

THE INFLUENCE OF PERCEIVED RISK ON CONSUMERS' INTENTION TO BUY ONLINE: A META-ANALYSIS OF EMPIRICAL RESULTS

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Abstract

When buying online consumers fear for the security of their financial data and the privacy of their personal information. These two fears summed up gives researchers the perceived risk of an online transaction. The influence of perceived risk on consumers' intention to buy online has been studied in various models, ranging from having an insignificant influence to having a strong and direct influence. Faced with these confusing results from previous empirical researches, we wonder why there are such differences among reported results. Is perceived risk a strong predictable of the consumers' intention to buy online? Should it be considered a significant impact variable when modelling online consumer behaviour? We answer these research questions by conducting a meta-analysis on previous empirical findings. We first conduct a search for academic articles that have included perceived risk in their explanatory and predictive models of online consumer behaviour. The search was carried out using ScienceDirect international database and Google search engine. The selection of articles to be included in the study was based on some defined inclusion criteria. All included models had to be based on an empirical research and had to report the correlation coefficient between perceived risk and intention to buy online. We selected 11 independent studies for inclusion in our meta-analysis. We report the findings from the mean effect sizes using a comparison between three methods: simple mean method, sample size-adjusted mean and Fisher r to Z transformation. Both limitations of this analysis and managerial implications are discussed.

Key words: perceived risk, online buying, meta-analysis, security, privacy

Introduction

The adoption of the Internet as a commercial medium has enabled consumers to buy online from their own homes or offices, not having to dress up, drive to the traditional store, or from store to store, face crowds, wait at checkpoints or deal with meddling sales people. All these benefits lead consumers to perceive that Internet buying is convenient and it saves time. Studies show that perceived convenience is among top reasons to adopt Internet buying (Margherio, 1998, p. 42; White and Manning, 2001, p. 42; Chiang and Dholakia, 2003, p. 181; Saprikis et al, 2010, p. 6; Gurvinder and Chen, 2004, p. 72). Time savings are also mentioned as a potential motivator for choosing to buy online (Khalifa and Limayem, 2003, p. 238; Gurvinder and Chen, 2004, p. 72).

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Confronted with information richness and a variety of products, brands and retailers, Internet buying can ease the process of products' selection (Gilly and Wolfinbarger, 2000, p. 189; Gurvinder and Chen, 2004, p. 72) and enable buyers to find bargains or goods at lower prices (Khare and Rakesh, 2011, p. 235; Khalifa and Limayem, 2003, p. 238; Gilly and Wolfinbarger, 2000, p. 193; Saprikis et al, 2010, p. 6)

Drawing from all these perceived benefits, one could ask himself why e-commerce is not adopted at a large scale. As consumers perceive benefits for buying online, they also perceive certain barriers that prevent them from shopping on the Internet. A potential barrier that has long been studied is perceived risk. Where does this fear come from? According to Grazioli and Jarvenpaa, perceived risk comes from a feeling of insecurity when having to disclose personal or financial information (Grazioli and Jarvenpaa, 2000).

Cases when data was intercepted and illegally manipulated were highly exposed by mass-media, lowering consumers trust in the security of an electronic transaction (Jahankani, 2009, p. 81). The fear that the electronic transactions are not safe enough represents one of the most important barriers that prevent consumer from buying over the Internet (Delafronz et al, 2011, p. 75; Pechtl, 2003, p. 152; Rudolph et al, 2004, p. 70; Khalifa and Limayem, 2003, p. 237; Suki and Suki, 2007, p. 89; Saprikis et al, 2010, p. 6; Miyazaho and Fernandez, 2001, p. 38; Suresh and Shashikala, 2011, p. 339)

The fear that personal information, such as name, address, personal identification number might be intercepted or it might be willingly alienated to third parties by retailers was found to be a significant barrier in adopting e-commerce (Rudolph et al, 2004, p. 70; Suki and Suki, 2007, p. 89; Miyazaho and Fernandez, 2001, p. 38)

Besides academic empirical results, there are other independent studies from various research institutes that state the same findings. For example, Romanian consumers are also reluctant in giving credit information in order to complete an online payment. Fear of electronic fraud was reported among 29.25% respondents of an e-commerce study on 5764 Romanian Internet users in 2010 (Radu et al, 2010). But if we take a closer look at the results of the same study, where consumers were asked about payment methods, 87.74% chose to pay cash upon delivery. There is only one conclusion we can draw from here: Romanians are not embracing online payment due to security issues.

According to Asia/Pacific, Middle East and Africa Online Shopping Study, 49% of the respondents that have never purchased online responded that they are not sure that online transactions are secure or safe (MasterIntelligence Knowledge Panel, 2010).

A study by Postcode Anywhere shows that 50% of the 1000 UK surveyed consumers reported online shopping turn offs due to data security concerns (Postcode Anywhere, 2011).

The Scope And Objective Of Current Study

In previous section we've highlighted that security and privacy are significant perceived barriers for embracing e-commerce. Consumers are reluctant in giving personal and financial information to online retailers in order to complete an electronic transaction.

Even though perceived risks exist among online consumers, some may choose to overcome the fear and buy online. The relation that shows best in which extent perceived risk can influence the adoption of e-commerce, is the direct relation between perceived risk (PR) and willingness or intention to buy online (I).

The PR - I relation was empirically tested and validated among various studies (Crespo and Bosque, 2008; Crespo and Bosque, 2010; Kim et al, 2008; Lin si altii, 2010; Liu and Wei, 2003; Shin, 2008; Lui and Jamieson, 2003; Eastin, 2002; Choi and Geistfeld, 2004; Shivraj and Vikas, 2004)

But different studies reported different results, ranging from an insignificant influence (Crespo and Bosque, 2008) to a high significant influence of perceived risk on the intention to buy online (Shin, 2008). Based on these confusing results of previous studies, one cannot assume whether perceived risk has or does not have a significant influence on the intention to buy online. Therefore, there's a need for further analysis of these reported results and shed light in this area of research in order to able to form a scientific statement in regards to the existence of a significant relationship PR-I and the extent of this relationship. For meeting our goal, we state the following objectives:

1. To identify and include in the study all relevant previous empirical results related to PR - I relation
2. To analyse previous PR - I relationships using various statistical techniques and report the findings
3. To find and discuss the effect of mediating variables that could have led to such different results

Methodology

Meta-analysis is considered an important research strategy that “enables researchers to combine the results of many pieces of research to determine whether the finding holds generally” (Burns and Burns, 2008, p.533). Rather than relying on an individual study to form a global assumption whether perceived risk influences or not the intention to buy online, we searched among various previous reported results. Gathering information on this particular relationship from more than one study enables us to compare and combine results, rather that make a “subjective eyeballing” (Burns and Burns, 2008, p.533). According to Burns R. and Burns R. a meta-analysis can be done in three stages: identifying the relevant variables, locating the relevant research and conducting the meta-analysis (Burns and Burns, 2008, p.533). Our methodology for finding and locating relevant articles for the inclusion in the study contains: the search strategy, identifying and applying the selection procedures and the extraction of data relevant to the study. The above mentioned steps followed B. Kitchenham recommendations for conducting a systematic review of literature (Kitchenham, 2004).

Search strategy: We searched for models of online buying behaviour in ScienceDirect, an international data base but we also used Google search engine for finding conference proceedings and other relevant articles. We mainly used keywords such as: “online buying” “online shopping”, ”e-shopping”, “e-buying”, “internet buying”, “internet shopping” and nevertheless “online consumer”. The preliminary search generated over 400 results. However, most of them did not meet our inclusion criteria.

Inclusion criteria: We were only interested in those results from an empiric quantitative research. Also, we only included general models of online buying behaviour, not sequential studies of certain category of products and services, for example travel products or services, apparel and books. For the purpose of this study, we only included those studies that reported correlation coefficients between the perceived risk and intention to buy online. The inclusion criterion table:

No.	Inclusion Criteria	Inclusion	Exclusion
1	Was the study based on a quantitative empirical research?	Yes	No
2	Was the empirical research conducted among a restrictive type of products and services?	No	Yes
3	Were the correlation coefficients between perceived risk and intention to buy online reported?	Yes	No

Table 1. Inclusion Criterion Table

Data extraction. We extracted data from the selected studies based on a checking list containing: the name of the author(s), the year when the study was published, the sample size, sample population, country and the correlation coefficient between perceived risk and intention to buy online. The data is presented in Table 1.

Author(s)	Country	Year	Correlation coefficient	Sample size	Sample population (students)	Cumulated sample
Crespo and Bosque	Spain	2008	0.0	675	no	
Kim et al	USA	2008	-0.220	468	no	
Crespo and Bosque	Spain	2010	0.0	998	no	
Lin et al	Taiwan	2010	-0.107	285	no	
Choi and Geistfeld	S. Korea	2004	-0.117	386	yes	
Choi and Geistfeld	USA	2004	-0.182	369	yes	
Liu and Wei	Singapore	2003	0.0	308	yes	
Eastin	USA	2002	0.0	247	no	
Lui and Jamieson	Australia	2003	-0.389	133	yes	
Shivraj and Vikas	USA	2004	0.0	183	yes	
Shin	USA	2008	-0.410	312	no	
						4364

Table 2. Data Extraction

When extracting data we paid special attention to two possible issues that could have led to biases in our analysis:

- The independence of individual findings. According to Ma and Liu this presumption can be violated when the same study reports more than one coefficient correlation from the same sample (Ma and Liu, 2004, p. 63). However, this was not the case of our studies.
- Estimation of effect sizes. According to Ma and Liu, different studies report different statistics (r , t , F or chi-square) and due to this, results may not be compared to provide meaningful results of the strength of our PR – I relation (Ma and Liu, 2004, p. 63). Fortunately, all studies reported correlation coefficient, so there was no need for further transformation in a common metric.

For conducting the meta-analysis we followed two approaches:

- Comparing studies, an approach that is followed when researchers want to determine whether two studies produce significantly different effects (Burns and Burns, 2008, p.538)
- Combining studies, an approach that is followed when researchers want to determine the average effect sizes of a variable across different studies (Burns and Burns, 2008, p.538)

For each approach, either p - values or effect sizes (correlation coefficients) can be recorded. Researchers highly recommend using correlation coefficients (r) because effect sizes provide a better estimate of the degree of impact of a variable than does p - value (Burns and Burns, 2008, p.538).

Data analysis and results

The data analysis and results section is divided among three parts: descriptive statistics of the extracted data, a comparison of studies by effect sizes and a combination of studies in order to determine the average effect size using three different methods.

Descriptive statistics

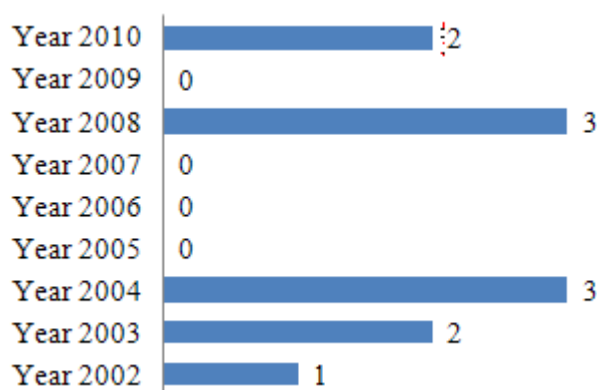
Before performing our meta-analysis, we would like to yield some descriptive statistics of the previous studies based on the year in which the study took place, the place (country) in which the study took place, their sample population and sample size.

As it can be seen in Graph 1, most of the studies included in our report were conducted in North America, followed by Asia with 3 studies and Europe with 2.



Graph 1. Descriptive Statistics (Continent)

Following Graph 2, the interest in online buying is new, the years when the studies were published range from 2002 to 2010, most of them being published in 2008 and 2010

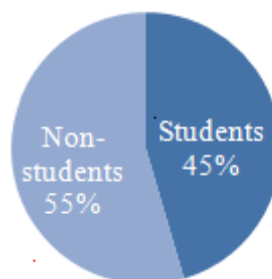


Graph 2. Descriptive statistics (Year)

According to Table 3, the samples size of the study range from 133 to 998 respondents, with an average value of 397 respondents. Also, as we can see in Graph 3, almost half of the studies used students as sample for the entire population.

Total number (N):	11
Max. sample size	998
Min. sample size	133
Mean (average) value:	397
Population standard deviation (σ):	247

Table 3. Descriptive statistics (Sample size)



Graph 3. Descriptive statistics (Sample)

Comparing Studies By Effect Size

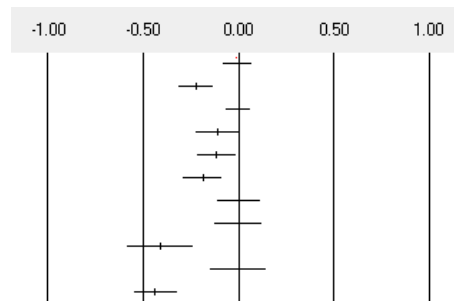
We first compared the empirical results of the separate studies to discover the degree of their findings' similarity. According to Burns R. and Burns R. the significance testing involves (Burns and Burns, 2008, p.538)

- Converting all statistics to correlation coefficients (r)
- Giving the correlation coefficients the same sign if studies show effects in the same direction.
- Finding for each ' r ' coefficient the associated Fisher z value and using ' z ' value in order to compute the Z score.

In order to eliminate any biases due to manual computing, we chose Comprehensive Meta Analysis (CMA) software to do the computation of Fisher z value and Z score. Results are shown in Table 4. The forest plot of Z scores at a 0.05 confidence interval is shown in Graph 4.

	Fisher z value	Std error	Variance	Z score	p- value
Crespo and Bosque (2008)	0	0.039	0.001	0	1.000
Kim et al	-0.224	0.046	0.002	-4.823	0.000
Crespo and Bosque (2010)	0	0.032	0.001	0	1.000
Lin et al	-0.107	0.060	0.004	-1.804	0.071
Choi and Geistfeld (Korea)	-0.118	0.051	0.003	-2.300	0.021
Choi and Geistfeld (USA)	-0.184	0.052	0.003	-3.521	0.000
Liu and Wei	0	0.057	0.003	0	1.000
Eastin	0	0.064	0.004	0	1.000
Lui and Jamieson	-0.411	0.088	0.008	-4.682	0.000
Shivraj and Vikas	0	0.075	0.006	0	1.000
Shin	-0.436	0.057	0.003	-7.657	0.000

Table 4. Fisher r to Z and Z score



Graph 4. Fisher's Z and 95% CI

The Z score provided by CMA were evaluated for statistical significance by using the areas under the normal curve involves (Burns and Burns, 2008, p.542). If our test statistic of a study was greater or equal to $Z=1.96$, then we can conclude that the study produced a significantly larger effect than the other studies. Accordingly, we find that 5 studies provided significantly larger effects than the rest of the 6 studies. This means that reported findings across various studies are not at all similar. We encounter two types of studies:

- Studies that report an insignificant influence of perceived risk (PR) on the intention to buy online (I): (Crespo and Bosque, 2008; Crespo and Bosque, 2010; Lin si altii, 2010; Liu and Wei, 2003; Eastin, 2002; Shivraj and Vikas, 2004)
- Studies that report an significant influence of perceived risk (PR) on the intention to buy online (I) (Kim et al, 2008; Choi and Geistfeld, 2004; Shin, 2008; Lui and Jamieson, 2003)

Finding such relevant different among reported findings, we cannot compute an average effect of all the 11 studies.

For further analysis, we divide the studies into two groups, as stated above, and we report the average effect of each group using three different techniques: the simple mean, sample size adjusted mean and Fisher r to Z transformation (Ma and Liu, 2004, p. 64).

Combining Studies For Average Effect

In order to compute the mean effect sizes of the two groups of studies, we employed according to Ma and Liu procedure:

- Simple mean: the average of all individual effect sizes (r) (Ma and Liu, 2004, p. 64).
- Sample size-adjusted mean: the sample size weighted average of individual effect sizes, computed with the formula (Ma and Liu, 2004, p. 65).

$$r = \sum (N_i * r_i) \div \sum N_i$$
 (where N and r are the sample size and effect size of each 'i' test)
- Fisher r to Z transformation: each correlation is transformed into Fisher Z score, the sample size weighted average of the individual Z score is computed for our PR – I relationship, and the weighted average Z score is converted back into a correlation coefficient (Ma and Liu, 2004, p. 65). To avoid computational errors, Comprehensive Meta Analysis (CMA) software was employed. CMA uses the following formula for computation:

$$\text{FisherZ} = 0.5 * \text{Log}((1 + r) / (1 - r))$$

$$\text{FisherZ Std. Error} = 1 / (\text{Sqr}(N - 3))$$

$$r = \text{Given}; r \text{ Std. error} = (1 - r^2)^{0.5} * \text{FisherZ Std. Error}$$

The mean effect sizes for the first group of studies can be seen in Table 5. For the first group we found identical results obtained using simple mean correlation and correlation from Zr. The sample size adjusted correlation reported a smaller value, which is in accordance with previous studies (Ma and Liu, 2004, p. 65). All three methods provide the same results, namely that perceived risk does not have a significant direct influence on the intention to buy online.

	Simple Mean Correlation	Sample size adjusted Correlation	Correlation from Zr
PR – I	-0.018	-0.011	-0.018

Table 5. Mean Effect Sizes for Group 1

However, the second group of studies report different results. The mean effect sizes for the first group of studies can be seen in Table 6. The three methods employed in measuring the mean effect sizes report different results, in accordance with previous literature (Ma and Liu, 2004, p. 65):

- Correlation from Zr between PR and I is usually inflated
- Correlation from Zr is the highest correlation and the sample size adjusted correlation is the lowest.

- However, correlation from Zr and simple mean correlation does not differentiate much.
- The results of the second group yield a significant influence of perceived risk on the intention to buy online. According to Cohen (1977) an effect size ranging between 0.233 and 0.274 has medium magnitude (Ma and Liu, 2004, p. 65).

	Simple Mean Correlation	Sample size adjusted Correlation	Correlation from Zr
PR – I	-0.259	-0.233	-0.274

Table 6. Mean Effect Sizes for Group 2

The fact that different groups of studies report different results could be explained by the existence of moderator variables such as the

- Sample population, whether the study was conducted among students or a representative population of online consumers,
- The period in which the survey was conducted, as perceptions change over time, especially risk perceptions tend to diminish due to applied risk-reduction strategies in the online environment

However, our small size of selected studies prevents us from running further regression analysis to investigate the possible effects of moderators.

Conclusion

There are various studies that investigate the potential barriers that keep internet users from embracing online buying. Among these studies, many reported perceived risk as being a major obstacle in adopting e-commerce. Perceived risk is usually related to the security of financial data and the privacy of personal data. Consumers fear that revealing credit card information, such as credit card number and credit card code can lead to possible fraud if data is intercepted and illegally manipulated. Consumers also fear that e-vendor can and will alienate their personal information to third parties.

But many of these studies provided descriptive statistics from which one cannot estimate the impact of perceived risk on the intention to buy online. Consumers can perceive and declare a fear for credit card fraud or for misuse of personal data, and still overcome the fear and buy online.

The only studies that can indicate the influence of perceived risk on the intention to buy online are those reporting the direct correlation between these two variables. Such correlations indicate the variance of consumers' intention to buy online that is due to perceived risk. Unfortunately we were not able to include in our analysis more than 10 studies that met our inclusion criteria. These studies provided 11 independent results based on different samples.

We took a twofold approach to analyse the empirical results. First we compared the selected studies to determine whether they yield different empirical results. We used the Fisher r to Z transformation to determine the Z score based on the effect size and Fisher's

z. Five of our studies reported a Z score higher than 1.96 which meant they were significantly different from the remaining 6 and could not be cumulated in order to determine the average effect of perceived risk on the intention to buy online.

In order to overcome this barrier that did not let us to compute an average effect of all our sample studies, we divided our sample into two groups, each group containing studies that yield similar results. This way we could compute an average effect of each group.

For the first group we computed the average effect by employing three different techniques: simple mean, sample size-adjusted mean and Fisher r to Z transformation. We found a -0.018 simple mean correlation; a -0.011 adjusted size-mean correlation and a -0.018 correlation from Zr. All techniques yielded the same result: the perceived risk has no direct influence on the intention to buy online.

For the second group, we employed the same techniques for finding the average effect. We obtained a -0.259 simple mean correlation, a -0.233 sample size-adjusted correlation and a -0.274 correlation from Zr. Obtaining the highest correlation using Fisher r to Z transformation and the lowest correlation using sample size-adjusted mean approach, was in accordance with previous studies. However, despite the technique used for determining the average effect, this group of studies shows a medium effect (r close to 0.300) of the perceived risk on the intention to buy online.

The existence of two different groups of studies, the ones that does not report a significant PR – I relationship and the ones that report a medium influence of perceived risk on the intention to buy online, does not shed light in regards to whether PR is a significant factor for explaining the variance in consumers' intention to buy online. One could just assume that different studies yield such different due to the effects of moderator variables. The same PR – I relation was replicated using differently sized samples. The surveys were taken in different countries under different cultural, social and economic conditions. In such cases, the effects of moderators should be studied. However our sample of 11 studies did not allow us to further perform regressions in order to determine possible moderators.

Limitations

The small sample size and the impossibility of analysing the effect of moderators are the main limitations of this meta-analysis. Another limitation lies in the search and the selection of the studies that were included in the analysis. Since most of online buying models are generated by multivariate analysis, studies tend to report standardized beta coefficients instead of the regression coefficients. Since standardized beta coefficients cumulate the total effect of one variable upon another (including both direct and indirect effect), they could not be used in current analysis. Thus, the inclusion of only those studies that reported the correlation coefficients between perceived risk and the intention to buy online, had let to omission of other reported empirical results.

Managerial Implications

Since perceived risk continues to be an issue, even though its direct influence on the intention to buy online is somehow uncertain due to various studies showing different

results, managers should pay a special attention to securing their e-commerce platforms against data breach. An ITRC study conducted in 2010 showed that 73% of the respondents would no longer buy online from a website that experienced a security breach (ITRC Study, 2010). According to the same study, consumers would advice friends and family to avoid that a particular website with a breach in data security.

Moreover, managers should make use of risk-reduction strategies in order to reinforce trust in online shopping. One of the most popular risk-reduction strategy is displaying trust indicators from third parties, such as TRUSTe and VeriSign. A study Synovate/GMI, an independent research company, shows that 86% of online consumers feel more confident about entering personal and financial information on e-commerce sites that use security indicators, namely trust marks (Synovate/GMI, 2008).

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