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A Meta-analysis of Online Trust Relationships in E-commerce

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Abstract

A meta-analysis examined the role of online trust in business-to-consumer e-commerce. The analysis of 16 pairwise relationships derived from 150 empirical studies involving online trust revealed that online trust exhibits significant relationships with selected antecedents (e.g., perceived privacy, perceived service quality) and consequences (e.g., loyalty, repeat purchase intention). Even so, additional analyses demonstrated that methodological characteristics such as study design, website type, and type of items used to measure the trust construct moderated certain online trust relationships. These additional analyses indicated that the relationships between online trust and its respective antecedents and consequences are simultaneously more idiosyncratic, complex, and subtle than previously envisioned. Implications of the analyses for theory, practice, and future research are discussed.

Keywords: Online trust; E-commerce; Consumer behavior; Meta-analysis; Moderator analysis

Introduction

Consumer online trust is an important construct that has been frequently studied in the e-commerce literature. Online trust is typically conceptualized as a mediator in research models between selected antecedents and consequences. Antecedents of online trust are studied to determine the extent to which they influence online trust. Consequences of online trust are studied to determine the extent to which online trust influences consumers' intention to use, use, or continue to use an e-commerce website (Pavlou 2003). However, empirical research involving online trust has produced inconsistent results. For example, the perceived size of an e-vendor had a significant positive effect on online trust in one study (i.e., Jarvenpaa, Tractinsky, and Vitale 2000), but an insignificant effect in other studies (e.g., Teo and Liu 2007). Inconsistent results create a quandary when attempting to generalize the existence, nature, and magnitude of online trust-related relationships.

One explanation proffered for the lack of consistent findings is that online trust and its antecedents and consequences do not have simple or direct relationships; rather, the relationships are moderated by other variables. The present research addresses possible moderated relationships involving online trust by means of a meta-analysis of empirical research findings from 150 business-to-consumer e-commerce studies involving online trust over the past 16 years. To date, while there have been several qualitative reviews of online trust relationships (e.g., Beatty et al. 2011; Beldad, de Jong, and Steehouder 2010; Chen and Dhillon 2003; Grabner-Kräuter and Kaluscha 2003; Salo and Karjaluoto 2007; Wang and Emurian 2005), no attempt has been made to quantitatively summarize the body of research involving online trust and its antecedents and consequences.

The manuscript begins with a brief description of online trust, followed by identifying 16 pairwise relationships involving online trust. The next section describes the search strategy used to obtain the meta-analysis data, the inclusion/exclusion criteria employed when harvesting data, and the meta-analysis procedures. The following section contains the results for the main effects emanating from the meta-analysis and the impact of possible research methodology characteristics on the relationships examined. The final section includes a

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discussion of the research findings and limitations as well as suggestions for theory, practice, and future research on online trust.

Online Trust Construct

With a plethora of e-commerce websites that consumers can choose from, online trust has become an important construct to investigate in the context of e-commerce. Online trust is generally regarded as reliance on a specific firm by its stakeholders with respect to the firm's business activities in the electronic medium generally, and specifically on its website (e.g., Kim 2012; Shankar, Urban, and Sultan 2002). Three attributes arguably comprise the main elements of online trust: integrity, ability, and benevolence (Lee and Turban 2001). For consumers, the assurance of online trust helps them mitigate vulnerabilities such as security and privacy breaches associated with online commercial transactions (Beldad, de Jong, and Steehouder 2010; Blut et al. 2015).

Although a plethora of antecedents and consequences that map into online trust has been investigated (e.g., Beldad, de Jong, and Steehouder 2010; Chen and Dibb 2010), the present research incorporates only those that have been frequently studied with at least ten observations identified from prior empirical research. For this meta-analysis, antecedents of online trust investigated include disposition to trust, perceived risk, perceived security, perceived privacy, perceived reputation, perceived usefulness, perceived system quality, perceived information quality, perceived service quality, and perceived design quality. Consequences of online trust investigated in the present meta-analysis include satisfaction, attitude, purchase intention, repeat purchase intention, intention to use website, and loyalty. Table 1 provides a brief overview of the 16 online trust relationships examined in the present meta-analysis.

Research Methodology

Data Collection

Several labor-intensive retrieval strategies were used to identify the analysis set of relevant published and unpublished studies. An initial search for studies was conducted through Google Scholar using the terms *trust*, *website*, *e-commerce*, *Internet*, and *online*, and combinations of these terms. The next step was to search for studies within ACM, Business Source Complete, CiteseerX, JSTOR, Emerald, ISI-Web of Knowledge, IEEE Xplore, SpringerLink, and ScienceDirect databases using the same terms. These databases were selected because they have a relatively high density of information systems, marketing, and communication articles and papers in which online trust-related studies would likely be found.

In addition, two dozen prominent academic journals (e.g., *Journal of Marketing*, *MIS Quarterly*) in which quantitative, Internet-related articles are frequently published were searched. All articles published in the journals reviewed over the period of 1999 to 2015 were thoroughly examined to determine if empirical studies included online trust and its antecedents and consequences as measured variables.

Relevant studies were also identified by scanning review papers and references from the retrieved papers. Finally, studies were retrieved from conference and dissertation databases. Proceedings of established information systems conferences including INFORMS, International Conference on Information Systems, Pacific Asia Conference on Information Systems, and the Hawaii International Conference on Systems Sciences were searched as were dissertations in ProQuest Dissertations & Theses Full Text.

Incorporating unpublished research allows addressing the file-drawer problem. Since journals are more likely to publish statistically significant results than nonsignificant results, articles therein are more likely to report the results of studies with effect sizes larger than studies that are not published (Rosenthal 1995). Although there is the possibility of overlooking potential studies, the data collection procedure attempted to obtain a complete set of studies—whether published or unpublished. The harvested values were zero-order correlations involving online trust and its respective antecedents and consequences; these values were used to create a database. In addition to these correlations, reliability estimates associated with the harvested values were coded. Finally, methodological characteristics of each study were also included in the database as potential moderators.

Inclusion/Exclusion Criteria

The literature search resulted in 231 articles and papers reporting empirical studies that incorporated online trust relationships. As long as online trust was measured empirically and was correlated with one or more antecedents or consequences in an e-commerce context, the study was initially included in the meta-analysis database.

However, some studies that examined online trust were excluded from the meta-analysis. Studies were excluded because they used the same dataset as another study (e.g., Gefen, Karahanna, and Straub 2003a; Gefen and Straub 2003) or only measured trust in the Internet (e.g., Pan and Chiou 2011). Studies were also excluded if they only measured trust in an e-vendor's brand (e.g., Ha 2004) or if they focused on business-to-business e-commerce or consumer-to-consumer e-commerce instead of business-to-consumer e-commerce (e.g., Pavlou 2002). Other studies were excluded because they did not report statistics necessary for the meta-analysis or only contained results from multivariate models (e.g., Chen and Barnes 2007). Consequently, 111 papers were excluded for one or more of these reasons. This resulted in 120 papers consisting of 97 journal articles, 14 conference papers, and 9 dissertations reporting findings for 150 independent studies providing data for the meta-analysis. The total sample size from all studies was 54,752; sample sizes ranged from 35 to 6,831 (M = 377.6, SD = 49.0). The 97 journal articles originated from 50 different journals.

Table 1
Relationships examined in meta-analysis.

Variables	Conceptual definition	Brief summary of relationship
Disposition to trust	Propensity to trust other parties as a result of lifelong experience, personality types, and cultural background (Fukuyama 1995).	When consumers possess inadequate knowledge about a website because of no prior interaction, disposition to trust is shown to be a factor in the formation of online trust (Gefen 2000).
Perceived risk	Consumer's belief about the potential uncertain negative outcomes from the online transaction (Kim, Ferrin, and Rao 2008).	Perceived risk must be present for trust to emerge such that trust would mitigate the uncertainties and risks (Corbitt, Thanasankit, and Yi 2003).
Perceived security	Refers to the perception that technical guarantees involving legal requirements and good practices related to privacy will be met (Casalo, Flavián, and Guinalíu 2007).	When security-based mechanisms provide protective measures for safeguarding individual information, the website bolsters consumers' confidence that the website can be trusted (Bart et al. 2005).
Perceived privacy	Refers to the perceptions that legal requirements and good practices exist to manage personal data (Casalo, Flavián, and Guinalíu 2007).	If privacy is assured in sharing personal information on a website, online trust is enhanced (Bart et al. 2005).
Perceived reputation	Consumer's perception of whether a retail store is honest, concerned about its customers, and has the ability to execute its promises (Doney and Cannon 1997).	A website with a good reputation spawns consumer trust by fulfilling its commitments that are promised to them (Casalo, Flavián, and Guinalíu 2007).
Perceived usefulness	Refers to the degree to which consumers believe that a particular technology will facilitate the transaction process (Davis 1989).	If consumers believe that using a website provides utility, the website can be trusted (Pavlou 2003).
Perceived system quality	Refers to the technical and functional characteristics of an information system pertaining to reliability, flexibility, accessibility, and timeliness (Aladwani and Palvia 2002).	When a website is easy to navigate and contains no errors, it is an indication that a website can be trusted (Yoon and Kim 2009).
Perceived information quality	Pertains to the content of the information displayed by the system, measuring the website's completeness, accuracy, format, and currency (Aladwani and Palvia 2002).	If the information provided by the website is reliable and accurate, it will increase the consumer's trust of the website (Cyr 2008).
Perceived service quality	Consumer's subjective evaluation of the interaction quality with a website and how well the service needs have been met (Parasuraman, Zeithaml, and Berry 1988).	Consumers will appreciate a website's effort for providing high-quality service, a sign that a website is capable of displaying integrity and trustworthiness (Brown and Jayakody 2009).
Design quality	Entails the perception of the balance, emotional appeal, aesthetics, and uniformity of the website's overall visual look (Garrett 2003).	A visually appealing website demonstrates the e-vendor's capability and professionalism, which would engender online trust (Bart et al. 2005).
Satisfaction	Contentment of the consumer with respect to his or her prior purchasing experience with an e-vendor (Anderson and Srinivasan 2003).	A series of positive encounters will demonstrate that a customer has reinforced his or her trust in the e-vendor and consequently was led to a satisfactory purchase experience (Chen and Chou 2012).
Attitude	A learned disposition to respond in a favorable or unfavorable manner with respect to a given object (Fishbein and Ajzen 1975).	When an e-vendor has trustworthy characteristics (i.e., ability, benevolence, integrity), consumers are more likely to form positive attitudes toward the e-vendor (Teo and Liu 2007).
Purchase intention	Consumer's volitional commitment to purchase a product/service from an online vendor (Kim, Ferrin, and Rao 2009).	Higher levels of trust for a website will increase the likelihood that a consumer is willing to accept vulnerability by forming an intention to purchase (Kim, Ferrin, and Rao 2009).
Repeat purchase intention	Consumer's volitional commitment to purchase a product/service from the same online vendor (Chiu et al. 2012).	The cumulative experience from using a website has already built up trust levels and this encourages the consumer to make additional purchases from the same source (Chiu et al. 2012).
Intention to use website	Consumer's volitional commitment to use a website (Gefen, Karahanna, and Straub 2003b).	Online trust encourages consumers to use a website by reducing the opportunistic behaviors that can be undertaken by the e-vendor (Gefen, Karahanna, and Straub 2003b).
Loyalty	Strength of the relationship between a consumer's relative attitude and repeat patronage (Dick and Basu 1994).	Once trust is secured, the degree of commitment, such as brand loyalty, attitudinal loyalty, number of visits, and number of exchanges, increases (Cyr et al. 2007).

Analysis Procedure

The analysis for each pairwise relationship followed the procedure for analyzing correlation coefficients suggested by Hedges and Olkin (1985). The effect size metric utilized for the relationships was the zero-order correlation "*r*". Studies that did not report correlations were examined to determine if there were other statistics that could be converted to *r*. Student's *t* and *F* ratios with one degree of freedom in the numerator were converted to *r* by means of formulas suggested by Hunter and Schmidt (2004), and standardized beta coefficients were converted to *r* by means of a heuristic procedure (Peterson and Brown 2005).

The Hedges and Olkin (1985) procedure assumes that correlations overestimate true effect sizes and thus requires that *r*s be corrected for bias through Fisher's *z*-transformation prior to analysis. Therefore, subsequent to the meta-analysis *z*-transformed effects were back-transformed into *r*s. Since reliability estimates might have varied across studies, correlations were corrected for attenuation following Hunter and Schmidt (2004). Cronbach alphas, and in cases where alphas were not reported, composite reliabilities, from each study were used in the correction formula (Hunter and Schmidt 2004). When reliability estimates were not available, the weighted mean reliability of a variable was used as a substitute.

To check for the existence of relationships between online trust and its respective antecedents and consequences, 95% confidence intervals and 90% credibility intervals were computed. While confidence intervals provide an interval estimate of corrected weighted mean correlations, credibility intervals refer to the distribution of the corrected weighted mean correlations (Hunter and Schmidt 2004). Credibility intervals use the corrected standard deviation, whereas confidence intervals use the standard error around the corrected weighted mean correlation. Calculating confidence intervals allows determination of the statistical significance of the correlations, and intervals that do not include zero suggest a relationship is statistically significant (at $p < .05$). If a credibility interval is "sufficiently large," it indicates the possible existence of moderators (Whitener 1990).

Because of its ability to balance Type I error rates and statistical power, the homogeneity statistic Q was computed to evaluate the variation in effect sizes for a given relationship (Cortina 2003). Q is distributed as a chi-square statistic with k (number of studies) minus one degree of freedom. A statistically significant Q statistic suggests the existence of moderators because the residual variance is not homogenous (Hunter and Schmidt 2004). In other words, if Q is statistically significant, an additional variable (variables) is (are) contributing to effect size variability.

A further analysis involved testing the robustness of the meta-analysis findings. The fail-safe N statistic was computed for each of the pairwise relationships (Lipsey and Wilson 2001) to assess the possible existence of a file drawer problem (Rosenthal 1979). The fail-safe N statistic indicates the number of studies with a correlation of zero between two variables necessary to reduce the effect size to a trivial result. A "small" fail-safe N statistic is an indication that effect sizes included in a meta-analysis are biased upwards because the identified studies mostly include significant results.

Finally, to evaluate the possible moderating effect of methodological characteristics on the online trust relationships investigated, a random-effects regression analysis was conducted on the transformed (corrected weighted mean) correlations to determine whether the methodological characteristics investigated could moderate the relationships studied. Random-effects regression was used because effect sizes were derived from different populations.

Possible Moderators

Research on online trust has been based on multiple forms of trust in a variety of study conditions. Therefore, to explore whether methodological characteristics may have influenced the magnitudes of the relationships investigated in the meta-analysis, eight common methodological characteristics were coded as potential moderators and regressed on the respective relationships between online trust and its antecedents and consequences. These potential moderators were selected based on their prior applications in various meta-analyses (e.g., Brown and Peterson 1993; Brown and Stayman 1992; Gilboa et al. 2008; Szymanski and Henard 2001). Each of these potential moderators is briefly described. Following Purnawirawan et al. (2015), to facilitate interpretation and comparisons among the potential moderators, all potential moderators were coded as dichotomous variables.

Sample Type

Researchers have frequently used samples of students. For example, Walczuch and Lundgren (2004) advocated the use of students for e-commerce research since they are active on the Internet for commercial transactions. However, certain conditions suggest that there might be differences between students and nonstudents in terms of placing trust in e-commerce websites (Pavlou 2003). Prior meta-analyses have shown that, on average, using student samples leads to higher correlations among variables than using nonstudents (e.g., Brown and Stayman 1992), and extrapolating student-based findings to the general population (Peterson 2001) has been found to be problematic. Student samples were coded as "0" whereas nonstudent samples were coded as "1" for the moderator analysis.

Sample Culture

Prior research using cultural dimensions in an e-commerce context has shown that differences exist between cultures in online shopping approaches (e.g., Teo and Liu 2007). Specifically, whether a sample comes from an individualistic or a collectivistic culture can influence the magnitude of effect sizes in pairwise relationships involving online trust. As evidence, Yamagishi and Yamagishi (1994) noted that individuals from collectivistic societies tend to be less trusting than individuals from individualistic cultures. In addition, Teo and Liu (2007) argued that e-commerce is generally more established and mature in individualistic cultures; therefore consumers in individualistic cultures will tend to have more positive appraisals of online interactions than consumers in collectivistic cultures. Hence, using samples from individualistic cultures (coded "1") may produce larger effect sizes for trust-related relationships than using samples from collectivistic cultures (coded "0"). For this study, sample culture designation was based on Hofstede's (1980) cultural dimension.

Sample Gender

Research has generally indicated that males are more likely than females to trust other parties (e.g., Glaeser et al. 2000). Females are more wary of uncertainty and risk (Byrnes, Miller, and Schafer 1999). Surveys and games from economics confirm these findings (e.g., Alesina and La Ferrara 2002; Buchan, Croson, and Solnick 2008). In one study involving gender and online trust, males possessed higher levels of trust regarding Internet shopping than females (Cyr and Bonanni 2005), although another study showed no significant difference in trust between the genders (Kolsaker and Payne 2002). Because study samples typically consist of a mixture of males and females, it is not possible to code samples by gender per se. To resolve this issue, the approach of Griffeth, Hom, and Gaertner (2000) was used to code gender differences: subgroups were formed by coding whether a sample consisted

of more than 50% male or female participants (>50% male (coded "1") versus >50% female (coded "0")).

Study Design

A potential methodological characteristic that could contribute to differences in the magnitudes of effect sizes across studies is whether a survey or an experimental design was used. Surveys can provide valid responses in real-life online purchasing contexts, but they have less flexibility than experiments with respect to controlling the variables being studied (Bryman 2012). Experiments, meanwhile, can control study variables, yet they may offer less realism because they might rely on artificial stimuli (e.g., a created website for a study). Different study designs can potentially be an important element in producing differences in the online trust effects reported in the literature. A meta-analysis conducted by Szymanski and Henard (2001) showed that using surveys produced higher correlations than using experiments. Here surveys were coded "1" whereas experiments were coded "0".

Website Type

Researchers have used test websites that are familiar (e.g., Amazon or eBay) or unfamiliar (e.g., a created website or relatively unknown website). For familiar websites (coded "1"), if consumers' prior interactions were favorable, they are more likely to be satisfied with their experience and trust the website when they encounter it the next time (e.g., Gefen, Karahanna, and Straub 2003b). In addition, a well-known website can potentially have a more positive reputation based on word-of-mouth and ratings from offline and online communities (Casalo, Flavián, and Guinalíu 2007). For unfamiliar websites (coded "0"), consumers do not know what to expect, resulting in relatively more uncertainty and consequently in placing less trust in the website. Empirical research has shown that consumers are more likely to trust websites that are familiar (e.g., Gefen 2000).

Sample Size

Systematic reviews of research in various fields have revealed that larger samples are inclined to have smaller effect sizes than smaller samples (e.g., Slavin and Smith 2009; Sterne, Egger, and Smith 2001). Effect sizes have more variability in smaller samples, so a small sample size requires a larger effect size to obtain statistical significance (Slavin and Smith 2009). Moreover, when a small sample size produces non-significant effects, the results are likely to be rejected by reviewers or will never be released to the public (Rosenthal 1979). Therefore, smaller sample size studies that are published tend to report significant and inflated effect sizes. With large sample size studies, a non-significant effect is usually a powerful indicator that there is no "true" relationship and is more likely to be published. Further, larger sample sizes have greater power than smaller sample sizes to identify the effect of a certain size, whether it is large or small. For this study, the median sample size ($N = 264$) of all the studies was used to form two subgroups: samples with ≤264 study participants (coded "0"), and samples with >264 study participants (coded "1").

Number of Items for Trust Construct

In a meta-analysis of salesperson job satisfaction (Brown and Peterson 1993), the effects of role constructs on job satisfaction were greater for studies that used a larger number of items to measure satisfaction. In studies analyzed in the present research, researchers have deployed between three (e.g., Kim, Ferrin, and Rao 2009) and 15 items (e.g., Chen and Dibb 2010) to measure online trust. In line with the results produced by Brown and Peterson (1993), using a larger number of items to measure online trust may produce stronger relationships due to likely higher reliabilities. For the moderator tests, effect sizes from research using three or fewer items (coded "0") were compared with effect sizes from studies using five or more items (coded "1") to measure online trust. In general, studies that typically deploy three or fewer items tend to adapt an entire scale from Doney and Cannon (1997), Jarvenpaa, Tractinsky, and Vitale (2000), or other highly-cited sources. Studies with five or more items typically select and combine items from different scales to measure online trust.

Type of Items Used to Measure Trust

There is confusion as to how to measure online trust (Shankar, Urban, and Sultan 2002), and researchers have applied two different measurement approaches. The first approach measures online trust with only positively valenced items, such as integrity, ability, and benevolence. The second approach also incorporates negatively valenced items measuring beliefs that an e-vendor will act in an opportunistic way (McKnight and Chervany 2001), in addition to positively valenced items. In this approach, negatively valenced items are negatively worded and the items are reverse-coded during the analysis process. For example, "this e-vendor would act in an opportunistic way" is a negatively worded item for an online trust scale that would be reverse-coded. Thus, mixed-valenced items are a combination of positively worded and negatively worded items. In general, mixed-valenced items tend to muddle a scale's internal consistency and dimensionality (Falthzik and Jolson 1974). Hence, online trust-related correlations generated using mixed-valenced items (coded "1") should be smaller than those generated using only positively valenced items (coded "0").

Results

Meta-analysis Results

Table 2 contains the meta-analytic results for the 16 relationships investigated between online trust and its respective antecedents and consequences. As can be seen in Table 2, all 10 antecedents investigated were significantly related to online trust ($p < .05$). The meta-analysis indicated that online trust is strongly related to numerous antecedents that are by-products of interacting with e-vendor websites (e.g., perceived security, perceived system quality). As such, the results are generally consistent with prior (qualitative) research reviews (e.g., Beldad, de Jong, and Steehouder 2010). The most strongly related antecedent of online trust was perceived service

Table 2
Meta-analysis of antecedents and consequences of online trust.

Variables	*k*	*N*	*r*	r_c	*SD*	95% CI		90% CV		*Q* statistic	fail-safe *N*
						Lower	Upper	Lower	Upper		
Antecedents											
Perceived security	32	20,062	.51	.58	.08	.55	.61	.42	.74	3,861.85**	2,246
Disposition to trust	28	9,714	.28	.31	.03	.30	.32	.25	.37	181.63**	884
Perceived reputation	26	9,267	.52	.59	.05	.57	.61	.49	.69	674.31**	1,873
Perceived risk	25	10,276	−.41	−.55	.14	−.60	−.50	−.78	−.32	4,549.33**	1,671
Perceived SQ	19	12,908	.47	.54	.05	.52	.56	.44	.64	436.68**	1,200
Perceived IQ	18	6,161	.43	.51	.06	.47	.53	.39	.62	386.83**	1,021
Perceived usefulness	15	5,199	.53	.59	.08	.55	.63	.46	.72	403.40**	1,081
Design quality	14	4,725	.40	.47	.11	.41	.53	.29	.65	674.35**	731
Perceived privacy	13	10,121	.55	.65	.06	.62	.68	.53	.77	272.59**	1,098
Perceived ServQ	12	3,320	.61	.69	.06	.66	.72	.57	.81	126.23**	1,131
Consequences											
Purchase intention	34	9,780	.51	.58	.05	.56	.60	.50	.66	930.17**	2,386
Satisfaction	28	10,072	.53	.65	.14	.60	.70	.42	.88	5,249.89**	2,366
Attitude	22	10,083	.55	.64	.07	.61	.67	.52	.76	1,041.83**	1,810
Loyalty	19	6,422	.46	.56	.07	.53	.59	.44	.68	591.84**	1,256
Intention to use website	18	11,715	.55	.64	.20	.55	.73	.31	.97	5,443.32**	1,481
Repeat PI	10	3,418	.53	.58	.08	.53	.63	.45	.71	165.61**	701

Note. SQ = system quality, IQ = information quality, ServQ = service quality, PI = purchase intention; *k* = number of samples; *N* = total sample size; *r* = weighted mean correlation; r_c = weighted mean correlation corrected for measurement unreliability; *SD* = standard deviation of r_c; 95% CI = lower and upper limits of 95% confidence interval; 90% CV = lower and upper limits of 90% credibility interval; *Q* statistic = homogeneity statistic; fail-safe *N* = number of studies averaging null results that would be needed to reduce to a trivial size.
* $p < .05$.
** $p < .01$.

quality (r_c = .69), followed by perceived privacy (r_c = .65), and perceived reputation (r_c = .59) and perceived usefulness (r_c = .59). While statistically significant, disposition to trust (r_c = .31) only had a moderately positive relationship with online trust, confirming previous findings (e.g., Gefen, Karahanna, and Straub 2003b).

Likewise, all six consequences investigated were significantly related to online trust ($p < .05$), with satisfaction (r_c = .65) being the most strongly related. These results also are generally consistent with previous reviews of online trust-related research. Consequently, they lend support to the claim that online trust plays an important role in establishing trust-related outcomes in e-commerce.

Simultaneously, the fail-safe *N* statistics indicate that the weighted mean correlations corrected for attenuation differed significantly from zero to the extent that a substantial number of studies would be needed to reduce the respective estimates to a level not considered to be statistically significant. That is, a substantial number of new, unpublished, or unretrieved non-significant studies would be required to reduce the observed effect sizes to a trivial, nonsignificant level. The relatively large *N* statistics and the effort to include unpublished dissertations and conference papers make it unlikely that a large number of null effects exist that were not captured in the database.

Even so, as can be seen in Table 2, despite the significant relationships between online trust and the antecedents and consequences investigated, all *Q*-statistics were statistically significant. A significant *Q*-statistic indicates that an effect size distribution is heterogeneous and that some variable(s) other than subject-level sampling and measurement errors contribute to effect size variance (Lipsey and Wilson 2001). In particular, relatively large *Q*-statistics were observed for antecedent relationships involving perceived security and perceived risk, and consequence relationships involving satisfaction and intention to use website. Additionally, the credibility intervals for these four relationships were among the widest obtained, also implying that their effect sizes were not homogeneous.

Moderator Analysis Results

The *Q*-statistics and credibility intervals suggested that substantial heterogeneity existed in the pairwise relationships involving online trust. This heterogeneity in effect sizes indicated that evaluating the possible influence of the eight potential moderating variables was warranted. Therefore, random-effects regression-based moderator analyses were conducted on the pairwise relationships for which at least four observations were available for an analysis subgroup.

Specifically, random-effects regression analyses were conducted on online trust relationships involving six antecedents and five consequences. The analyses were not conducted on effects for online trust relationships involving perceived privacy, perceived usefulness, perceived service quality, or design quality. There were not enough individual effect sizes relative to the number of moderator variables for these relationships to be analyzed. Further, a purchase intention moderator variable was created for the analysis that was a combination of intention to purchase and intention to repeat purchase. In brief, 11 online trust-related relationships were examined for possible moderator effects.

Table 3
Regression analysis of moderator variables on effect sizes.

Relationship	Intercept	Moderator coefficients								R^2
		Sample type	Sample culture	Sample gender	Study design	Website type	Sample size	Number of items	Type of items	
Antecedents										.51 [a]
Disposition to trust	.35**	.11	.04	–	−.15	.07	.10	−.09	–	.21
Perceived risk	−.45**	−.20	−.29**	–	–	−.07	.17	.21	.45**	.61
Perceived security	.55**	.03	.00	–	–	.22**	.04	.04	−.27**	.40
Perceived reputation	.64**	.06	−.02	.16**	.21**	−.14	.02	−.01	–	.49
Perceived SQ	.49**	–	−.01	−.20*	–	.42**	−.26*	.11	–	.68
Perceived IQ	.93**	.16*	.29**	–	.33**	−.00	.16	.03	–	.69
Consequences										.33 [a]
Satisfaction	.60**	.31*	.10	.04	–	–	−.23	.09	−.27**	.36
Attitude	.65**	−.01	−.03	–	−.16*	.47**	−.09	.04	–	.44
Purchase intention	.56**	.08	.00	−.01	.21**	.07	−.08	−.01	.05	.52
Intention to use website	.65**	.12	.04	–	−.05	–	−.08	.00	–	.14
Loyalty	.59**	.04	−.09	–	–	.01	−.10	.20	.01	.19

Notes: SQ = system quality, IQ = information quality, ServQ = service quality; sample type (nonstudents = 1, students = 0); sample culture (individualism = 1, collectivism = 0); sample gender (male = 1, female = 0), study design (survey = 1, experiment = 0), website type (familiar = 1, not familiar = 0), sample size (larger = 1, smaller = 0), number of items (larger = 1, smaller = 0); type of items (mixed valence = 1, positive valence = 0).
In some cases, coefficients were not computed for moderator variables with subgroups that contained four or fewer observations. In other cases, there were too many missing effect sizes to permit an analysis.

* $p < .10$.

** $p < .05$.

[a] R^2 for the antecedents (.51) and consequences (.33) is the respective average among the antecedents and consequences rows in the table.

Table 3 reports the results of the moderator analyses. Specifically, Table 3 reports the intercepts, regression coefficients, and R^2 values of the moderator variables for 11 online trust- related relationships. With the exception of the number of items used to measure online trust, all of the remaining moderator variables were significantly related to the effect sizes of at least one of the online trust relationships examined, and three moderators significantly impacted three or more relationships. Consider the moderator website type. Familiar websites produced larger effect sizes for the perceived security–online trust, perceived information quality–online trust, and online trust–attitude relationships than did unfamiliar websites.

At the same time, no moderator variable was significantly related to effect sizes for the disposition to trust–online trust, online trust–intention to use a web site, or online trust–loyalty relationships. One or more moderator variables were significantly related to effect sizes in the remaining eight online trust relationships. For example, larger effect sizes were observed for the perceived information quality–online trust relationship for individualism sample culture than collectivism sample culture and for survey designs versus experimental designs.

Although experiments are able to offer more conclusive evidence – compared to surveys – with respect to online trust effects by controlling for possibly influencing factors, they typically include a level of artificiality that limits their external validity (Grabe, Ward, and Hyde 2008). Studies in this meta-analysis that employed experiments tended to rely on created/unknown websites that were not realistic. Naturally, these websites would likely contain website features (i.e., perceived security, perceived information quality) that are relatively underdeveloped, making it difficult to place trust in them. Therefore, it is not surprising that online trust relationship effects would be larger for perceived reputation, perceived information quality, and purchase intention, but smaller for attitude when surveys were employed.

The website type moderator test involved distinguishing between studies that utilized familiar websites versus those that used unfamiliar websites. Effect sizes were significantly larger for familiar websites as opposed to unfamiliar websites for three of the relationships involving online trust—perceived security–online trust, perceived system quality–online trust, and online trust–attitude. According to the literature, consumers return to familiar websites because of favorable experiences and when it is more likely that an e-vendor would honor its obligations in the future (Kim, Ferrin, and Rao 2008). Consequently, it is not surprising that the type of website employed in a study would moderate certain trust-related relationships (Gefen 2000).

The type of items employed when measuring online trust (positive valence versus mixed valence) significantly influenced three online trust relationships. Mixed-valence items produced larger effect sizes for the perceived risk–online trust relationship than positive-valenced items but smaller effect sizes for the perceived security–online trust relationship and the online trust–satisfaction relationship. Given the composition of mixed-valence scales used to measure online trust, this finding was not especially surprising, even though prior research (Falthzik and Jolson 1974) suggested mixed-valence scales would produce smaller effect sizes.

As can be seen from Table 3, the moderator variables, considered jointly, were able to account for more than 60% of the variance in online trust relationships for three antecedent

relationships—perceived risk–online trust, perceived system quality–online trust, and perceived information quality–online trust. On average, 51% of the effect size variance in the online trust relationships was accounted for by the moderator variables across the six antecedents. Only one consequent relationship, online trust–purchase intention, had more than half of the effect size variance in the relationship (52%) accounted for by the moderator variables. On average, only about one-third (33%) of the effect size variance in the online trust–consequences relationships was explained by the moderator variables.

Previous research on online trust has either concluded or implied that straightforward relationships exist between it and its antecedents and consequences. Indeed, based on statistical criteria, the meta-analysis conducted in this research also suggested such straightforward relationships. However, even though the effect sizes in the meta-analysis were statistically significant, the patterns, magnitudes, and directions of the moderator coefficients collectively indicated that the relationships between online trust and the antecedents and consequences investigated are more idiosyncratic, complex, and subtle than previously thought. This seems especially true for the online trust–consequence relationships, most notably the online trust–intention to use website relationship.

Discussion

Meta-analysis consists of procedures that permit the orderly synthesis of empirical results from different studies. As such, it promotes quantitative generalizations. At the same time, though, meta-analysis helps to identify avenues that warrant more research attention. Although the present meta-analysis documented several significant direct relationships between online trust and selected antecedents (e.g., perceived service quality–online trust) and consequences (e.g., online trust–satisfaction), given the unexplained heterogeneity observed in effect sizes in light of possible methodological moderators, further research is needed to identify and examine potential moderators as well as explanatory variables. (See, for example, Blut et al. (2015) for a similar conclusion.) For instance, while the meta-analysis suggested that disposition to trust–online trust, perceived service quality–online trust, and online trust–repeat purchase intention were fairly robust across study conditions, other trust-related relationships investigated appear to be influenced by methodological decisions.

The online trust–intention to use website relationship appears particularly complex. Not only did this relationship have the largest Q-statistic, 5,443.32, indicating the largest effect size heterogeneity of any relationship, it also had the widest credibility interval (.66) and the smallest R^2 value (.14) of the moderator analyses undertaken, and none of the individual moderators were significantly related to the relationship effect sizes investigated. Clearly more research on this relationship is needed.

The present meta-analysis only focused on common methodological choices or variables that reflect, in one sense, research artifacts that could contaminate or weaken the online trust relationships investigated. Other possible moderators should be explored. One category of possible moderators that needs to be explored consists of individual difference variables. Data collection for the meta-analysis revealed that individual differences have rarely been studied in the online trust literature.

Prior research has found that individual differences play a role in adopting technology (Agarwal and Prasad 1999) and have played a role in explaining technology adoption compared to institutional and technological factors (e.g., Lewis, Agarwal, and Sambamurthy 2003). In that regard, in-depth investigation of demographics as determinants and/or moderators of online trust should be a future research endeavor. Additionally, it would seem informative to know if and how stable (e.g., personality) and dynamic (e.g., computer self-efficacy) individual differences influence online trust. Since e-commerce website use is ultimately an individual decision, it is necessary to understand the individual difference variables that drive or moderate online trust from both theoretical and practical perspectives. This would especially seem to be true for an important relationship such as the online trust–intention to use website relationship. Given the documented variability in this relationship coupled with the inability to account for that variation with the moderators investigated, it seems logical that individual differences need to be examined in detail, both as potential drivers and moderators.

Relatedly, the present meta-analysis did not address the full extent of antecedents and consequences of online trust. Assuming that empirical studies incorporating more and different variables and constructs will be forthcoming, comprehensive meta-analyses can provide a springboard for future research that investigates additional antecedents and consequences of online trust. As new empirical studies emerge, future meta-analyses will be able to incorporate such variables.

Although excluded from this meta-analysis due to lack of data, possible variable candidates for future meta-analyses include third-party seals (Li, Jiang, and Wu 2014), Internet experience (Zhang et al. 2011), offline trust (Kuan and Bock 2007), social presence (Cyr et al. 2007), word-of-mouth (Bock et al. 2012), personality traits (Walczuch and Lundgren 2004), anxiety (Hwang and Kim 2007), perceived market orientation (Corbitt, Thanasankit, and Yi 2003), community features (Bart et al. 2005), and positive and negative reviews (Utz, Kerkhof, and van den Bos 2012).

Future research should incorporate more experimentation, new types of data, longitudinal approaches, and more robust measurement. The present meta-analysis found a general absence of experiments compared to surveys in evaluating online trust-related relationships. Creative experiments, similar to those of Kim, Kim, and Park (2010), Miyazaki (2008), or Riegelsberger, Sasse, and McCarthy (2003), are needed to determine cause-and-effect relationships. New types of data could provide unique perspectives on the nature of online trust. As an example of a new type of data, Riedl, Hubert, and Kenning (2010) used functional magnetic resonance (fmr) imaging to show that brain areas that encode trustworthiness differ between males and females. Longitudinal analysis is needed because trust is known to be a process developed over

time (Urban, Amyx, and Lorenzon 2009). However, scant research on online trust has been conducted on a longitudinal basis (e.g., Kim, Ferrin, and Rao 2009), even though longitudinal studies would be ideal for detecting long-term changes in online trust levels and behavior patterns.

Finally, the scales used to measure online trust are often ambiguous. This necessitates a well-developed scale to measure online trust that is specifically tailored to the business-to-consumer e-commerce environment. It needs to be shown that online trust is different from such concepts as perceived service quality, perceived security, and satisfaction. Many facets of online trust have already been identified, such as ability, integrity, benevolence, reliability, predictability, and overall trustworthiness, and future research needs to parse out and assess their respective explanatory capabilities and predictive validities. In sum, despite past efforts to identify reliable and valid measures of online trust (e.g., Bhattacherjee 2002; McKnight, Choudhury, and Kacmar 2002), the measurement process needs extra rounds of refinement in the context of business-to-consumer e-commerce, and pursuing this line of inquiry in the future is strongly encouraged.

Limitations

Analogous to all meta-analyses, this meta-analysis is not without limitations. First, moderator analyses based on small numbers of studies should be interpreted with caution and strong inferences should not be drawn. Several of the estimated relationships involved a small number of studies, limiting the power of the moderator analyses and posing a threat to the validity of the reported results.

Second, there might be possible weaknesses in the manner in which certain moderator variables, such as gender, sample size, and number of items were operationalized in the present research since the dichotomous criterion for determining particular subgroups may be imprecise. Such operationalizations could possibly add variability to the analysis and partially mask significant differences.

Third, the degree of heterogeneity identified in the online trust relationship effect sizes in the meta-analysis indicates that there are likely additional methodological as well as non-methodological moderators to be identified and examined. Future research that identifies variables that moderate online trust relationships could greatly improve understanding of how online trust is related to its antecedents and consequences.

Finally, the present analysis was hampered by the constructs deployed across the empirical studies. Constructs such as online trust have been defined and operationalized differently by researchers working in such disparate disciplines as marketing, management, or information systems. Hence, there is some ambiguity as to what items should capture or comprise online trust. For instance, there has been considerable conceptual and item-content overlap across measures proposed to measure online trust as well as other constructs. In some studies items used to measure online trust could be classified as a component of perceived service quality, or vice versa in other studies. In other studies, online trust was measured by facet (e.g., integrity, ability, benevolence) instead of by a composite measure (this difference was not analyzed as a moderating variable here due to a lack of studies measuring online trust by facet). In general, there is a proliferation of items representing a few underlying constructs in the online trust literature, making theoretical integration difficult. Hence, researchers should strive to use a rigorous psychometric development process to conceptually define and operationally refine online trust as well as its antecedents and consequences.

Conclusion

The future of business-to-consumer e-commerce would be tenuous without online trust. Indeed, according to Reichheld and Schefter (2000), price is not the determinant of online purchases; trust is. Thus, online trust will continue be an important aspect of e-commerce even though both e-commerce and the Internet itself have evolved considerably over time. Establishing consumer trust in e-commerce presents a challenge for e-vendors and is a subject that generates continuous interest and research.

The present meta-analysis provides new insights regarding the relationships involving online trust and selected antecedents and consequences. These insights are particularly germane for clarifying the conceptual ambiguities surrounding online trust-related relationships. The present research has also taken a step toward explaining the variance in relationship effect sizes observed across studies. Overall, this meta-analysis can be used as a starting point for future studies of online trust. To the extent that the present results are disseminated, future research on online trust should be more valid, reliable, and generalizable. Moreover, insights from this research should provide e-vendors with opportunities to experience positive returns (e.g., trust) on their investments.

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