

# Trust and Risk in Consumer Acceptance of e-Services: A Meta-Analysis and a Test of Competing Models

*Completed Research Paper*

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## Abstract

*Consumer perceptions of risk and their trust beliefs are considered amongst the most important psychological states influencing online behavior. Despite the number of empirical studies that have explored the effects of trust and risk perceptions on consumer acceptance of e-services, the field remains fragmented and the posited research models are contradictory. To address this problem, we examined how trust and risk influence consumer acceptance of e-service through a meta-analysis of 52 studies followed by tests of competing causal models. The findings confirm that trust and risk are important to e-service acceptance but trust has a stronger effect size. We found that certain effect sizes were moderated by such factors as the consumer population under study, the type of e-service, and the object of trust under consideration. The data best supports the causal logic that positions trust as antecedent to risk perceptions. Risk partially mediates the effects of trust on acceptance.*

**Keywords:** Trust, risk, meta-analysis, electronic service

## Introduction

Electronic services or e-services include all forms of interaction and transaction taking place between service providers and service consumers over electronic communication networks. The contexts for e-service are both commercial (e.g., e-tailing and e-banking) and non-commercial (e.g., e-government and e-health). E-services offer the promise of increased convenience, lower-cost of transacting, increased consumer choice, and greater accessibility by eliminating space and time constraints (de Ruyter et al. 2001; Rust and Kannan 2003).

Despite this potential, uncertainty and fears of opportunism still characterize the online context and varying degrees of consumer acceptance and engagement in the use of e-services has been observed. The technology mediated nature of e-service creates a temporal and physical distance between the service consumer and the service provider. The inability to interact with the service provider means that consumers cannot rely on visual and physical clues to reassure themselves of the bona fides of the provider (Harridge-March 2006). This increases the ease with which online vendors can take advantage of their anonymity to engage in opportunistic behaviors such as misrepresentation, unfair pricing, conveying inaccurate information, violating privacy, failing to adhere to obligations to process transactions completely and accurately, or mishandling consumer information (Gefen et al. 2003a; Kim et al. 2008). There is added uncertainty associated with the use of an open and global Internet infrastructure, which may not function predictably and may fail to keep information safe (Pavlou 2003; Pavlou and Gefen 2004).

The uncertainty and opportunism inherent in e-services results in increased perceptions of risk in electronic exchange relationships and elevates the need for trust (Pavlou 2003). Consequently, consumer perceptions of risk and their trust beliefs are considered amongst the most important psychological states influencing their online behaviors (Pavlou and Gefen 2002; Pavlou 2003; Kim et al. 2008). Over 50

empirical studies have explored the effects of trust and risk perceptions on consumer acceptance of e-services. Unfortunately, despite this effort, the field is fragmented and the posited research models are contradictory. As we will illustrate below, the nature of relationships between trust, risk and consumer acceptance of e-services is a source of confusion for researchers and is a research problem in need of attention (see also Gefen et al. 2003b).

We aim to address this problem through a meta-analytic investigation of the effects of trust and risk on consumer acceptance of e-service. Furthermore, to identify which of a multitude of competing nomological networks is best supported by the empirical evidence, we use the data from our meta-analysis to test and compare various models relating trust, risk and consumer acceptance. The research questions guiding our investigation are:

- RQ1. What is the overall relationship between trust and risk perceptions in e-service?
- RQ2. What is the overall relationship between consumer attitudes and intentions toward the use of e-services and their trust and risk perceptions?
- RQ3. To what extent are these relationships moderated by factors such as culture, type of e-service, object of trust, sampling strategy and year of publication?
- RQ4. Which nomological network of relationships is best supported by the combined empirical evidence?

Managing consumer trust and perceptions of online risk are considered critical to the continued development and success of the online service environment (Pavlou 2003). Moreover, the efforts of e-service providers to mitigate risk perceptions and build trust are hampered by a lack of understanding of how trust and risk perceptions interact and how they come to influence online behavior. Our results will thus help e-service providers determine the relative emphasis they need to place on strategies for risk mitigation versus strategies for trust-building. Moreover, the contradictory interpretations of the trust-risk relationship and the lack of consensus regarding their individual and joint effects on online consumer behavior limit the field's ability to develop a coherent and cumulative body of e-service research. This paper's effort to improve understanding of the trust-risk relationship and their effects on consumer acceptance is thus of theoretical importance.

The next section of this paper discusses the roles of trust and risk in e-services and their importance to consumer acceptance. To illustrate the inconsistencies in past research work, various models of the effects of trust and risk and their effects on consumer acceptance of e-services are then presented. We then discuss our research methodology, present results of our meta-analysis, and present tests of competing structural models. We conclude with a discussion of the findings and their implications.

## **Theoretical Background**

### ***Trust, Risk and Consumer Acceptance of e-Services***

Trust is important to all forms of social exchange and buyer-seller transactions, and reflects a consumer's belief that favorable conditions exist to facilitate transaction success (Pavlou and Gefen 2002). Trust allows the consumer to accept vulnerability because of an expectation that it can rely on the other party not to behave opportunistically (Bart et al. 2005). Trust stems from a consumer's confidence in the ability, benevolence, competence, honesty, integrity, and predictability of not only the exchange partner but also in the structures facilitating the exchange (McKnight et al. 1998; Gefen 2002a; Bhattacharjee 2002; McKnight et al. 2002). Trust in the e-service context has thus been considered in relation to multiple objects of trust, including the e-service provider (Pavlou and Gefen 2004), the e-service web site or platform as well as the enabling technologies or infrastructure e.g., the Internet (Bart et al. 2005). For example, Thatcher et al. (2013) distinguished trust as general trust and specific trust in the B2C e-commerce context. General trust includes trust in IT infrastructure and trust in institutional mechanisms; specific trust includes trust in merchant and trust in website. Taken together, trust in the e-service context can thus be defined as a consumer's confidence in and willingness to depend on 1) the e-service provider's reliability, good intentions, and ability to deliver on expectations; 2) the product or delivered service to meet the consumer's needs; 3) the e-service website or platform to perform the required functions; and 4)

the integrity and dependability of the enabling technological environment (Bhattacharjee 2002; Pavlou 2003; Bart et al. 2005; Ribbink et al. 2004; Harridge-March 2006).

The uncertainties of transacting online are also argued to increase perceptions of risk. Perceived risk in e-services is the consumer's subject belief about the potential for something to go wrong when undertaking service transactions online, and the probability of suffering a loss if it does (Garbarino and Strahilevitz 2004). Individual consumers will have differing beliefs about the inherent risks involved in the use of e-services but the two most prominent are perceived financial and privacy related risks (Pavlou 2003; Bart et al. 2005; Kim et al. 2008). Financial risks include monetary losses whilst transacting online. Financial losses may result from the duplication of an online transaction due to technology error, the misuse of the consumer's credit card data, the purchase of a defective product or a service that is not performed as expected, and problems experienced in shipping and/or delivery. Consumers may also risk having their time wasted in following up unreliable service providers, correcting errors, seeking compensation, or otherwise unnecessarily having to access customer support services. Privacy risks result from submission of confidential information including credit card data, address and telephone details, employment and tax-related data, or health and medical data that may subsequently be exposed. Garbarino and Strahilevitz (2004) found consumers rated loss of privacy as the risk most likely to occur, whilst financial risk, due to unauthorized use of credit card data, as having the most serious consequences.

Over 50 empirical studies have explored trust and risk as determinants of consumer acceptance of e-service. These past studies typically draw on technology acceptance and consumer behavior literature to define e-service acceptance as the consumer's attitude and/or behavioral intention toward the use of the e-service. Attitudes are an overall evaluative response, including both cognitive and affective components, toward the use of an e-service, whilst behavioral intentions refer to consumer willingness or intention to use, participate, share information or transact with the e-service provider. Past studies also draw on social exchange theory to underpin the importance of trust to exchange relations, and the theories of reasoned action and planned behavior to define trust and risk as salient behavioral beliefs capable of influencing consumer attitudes and behavioral intentions. However, despite this common theoretical grounding, the trust-risk relationship and their effects on attitude and behavioral intentions have been modeled differently across studies. We discuss these differences next.

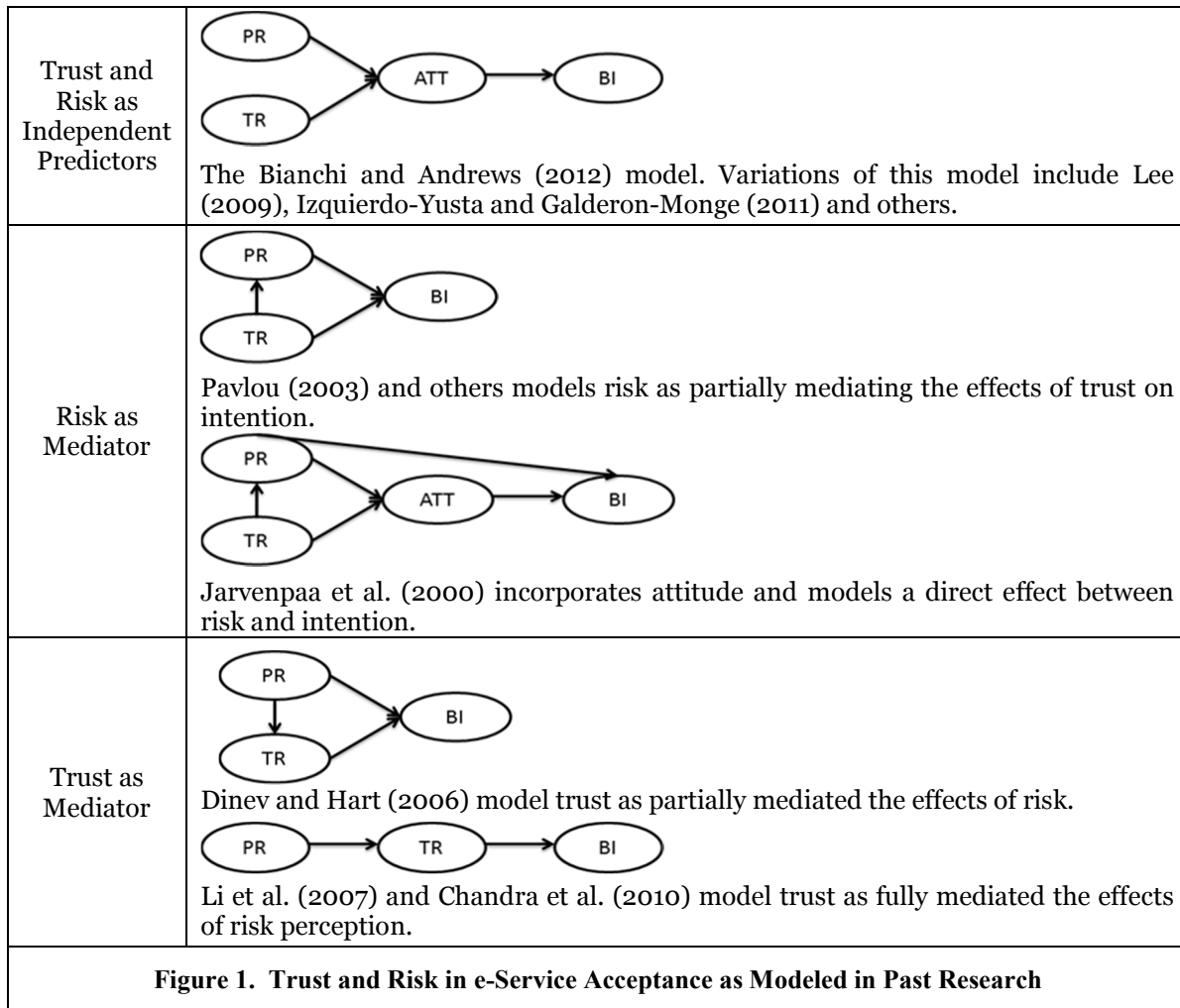
First, two perspectives on the trust-risk relationship have emerged in the e-services literature. The first views trust as a solution to the uncertainty and risk present in online transactions (Pavlou 2003; Kim et al. 2008). This view considers trust to lower the perceived risks of e-service. The second perspective argues that the need for a consumer to form a trusting belief is based on that consumer's perceived level of risk (Dinev and Hart 2006) i.e., a lower perceived level of risk leads to higher levels of trust.

Second, the effects of risk and trust on consumer acceptance have been modeled differently in past work. For example, Jarvenpaa et al. (2000) model the effects of trust on consumer purchase intentions in online shopping as being fully mediated by attitude and risk perceptions, and include an additional direct effect of perceived risk on intention. Others however attempt a more parsimonious model by omitting attitude and consider trust's effect on intention as only partially mediated by perceived risk (e.g., Pavlou 2003; Pavlou and Gefen 2005; Nicolaou and McKnight 2006; Kim et al. 2008 and Kim et al. 2009). van der Heijden (2003) recognizes the effect of trust on perceived risk but considers attitude to mediate both their effects on intention.

Those who consider risk as antecedent to trust have modeled trust as partially mediating (e.g., Dinev and Hart 2006), or fully mediating (e.g., Li et al. 2007; Chandra et al. 2010) the risk-intention relationship. Others (e.g., Horst et al. 2007) model the effects of trust and risk as fully mediated by other cognitions such as perceived usefulness. Still further, some consider no inter-relationship between trust and risk and view them as independent predictors of attitude (e.g., Verhagen et al. 2006; Bianchi and Andrews 2012), intention (e.g., Song 2010), or a combination of attitude and intention (e.g., Lee 2009; Izquierdo-Yusta and Galderon-Monge 2011). Figure 1 reflects some of these inconsistent ways in which the trust-risk relationship and their effects on consumer acceptance have been modeled in past research.

Our review of the field suggests that while past studies have contributed much to our understanding of trust and risk in e-services, the literature is characterized by competing perspectives that have led to a confusing number of research models being postulated. In addition, the effect sizes reported in past work have varied, and the sources of this heterogeneity have not been uncovered. As a result, the field lacks a

general conclusion about the trust-risk relationship and it is not clear which between the two has the stronger average effect on consumer acceptance. Significant heterogeneity in reported effect sizes could indicate that trust and risk perceptions have different effects on consumer acceptance depending on factors such as the type of e-service or the characteristics of the consumer population. It is also not clear which of the competing logics linking trust and risk to e-service acceptance is best supported by the available evidence. The divergent perspectives highlighted a decade ago in Gefen (2003b) are becoming even more pronounced, the efforts of e-service researchers remain uncoordinated and a more complete theory of online consumer behavior still eludes the field. Our intent therefore is to combine evidence from multiple studies to determine the average strength of the relationship between trust and risk perceptions (RQ1) and their relationship with consumer acceptance variables (RQ2), to examine a set of factors that might explain any heterogeneity in the effect sizes reported in past studies (RQ3), and to determine which of the competing nomological models best fits the combined data (RQ4). We discuss our approach next.



## Research Methodology

### Meta-Analytic Structural Equation Modeling

To address the fragmented and contradictory nature of the field and the research questions posed in the introduction, we adopted a meta-analytic structural equation modeling (MASEM) approach. MASEM combines the procedures of meta-analysis and structural equation modeling in a step-wise fashion. First,

meta-analysis is used to combine quantitative evidence from prior studies and to estimate both weighted mean and true-score correlations between the variables of interest (Hunter and Schmidt 2004). Cumulating the available evidence from across a number of studies allows us to reach a general conclusion about the relationships between trust and risk, and their consequent effects on consumer attitudes and intentions toward e-services posed by research questions 1 and 2. Moreover, meta-analytic techniques can identify heterogeneity in effect sizes across studies. This allows for subsequent examination of the influence of moderators that may account for observed inconsistencies in the effect sizes reported by prior studies. Accounting for any observed heterogeneity through examination of moderators addresses our third research question. Furthermore, a matrix of true-score correlations derived from a meta-analysis can then be applied in a structural equation modeling (SEM) analysis for testing whether a given model fits a hypothesized pattern of relationships (Viswesvaran and Ones 1995). This will allow us to address the fourth research question by testing which of a number of competing models (Figure 1) best fits the combined data. In the following sections we discuss our data sources and our criteria for inclusion of studies in the meta-analysis. We then discuss our procedures for data coding and analysis before presenting our results.

### ***Identifying the Studies***

To ensure the validity of the meta-analysis, we sought to include as many studies as possible where trust and risk perceptions were both treated explicitly in investigations of e-service acceptance.

We adopted a broad definition of e-service to include all forms of B2C electronic commerce, electronic banking, online health services, e-government, professional services such as online financial advisory and legal services, consumer-to-consumer exchanges, and mobile payment services, amongst others.

We conducted a computerized search of the following electronic databases: EBSCO Business Source Premier, Science Direct, Jstor, Emerald and ABI/INFORM Global. Our search terms included “consumer” or “customer” or “user” or “citizen” or “individual”; “use” or “adoption” or “acceptance” or “behavioral intention”; “risk” and “trust”; and variations of “e-service” or “e-commerce” or “e-banking” or “e-government” or “e-health” or “mobile payment” or “online”. We further restricted the search to empirical studies through the use of search terms such as “survey” or “experiment” or “field study” or “correlation”. We further restricted the time frame to articles published (or in press) between January 2000 to March 2013. Prior to 2000 research on consumer behaviors was mostly focused on off-line transactions. Jarvenpaa et al. (2000) was the first empirical study integrating trust and risk research in e-commerce and paved the way for the subsequent trust and risk studies to be reviewed here. English was the language criterion for all articles. To avoid the concerns of publication bias with meta-analysis (King and He 2005; He and King 2008) we also considered conference publications via a search of IEEE Xplore and the AIS e-library.

All the studies had to be accessible to the authors through their university’s library system and its comprehensive electronic database subscription. Articles were required to include examination of both trust and risk. We thus excluded papers that focused on only one of trust or risk (e.g., Ba and Pavlou 2002). We excluded articles that did not focus on trust and risk in online services. For example, Kerler and Killough (2009) studied trust and perceived risk but not in an online environment. We excluded articles not reporting on results of an empirical study (e.g., Gefen, et al. 2003b; Yousafzai et al. 2003; Corritoro et al. 2003; Taleghani et al. 2011). We also excluded papers that did not report correlations. For example, van der Heijden et al. (2003) and Verhagen et al. (2006) provided only SEM estimation results. Furthermore, we excluded papers where we were not able to resolve queries regarding the reported correlation matrix prior to submission (e.g., Bélanger and Carter 2008; Song 2010). Finally, a total of 52 published studies remained for the purposes of the MASEM analysis (43 journal articles, 8 proceedings papers and 1 dissertation).

### ***Coding the Studies***

Each article or publication was examined to extract data required for the meta-analysis. The two authors of this article independently coded the studies and discussions were held to resolve any disagreement. We collected information on each study’s year of publication and sample size. We identified that almost half the studies were published in the last 3 to 4 years - 28 were published from 2000 to 2009, and 24 were

published between 2010 and March 2013. We classified articles based on the type of e-service under examination. These were classified as commercial based e-services such as e-commerce, Internet store, e-shopping, and e-banking. Non-commerce based e-services such as e-government, healthcare and social networking services (SNS). Based on the consumer population under examination, we classified studies into Western or Eastern culture groups. Furthermore, we identified whether studies employed convenience sampling through the use of student samples. The studies are summarized in Table 1.

<b>Table 1: Summary of Studies Included in Meta-Analysis</b>		
Years	<i>Last decade:</i> 2000 (1); 2001 (2); 2002 (2); 2003 (3); 2004 (2); 2005 (2); 2006 (7); 2007 (3); 2008 (2); 2009 (4). <i>Current decade:</i> 2013 (3); 2012 (4); 2011 (10); 2010 (7).	
Publication types	<i>Publication</i>	<i>No of articles</i>
	Information Systems Research	6
	Decision Support Systems	6
	Information & Management	3
	Journal of the Association for Information Systems	2
	Journal of Internet Commerce	2
	Electronic Commerce Research and Applications	2
	Computers in Human Behavior	2
	Other AIS basket journals namely EJIS, CAIS, JIT	3
	Other journals	17
Conference Proceedings	8	
PHD dissertation	1	
E-service intervention	<i>Commercial based e-services:</i> e-commerce (15); Internet store (9); e-shopping (6); e-banking (6). <i>Non-commercial based e-services:</i> e-government (4); online legal services (1); Internet user (1); peer-to-peer sharing (1); wi-fi hotspots (1); location-based services (1); healthcare (3); information disclosure (1); social networking (3).	
Country*	<i>Western:</i> USA (25); UK (1); Australia (2); Canada (1); New Zealand (1); The Netherlands (3); Spain (1); Chile (1); Greece (1); Dutch (1); Italy (1); Germany (1). <i>Eastern:</i> China (5); Taiwan (4); Singapore (3); Hong Kong (1); Jordan (1); India (1); Malaysia (1); Korea (1); Iran (1).	
Object of Trust#	<i>Trust in provider:</i> store (6); online provider (8); vendor (11); retailer (4). <i>Trust in platform and technology:</i> Internet (1); technology media (4); website (10); e-services (6). <i>Mixed trust variable</i> (10). Note that studies with a focus on multiple objects of trust were excluded from the moderator tests.	
* > 52 due to some studies examining more than one consumer population		
# > 52 due to some studies examining more than one object of consumer trust		

We examined the constructs employed in these studies and considered conceptual and operational definitions to confirm their consistency with our constructs of trust, perceived risk, attitude and behavioral intention.

Variables were coded as trust if they reflected a consumer's willingness to depend on the object of trust, such as the e-service provider, the e-service platform (e.g., website), or the communications network (e.g., Internet), based on a belief or confidence in the dependability, competence, ability, integrity, credibility and/or reliability of that trust object. Variables such as vendor reputation, third party assurances, vendor policies, service quality, or consumer propensity to trust were not coded as trust since past work has

shown them to be antecedents of trust beliefs. We further noted the object of trust under study (i.e., trust in the e-service vendor versus trust in the e-service platform) for use in subsequent testing.

Variables were coded as risk if they reflected a consumer's subjective assessment of the potential for loss associated with using the e-service. Variables reflecting consumer perceptions of mechanisms in place for security and information safeguarding were not coded as a risk perception as they have been defined by past work as determinants of risk perception.

Despite conceptual distinctions having been made in the literature (e.g., McAllister 1995) with regards to cognitive and affective dimensions of both trust and risk, we found that all extracted studies sufficiently met definitions of cognitive based trust and risk perceptions.

Variables were coded as attitude if they reflected a consumer's overall evaluative judgment regarding the e-service and variables were coded as behavioral intention if they reflected intentions to use or participate in an e-service. These included for example, purchase intentions, adoption intentions, willingness to disclose information, and intention to transact.

The authors then independently recorded each study's reported effect sizes (i.e., the correlations between our six variables of interest). These were then cross-checked for agreement. In certain cases, squared correlations needed to be transformed (e.g., Cho 2006). In one instance (Malhotra et al. 2004), we used the SEM path result to infer a positive rather than negative correlation between trust and behavioral intention. In one study, we included only a subset of the correlations related to the use of a health e-service site rather than more general Internet use such as email (Zimmer et al. 2010). In one further study (Luo et al. 2010) we coded only for the overall risk variable rather than its components.

In addition to the effect sizes, we coded the reliabilities of each study's variables using the reported Cronbach's alpha coefficient or if not available the reported composite reliability or internal consistency scores. Based on the reported reliabilities, we calculated an average reliability score for each variable for use in subsequent analysis.

### **Meta-Analytic Approach**

This study followed the methods of Hunter and Schmidt's (2004) random effects models to estimate effect sizes between our variables of interest. First, to correct for sampling error, we calculated the bare-bones or weighted mean effect size ( $r_+$ ). This approach weights each study's correlation by the number of observations in that study according to the formula:

$$r_+ = \frac{\sum N_i r_i}{\sum N_i}$$

Where  $N_i$  is the sample size of each study and  $r_i$  is the observed correlation value of each study.

Second, to correct for measurement error, we calculated the true-score correlation ( $r_c$ ) using the following formula:

$$r_c = \frac{r_{xy}}{\sqrt{r_{xx}} \sqrt{r_{yy}}}$$

Where  $r_{xy}$  is the average observed correlation across the studies,  $r_{xx}$  is the average of the reported reliability estimates for the independent variable, and  $r_{yy}$  is the average of the reported reliability estimates for the dependent variable.

Third, following Hedges and Olkin's (1994) recommendation, we also carry out homogeneity tests to determine whether any heterogeneity in the underlying correlations used in the meta-analysis is present. Variance in the underlying correlations may suggest the presence of moderating variables. First, we calculate 95% credibility intervals (Hunter and Schmidt 2004). If the intervals are sufficiently large then the presence of moderators should be expected. Second, we carry out a homogeneity test to determine if  $Q$  exceeds the critical value. If  $Q$  exceeds the critical value, moderating effects should be suspected (Schepers and Wetzels 2007).

Finally, the fail-safe test is used to test the robustness of the findings by estimating the number of non-significant results or non-published studies that would be required to reduce an obtained mean effect size

to a trivial level (Rosenthal 1979). A general rule of thumb is that the fail safe N value should exceed  $5K+10$  (where K is the number of observed correlations).

## Results

### Descriptive Analysis

The descriptive statistics of the meta-analysis are presented in Table 2. For each pair-wise relationship, we report the total number of studies, the total number of observed correlations, range of correlation, range of sample size, the cumulative sample size and the average of sample size. Because some publications reported results from tests on more than one sample or had more than one object of trust, risk or behavior under examination, the number of available pair-wise correlations could exceed the number of publications.

The correlations for TR-PR range from -0.810 to 0.260 and the average correlation is -0.377, for TR-ATT from 0.096 to 0.744 and the average correlation is 0.508, for PR-ATT from -0.722 to 0.000 and the average correlation is -0.422, for TR-BI from 0.000 to 0.789 and the average correlations is 0.455, for PR-BI from -0.780 to -0.002 and the average correlation is -0.384, the correlation of ATT-BI is in the range from 0.316 to 0.844 and the average correlation is 0.570.

Pair-wise relationship	No of studies	No of correlations (K)	Correlations			Range of sample size		Total N	Ave N
			Lower	Upper	Ave	Lower	Upper		
PR-TR	52	60	-0.810	0.260	-0.377	52	1381	21696	362
TR-ATT	14	18	0.096	0.744	0.508	145	1381	7955	442
PR-ATT	14	18	-0.722	0.000	-0.422	145	1381	7955	442
TR-BI	46	55	0.000	0.789	0.455	52	1381	20900	380
PR-BI	46	53	-0.780	-0.002	-0.384	52	1381	19679	371
ATT-BI	14	17	0.316	0.844	0.570	145	1381	7768	457

TR: Trust; PR: Perceived risk; ATT: Attitude; BI: Behavioral Intention; N: sample size; Ave: average.

### Meta-Analysis of Effect Sizes

To answer our first two questions on the overall relationship between trust and risk perceptions in e-service and the overall relationship between consumer attitudes and intentions toward the use of e-services and their trust and risk perceptions, we report the meta-analysis of the effect sizes, including both the bare-bones effect corrected for sampling error, and the true-score effect corrected for measurement error (Table 3). 95% confidence intervals for each bare-bones correlation reveals no intervals containing zero. Thus all 6 correlations are significant. Both  $r_+$  and  $r_c$  suggest the correlations between our variables of interest are moderate to strong. The calculated effect sizes show that trust and risk are related but that trust has on average a stronger correlation with both attitude and behavioral intention than risk perception. Each fail-safe N statistic was greater than  $5K + 10$ . Thus all pair-wise correlations pass the fail-safe test and the results are considered robust to publication bias.



95% credibility intervals are however sufficiently large. Thus suggesting the underlying studies are not homogenous and the presence of moderators is expected. We explore this next in an effort to answer our third research question.

Table 3: Meta-Analysis Results											
Pair-wise relationship	$r_+$	$r_c$	Var $r_+$	Var $r_c$	SD( $r_c$ )	95% Confidence interval		95% Credibility interval		Fail-safe N (Nfs 0.05)	Result
						Lower limit	Upper limit	Lower limit	Upper limit		
PR-TR	-0.356	-0.435	0.046	0.043	0.230	-0.410	-0.302	-0.040	-0.829	416	Sig
TR-ATT	0.578	0.582	0.035	0.041	0.225	0.492	0.665	0.192	0.972	232	Sig
PR-ATT	-0.413	-0.482	0.034	0.041	0.226	-0.498	-0.327	-0.092	-0.872	148	Sig
TR-BI	0.467	0.519	0.023	0.025	0.169	0.427	0.507	0.222	0.816	519	Sig
PR-BI	-0.369	-0.437	0.038	0.039	0.218	-0.422	-0.317	-0.059	-0.814	381	Sig
ATT-BI	0.596	0.644	0.022	0.023	0.162	0.526	0.666	0.355	0.933	227	Sig

$r_+$ : Bare-bones effect size;  $r_c$ : true-score correlation; SD( $r_c$ ) Standard deviation of  $r_c$  ;  
Sig: Significant; Var: Variance.

### Moderator Analysis

In addition to the large credibility intervals (Table 3), Table 4 shows that Q values exceed the critical value in all pair-wise relationships, and we therefore considered the potential for the relationships to be moderated. To address our third research question, we considered five factors for their potential moderating effects.

First, convenience sampling in e-services research is prevalent. Of the 60 observed correlations between trust and risk, 42 were based on data collected from student samples. Opponents of the use of student samples would argue the limitations to generalizability that may result, whilst proponents might suggest that because general theories of behavior and internal systems of relationships are under examination, the use of student samples is valid and appropriate (Compeau et al. 2012). We therefore decided to follow other meta-analytic studies (e.g., Schepers and Wetzels 2007) to determine whether the use of a student sample moderated the calculated effect sizes.

Second, we consider whether the effects of trust and risk perceptions on online behavior are culture bound. Gefen et al. (2005) examined whether the role of trust in an e-service differed across US and South African citizens, Teo and Liu (2007) compared US, Singapore and China to determine whether effects of trust were universal across the cultural contexts, whilst Park et al. (2012) examined whether relationships between trust and online behavior differ between US and Korean consumers. We therefore examined the potential moderating effects of culture by classifying consumer populations as Western (e.g., USA; UK; Australia; Canada; New Zealand; The Netherlands; Spain etc.) and Eastern (e.g., China; Taiwan; Singapore; Hong Kong; India; Pakistan and Indonesia etc.).

Third, we considered whether the type of e-service would moderate the effect sizes. Our definition of e-service extends across a wide range of online exchanges including commercial based transactions between business and consumers and non-commercial services such as healthcare, social networking and those enabled by e-government systems. We compared whether type of e-service (commercial versus non-commercial) influences the strength of effects.

Fourth, our meta-analysis extends from the year 2000 to present. Over that time period, consumers have had an opportunity, on average, to become more experienced and familiar with transacting online. This has led some to question whether trust and risk may still be relevant in online consumer behaviors. In at least one study, online habit and routine use had only a small moderating effect on the link between trust and online consumer intentions (Chiu et al. 2012) - suggesting that trust retains a significant direct effect even for more experienced e-service users and over repeated interactions with e-service providers. On the other hand, one study suggested that familiarity may simply increase trust perceptions but not moderate the effect of trust (Bhattacharjee 2002). We therefore compared studies carried out in the last decade (2000-2009) with those carried out from 2010 to 2013 to determine whether effect sizes have weakened as a result of any average increase in consumer familiarity and experience with e-service transactions.

Fifth, we acknowledge the varying perspectives in the literature on the object of trust that is most relevant to online consumer behaviors i.e., whether trust in the e-service provider or trust in the e-service platform and enabling communications infrastructure exerts the stronger effect. We therefore compared whether effect sizes are dependent on the object of trust under study.

Table 4 shows the bare-bones correlation ( $r_+$ ) of each relationship in the subgroups, and the Fisher Z scores for comparing correlations between the subgroups. The significance of the Z score ( $>1.96$ ) provides confirmation of a moderating effect. We find a number of significant moderated effects, which are discussed after addressing our fourth research question.

Table 4: Moderator Analysis						
	PR-TR	TR-ATT	PR-ATT	TR-BI	PR-BI	ATT-BI
Q	1501	469	424	730	1139	414
Critical value	77.93	27.59	27.59	72.15	69.83	26.30
Student	-0.37	0.62	-0.45	0.47	-0.39	0.64
Non-student	-0.34	0.48	-0.33	0.47	-0.32	0.50
Z-value	<b>-2.30</b>	<b>8.03</b>	<b>-5.61</b>	0.08	<b>-5.08</b>	<b>8.24</b>
Western	-0.37	0.55	-0.45	0.46	-0.38	0.56
Eastern	-0.34	0.62	-0.38	0.47	-0.35	0.64
Z-value	<b>-2.08</b>	<b>-4.78</b>	<b>-3.86</b>	-1.01	<b>-2.86</b>	<b>-5.36</b>
Commercial	-0.36	0.62	-0.44	0.46	-0.38	0.59
Non-commercial	-0.33	0.40	-0.31	0.48	-0.40	0.61
Z-value	<b>-2.22</b>	<b>10.81</b>	<b>-5.62</b>	-1.41	<b>-2.43</b>	-1.12
Last decade	-0.36	0.64	-0.46	0.46	-0.38	0.65
Current decade	-0.35	0.47	-0.34	0.47	-0.35	0.51
Z-value	-0.83	<b>10.61</b>	<b>-5.96</b>	-0.91	<b>-2.35</b>	<b>9.35</b>
Trust in e-service vendor/provider (k=29)	-0.43	0.66		0.47		
Trust in platforms and technology (k=21)	-0.24	0.37	-	0.48	-	-
Z-value	<b>-14.37</b>	<b>13.77</b>		-0.85		

## SEM Analysis

Our final research question considers which nomological network of relationships (see Figure 1) would best be supported by the combined empirical evidence from the meta-analysis. To answer this question, we carried out a SEM analysis using a matrix of true-score correlations. We used maximum likelihood to fit the model and we used the harmonic mean of the sample sizes as a conservative estimate of sample size ( $n=221$ ) for input into the analysis. This approach is recommended in Viswesvaran and Ones (1995). We conducted the SEM analysis using AMOS version 20. Table 5 shows the results of SEM analysis of the competing models. In all the models, the paths are significant. The significance of the  $\chi^2$  statistics results from the relatively large sample size and the RMSEA values are high given the low degrees of freedom. Some of the models, e.g., Pavlou and Dinev, were just-identified. We tested an additional model, which recognizes the relative importance of trust over risk and we consider it to have the best overall fit. The implications are discussed next.

Model	$\chi^2$	p	df	AIC	GFI	RMSEA	AGFI	NFI	CFI
Bianchi and Andrews (2012)	63.03	0.000	3	77.034	0.876	0.302	0.806	0.588	0.786
Dinev et al. (2006)	0.000	-	0	12.000	1.000	0.443	-	1.000	1.000
Gefen et al. (2003b) <sup>a</sup>	46.15	0.000	1	56.148	0.888	0.453	0.328	0.652	0.651
Gefen et al. (2003b) <sup>b</sup>	39.65	0.000	1	49.650	0.901	0.419	0.406	0.701	0.701
Izquierdo-Yusta and Galderon-Monge (2011)	101.58	0.000	2	117.581	0.844	0.476	0.220	0.655	0.655
Jarvenpaa et al. (2000)	8.90	0.003	1	26.895	0.981	0.189	0.806	0.970	0.973
Lee (2009)	50.89	0.000	2	66.886	0.906	0.333	0.531	0.827	0.831
Li et al. (2007)	17.23	0.000	1	27.228	0.952	0.272	0.713	0.870	0.875
Pavlou (2003)	0.000	-	0	12.000	1.000	0.443	-	1.000	1.000
Song (2010)	159.75	0.000	3	173.746	0.725	0.487	0.082	0.458	0.457
Van der Heijden et al. (2003)	16.89	0.000	2	32.886	0.964	0.184	0.822	0.943	0.948
Verhagen et al. (2006)	46.15	0.000	1	56.148	0.888	0.453	0.328	0.711	0.712
Additional proposed model <sup>c</sup>	4.74	0.030	1	22.738	0.989	0.130	0.895	0.984	0.987

a: TR->BI and PR->BI  
b: TR->PR and PR->BI  
c: TR->PR, TR->ATT, PR->ATT, ATT->BI, TR->BI

## Discussion

Over 50 empirical studies have explored the effects of trust and risk perceptions on consumer acceptance of e-services. However, the relationship between trust and risk and their effects on consumer acceptance has received inconsistent treatment in the literature. This has left a number of unanswered questions with regards to the overall relationship between trust and risk and the manner in which they come to influence acceptance. In an effort to address these questions, we carried out a meta-analysis that enabled us to synthesize the available correlational evidence on the trust-risk relationship and their effects on consumer attitudes and intentions toward the use of e-services.

Our results show that the mean corrected correlations between the variables are all significant. This confirms the importance of trust and risk perceptions to the study of online consumer behavior. Trust and

risk are found to be related and they are both salient beliefs influencing consumer acceptance of e-services. The question as to which of the two beliefs has a larger average effect size has been resolved by our analysis. By cumulating evidence from past studies, we have found that trust has (on average) a stronger relationship with both attitude and intention than does risk perception. This suggests trust may be the more relevant of the two variables in providing explanations of online behaviour. Interestingly, the relationship between trust and attitude is stronger than the average relationship between perceived usefulness and user attitudes reported in prior meta-analytic studies of the popular technology acceptance model (Zhang et al. 2012; Yousafzai et al. 2007; Schapers and Wetzels, 2007). The effect of trust on behavioral intention is stronger than the effect of perceived usefulness on intention reported in at least one prior meta-analytic review (Zhang et al. 2012) although slightly lower than that same relationship reported elsewhere (Yousafzai et al. 2007; Schapers and Wetzels 2007). From a theoretical standpoint the importance of both trust and risk constructs, and their explanatory power in the e-services context has been confirmed and their roles within the study of e-service acceptance deserves continued exploration.

We used the data from the meta-analysis to test a number of competing models found in the literature. Our SEM analysis has provided some useful insights into the interrelationships between our variables of interest, which to date have been modeled inconsistently in the literature. Of the analyzed models, we found the Jarvenpaa and van der Heijden models fit the data quite well. Both models incorporate attitude and recognize the effects of trust on risk. However, we found that a better fit model could be obtained by including a direct effect of trust on behavior and eliminating the direct effect of risk. This model recognizes the relatively more important role of trust in consumer acceptance shown by our meta-analysis. Models that present trust merely as antecedent to risk and attitudes are of poorer fit. Moreover, models that position risk as a determinant of trust only, or that consider trust and risk as independent predictors are of poorer fit. This suggests that the synthesized evidence as it relates to trust and risk best fits the causal logic discussed in Pavlou (2003). This logic describes trust as reducing behavioral uncertainty and related risk perceptions. When consumers have greater trust, they can rely on the service provider not to behave opportunistically and can depend on the provider to take steps to reduce the risks associated with the e-service infrastructure. Trust thus attenuates the perceived risks associated with e-services (Pavlou, 2003). However, our best fit model identified that trust also retains a strong direct effect on behavioral intention. Thus risk only partially mediates the effects of trust. Risk reduction may not be the only mechanism through which trust influences online behavior. Identifying the other mechanisms responsible for translating the effects of trust into increased acceptance would be a useful avenue for future research.

Our meta-analysis did however reveal significant heterogeneity in the effect sizes reported by prior studies. We examined whether moderators may play a role in explaining differences in the magnitudes of effect sizes. First, we found that studies involving the use of students are prone to reporting higher than average correlations. One explanation might be that student respondents are more prone to certain methods biases that can artificially inflate correlations such as social desirability biases. Researchers should thus be cautious in generalizing results from studies involving student populations.

The effects of trust on behavior do not seem to differ between Eastern and Western contexts. However, perceptions of risk are more strongly correlated with attitudes and behaviors amongst Western consumers, while trust is more important to the formation of attitudes amongst Eastern cultures. This can be explained with reference to the more collectivist orientation of Eastern cultures. Trust reflects a willingness to rely on others not to behave opportunistically, and a willingness to be vulnerable. However, in collectivist cultures there is a tendency not to want to transact with unfamiliar parties, and where out-groups are treated with greater suspicion. This is likely to elevate the importance of trust to attitude formation (Gefen and Heart 2006). Weber and Hsee (1998) offer an explanation for the relatively more important role of risk perceptions to behavior in Western contexts by suggesting that persons in individualist cultures, such as the US, are expected to be more self-reliant and to personally bear the possible adverse consequences of making a risky decision. Thus they often lack the possible support that could cushion losses more common amongst socially-collectivist cultures.

High trust and low risk perceptions are more important to forming positive attitudes toward commercial than non-commercial e-services. Online commercial interactions are often conducted with less familiar providers, and the perceived financial risks associated with uncertain transactions are more immediately evident. This is likely to be important to attitude formation. On the other hand, attitudes toward e-service

use in non-commercial settings appear to be driven less by uncertainties and fears of opportunism and may be influenced by other motivations. Uncovering determinants of attitude toward non-commercial e-services is a useful avenue for future research.

Interestingly, the relationship between trust and risk and their associations with behavior have not changed much over the years. E-service use may not have yet become a sufficient enough consumer habit (Chiu et al. 2012) for these relationships to be weakened. The uncertainties that create a need for trust and which increase risk perceptions continue to remain important to our explanations of behavioral intentions.

Finally, one of our most important findings from the moderation analysis is determining that service provider or vendor based trust is more important than platform and technology based trust to consumer attitude and risk perceptions. This suggests that consumers are more confident in e-service infrastructures and are likely to place more emphasis on their perceptions of the e-service vendor when forming attitudes and considering risks. This finding is somewhat consistent with Harridge-March's (2006) suggestion that due to the growth in the Internet and the number of transactions taking place online, that the object of trust is shifting away from trust in the enabling mechanisms and channels toward trust in the e-service provider. Importantly, however, trust in both the e-service provider and the e-service platforms are important when it comes to behavioral intentions.

Taken together, the meta-analysis of effect sizes and the moderator findings suggest that the continued development of e-services needs to focus on developing a climate of trust. Trust directly and through its effects on risk perceptions are important to ensuring consumers are at ease in disclosing information and undertaking transactions. Despite some observed heterogeneity, the effects of trust on behavioral intentions are not moderated by any of the factors we considered and this requires attention in future research. Moreover, the effects of trust are only partially mediated by risk. Future research needs to continue previous efforts (e.g., Gefen 2003a; Kim et al. 2009; Lu et al. 2011) to uncover these additional mechanisms responsible for translating trust into increased acceptance.

## ***Contributions***

This paper has contributed to research on e-services in a number of ways. This is the first study to use a meta-analysis to examine the effects of both trust and risk on consumer acceptance and in so doing shed light on their relative importance to consumer attitudes and intentions. By integrating the available evidence from prior studies, our results provide a benchmark against which future studies can compare their effect sizes. Furthermore, our study compares competing nomological models found in the literature and in so doing improves our understanding of how trust and risk are related and how they combine to influence consumer acceptance. By examining the heterogeneity of effect sizes, we were able to identify important moderating effects. In particular, different objects of trust have different effects on acceptance and culture has an important influence on the relative effects of trust and risk. Trust and risk perceptions showed relatively consistent effect sizes with attitude and intention in both commercial and non-commercial e-service contexts. Moreover, the effects of trust and risk on behavior remain just as relevant today as they did in the early days of e-service. From a practical perspective, we highlight for e-service providers the importance of focusing on vendor-related trust which may have increased payoffs for consumer acceptance than technology platform trust alone. They will need to convince consumers of their capabilities and good intentions. In addition to trust building, e-service providers in Western consumer populations need to also focus on improving attitudes through additional risk reduction mechanisms whilst those in Eastern contexts should focus on changing trust attitudes through implementation of trust-building mechanisms relevant to more collectivist cultural contexts.

## ***Limitations and Future Research***

As in all meta-analyses, our findings are influenced by the underlying methods used in the primary empirical studies. Moreover, by aggregating findings from across studies, meta-analytic work loses information about the original study contexts. We could also not incorporate certain studies due to unresolved questions about reported values. We further restricted ourselves to only analyzing past studies that incorporated both trust and risk perceptions. The number of studies analyzed for pair-wise relationships between trust and attitude, trust and intention, risk and attitude and risk and intention,

would have been much greater had we included studies that reported on either trust or risk but not both. We found certain moderators to be important and future research may wish to further explore those findings. For example, alternative classifications of culture rather than the more basic Western/Eastern distinction may reveal additional insights into the moderating effects of culture. Future research needs to account for the possible causes of heterogeneity in the trust-intention relationship not uncovered here. Moreover, identifying the additional mechanisms through which trust influences acceptance deserves attention. As an extension to this meta-analysis, we aim to include an examination of factors that may influence trust and risk perceptions in e-services.

## Conclusion

This paper carried out a meta-analytic assessment of the effects of trust and risk perceptions on consumer acceptance of e-services. Results showed that trust and risk are significantly related but, between the two, trust is relatively more important to consumer acceptance and its effects on acceptance are only partially mediated by risk perceptions. Moreover, trust in the e-service provider and the e-service platform are important when it comes to behavioral intentions. Through the test of competing causal models, we were also able to resolve the inconsistent treatment of trust and risk perceptions in past e-services research. Our findings provide useful guidance for future e-service researchers on how to model trust and risk.

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