous constructs, and the model fit indices generated by LISREL. Chi-square test can also be used to determine if two models are indeed significantly different from each other, but only if the models are nested (Hu & Bentler, 1999; Rigdon, 1998). Given that each correlation in Table 5 has different sample size, we used the harmonic mean during path analysis as proposed by Viswesvaran and Ones (1995).

	Model 1	Model 2	Model 3	Model 4
Estimates (β)[a]				
BI → B	.53	.43	.43	.43
PBC → B	-	.21	.21	.21
A → BI	.55	.55	.51	.55
SN → BI	-	.06	.04	.06
PBC → BI	-	.23	.17	.23
PU → BI	.25	-	.15	-
PU → A	.29	-	.29	.29
PEOU → A	.39	-	.39	.39

PEOU → PU	.61	-	.61	.61
PEOU → PBC	-	-	-	.61
Variance Explained[b]				
B	.28	.31	.30	.30
BI	.51	.52	.51	.49
A	.38	-	..38	.38
Fit Indexes				
χ^2	109.09 (0.00)[c]	65.71 (0.00)	677.30 (0.00)	929.53 (0.00)
df	4	2	9	11
χ^2/df	27.27	32.86	72.56	84.50
RMSEA	.13	.17	.24	.25
NFI	.96	.96	.81	.76
CFI	.97	.97	.81	.76
GFI	.97	.98	.87	.83
AGFI	.90	.82	.60	.57
Harmonic Mean	1612	1047	1298	1298

[a] p< .05 for all estimates
[b] Squared multiple correlation
[c] p-value

Table 6. Result of meta-analysis of the competing technology acceptance models

The estimated coefficients in all models were significant. However, this statistical significance should be interpreted with caution since the sample sizes in the analyses are considerably large. Consistent with the literature, the results across all models demonstrated that behavioral intentions are important determinants of behavior (β ranges from .43 to .53). Further examinations of the results show that attitude has greater effect on intentions (β=.51) than subjective norm (β=.04), perceived behavioral control (β=.17) and perceived usefulness (β=.15).

When the model fits are compared, Model 1 (TAM) and Model 2 (TPB) showed better fit than Model 3 and Model 4 (combined TAM-TPB). Moreover, with a smaller RMSEA and larger AGFI, Model 1 demonstrated the best fit among all models. However, this is not the case when the average variance explained was analyzed. Although Model 1 has the best fit among the models, it has the lowest explanatory power in explaining individual's behavior.

One of the common methods to evaluate competing models in SEM is to examine the chi-square difference between the models. However, chi-square difference test can be utilized only if the competing models are nested (Rigdon, 1998). Since only Model 3 and Model 4 are nested, we used chi-square difference test to evaluate only these two models. When Model 3 and Model 4 are compared, both models demonstrated similar explanatory power, yet Model 3 have better fit than Model 4. Moreover, the chi-square difference between Model 3 and Model 4 is significant ($\Delta\chi^2$= 201, Δdf=2), thus, indicating that the restrictions imposed in Model 4 resulted in a considerable decrement in model fit.

We must note that the all four models have relatively large χ^2 (significant at $p < 0.01$) and χ^2/df (>3) which would have indicated poor fit of the models with data in traditional LISREL analysis (Gefen et al., 2000). However, χ^2 indicators are significantly skewed by the sample size and large sample sizes tend to generate larger values (Rigdon, 1998). In this case, the underlying sample sizes used in our

calculations (i.e., harmonic means) range between 1,047 and 1,612. The degree of freedom is also skewed since the degree of freedom in the measurement indicators are not counted in meta-analysis models, resulting significantly smaller values, as shown in Table 6. This is in fact common in meta-analysis (e.g., Geyskens et al., 2006; Harrison et al., 2006). Therefore, a fair comparison should be based on the comparative values of χ^2 and χ^2/df between two models, not the absolute values. From the perspective, the χ^2 indicators are consistent with the other indicators: Model 1 and Model 2 fit significantly better with data than Model 3 and Model 4.

5 DISCUSSION AND CONCLUSIONS

In this study, we examined the explanatory power and model fit of four different research models used for predicting technology acceptance behavior in the context of using Internet for online purchases using a meta-analysis approach with data gathered from the technology acceptance studies in the literature. After correcting the correlations for sampling error and measurement error, we conducted path analysis to compare the models. The results show that both original TAM and TPB have better fit to data than the hybrid models that combined these two related yet distinct theoretical frameworks. Our results show that in terms of predicating user behavior, comprehensive models with more core constructs than TAM or TPB are not better than the original parsimonious models. Our findings have a number of significant implications to future academic research in the technology acceptance domain. Theoretically, our results confirm that both TAM and TPB have adequate explanatory and predictive power, and that the attempts to combine TAM and TPB models to achieve higher explanatory and predictive power not only scarified parsimony but also failed to achieve the intended objectives. Methodologically, to the best of our knowledge, this study is the first in the IS literature to use meta-analytic data for theory testing. Although early studies in the literature have compared these models with single data set, such studies have several weaknesses including sampling error, measurement error, and limited generalizability. Our meta-analysis overcomes these limitations by correcting for such artefacts. Moreover, by using these corrected correlations in a path analytic model, we take meta-analysis calculations from mere data summarization to one step further into the theory testing.

Our findings do not support the argument for or against either TAM or TPB when used for studying user online purchasing behavior, and perhaps technology acceptance in general. Our results clearly suggest that these two theoretical models are comparable. However, this is by no means suggesting that these two models are substitute for each other and could be used interchangeably regardless the underlying user behavior research context. While we reject the effort of combining the two models, we do accept the notion that the two models have distinct features that would make one superior to the other in specific context and under different research objectives. TAM is clearly more parsimonious than TPB and is more suitable from the technology imperative perspective. TPB, on the other hand, with its constructs that capture the social dimension of user behavior, is more suitable from organizational/social imperative perspective. In the increasingly complex socio-technological environment, a richer understanding of user behavior toward technology may demand the consideration of both imperatives, that is, from the emergent perspective. In that sense, we recommend future research on user online purchasing behavior, and technology acceptance in general, focusing on developing more context specific antecedents to the established constructs in either TAM or TPB models, depending on the focus of the study. Researchers who focus on the questions of how technology related characteristics affect user behavior may be better off to base their model on TAM but with social and organizational antecedents. On the other hand, researchers who focus on the issues of how social and organizational factors affect user behavior may gain richer insights by basing their mode on TPB but with technological antecedents.

Finally, we must point out a few limitations of this study. While meta-analysis is a powerful statistical methodology that can be used to compare alternative theories and models based on aggregated data, its power depends on the accuracy of the published data and the size of the sample publications that provide required statistics. In this paper, we were able to collect data from only 32 studies, though the

underlying sample size is large, these studies may not be representative of the pool of research on user online purchasing behavior using TAM, TPB, or the hybrid models. In the future, we plan to expand the search and increase the sample study pool significantly to ensure reliability of the meta-analysis. Another potential problem is that the number of studies that provided necessary statistics for the non-focal relationships, such as PU->PEOU, are small, which may cast a shadow on the reliability of the path coefficients of these relationships presented in this study. This problem could be resolved if larger number of studies can be found and included in the analysis in the future.

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