

# Does Financial Investment Decision-Making Relate To Risk Tolerance? Evidence from the United States

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## Abstract

The intolerance of uncertainty scale (IUS), which measures individual differences, may have a moderating effect on how investors allocate their portfolios among securities with varying risk levels. This study explores this possibility. The study's participants decided how much money to put into securities with varying risk profiles. The securities ranged from government securities (safe) to more risky securities. The investment risk of each security is manipulated by altering beta or market risk, expected return, and standard deviation of the return. The findings show that less risk-tolerant individuals invested less capital in riskier stocks and more money in safer government securities. However, those with more risk tolerance exploited more money in the less hazardous investment. As anticipated, those with less risk tolerance allocated more capital to the more secure stocks.

## Introduction

Individuals differ in the way they deal with and react to risky or uncertain situations (Weber, Blais, & Betz, 2002). Such individual differences can usually be interpreted by examining the risk attitude of individuals (Weber *et al.*, 2002). To enhance their understanding of individuals' attitude toward risk, scholars (e.g. Freeston, Rheume, Letarte, Dugas, & Ladouceur, 1994) developed the Intolerance of Uncertainty Scale (IUS), and found that individuals with high intolerance of uncertainty tend to worry excessively and that they perceive ambiguous situations as threatening. The IUS assesses individuals' risk attitude by examining their emotional, cognitive, and behavioral reactions to risky or uncertain situations (Freeston *et al.*, 1994). The scale has high internal consistency ( $\alpha=0.94$ ), satisfactory test-retest stability ( $r=0.74$ ), and convergent and discriminate validity (Freeston *et al.*, 1994), and it has been used by many scholars to study the impact of risk, as measured by IUS, on people's decisions (DeBruin, Rassin, & Muris, 2006) particularly decisions related to financial investment (Chou, Huang, & Hsu, 2010). The purpose of this paper is to examine whether individual differences as measured by the IUS affect the way investors make investment decisions. To achieve this goal, we used a sample of 54 MBA students who were asked to make decisions regarding the amount of funds to be invested in companies with different investment risks.

The results of our study indicate that individuals who are less tolerant of risk invested more money in the safer government securities and less capital in ABC stock which is more risky. On the other hand, individuals with more risk tolerance invested more money in the less risky stock which is XYZ. As expected, individuals with less risk tolerance invested more capital in the safer stock which is XYZ.

The layout of the paper is as follows. The next section discusses IUS and worry. Then, we discuss worry, risk perception and behavior. After that, we present past literature which shows how IUS varies with risk levels. The design of our experiment and results are presented next. The last section concludes the paper.

## Intolerance of uncertainty and worry

IU construct is measured by the intolerance of uncertainty scale (IUS) which is a self-report questionnaire used to assess emotional, cognitive, and behavioral reactions to ambiguous situations, implications of uncertainty, and future control attempts (Freeston, Rheume, Letarte, Dugas, & Ladouceur, 1994).

Intolerance of uncertainty (IU) is defined as “the predisposition to react negatively to an uncertain event or situation independent of its probability of occurrence and associated consequences” (Ladouceur, Gosselin, and Dugas, 2000, p. 934). Dugas, Gagnon, Ladouceur, and Freeston (1998) described intolerance of uncertainty as an essential element for acquiring and retaining excessive worry. Also, intolerance of uncertainty was defined “the way an individual perceives information in ambiguous situations and responds to this information with a set of cognitive emotional and behavioral reaction” (Ladouceur, Talbot, and Dugas, 1997, p. 356). Responses to such ambiguous situations are usually negative and they do not depend on the probability of the occurrence of the situation and its outcomes (Ladouceur, Gosselin, & Dugas, 2000). Consequently, people with high levels of IU often worry about events or situations that might possibly take place in the future because they cannot tolerate the uncertainty associated with future events or situations (DeBruin, 2006) and they raise many “what if” questions about uncertain future events and such questions initiate anxiety and worry (Dugas, Gagnon, Ladouceur, & Freeston, 1998).

The relationship between IU and worry has been examined and tested and many scholars have confirmed that individuals with high IU tend to develop high levels of worry and anxiety (Koerner & Dugas, 2007). Individuals with high levels of intolerance of uncertainty experience higher levels of fear and stress when dealing with ambiguous or uncertain situations in their daily life (DeBruin, Rassin, & Muris, 2006). Consequently, they develop dysfunctional emotions, and demand more evidence before making final decisions (Freeston *et al.*, 1994). As such, intolerance of uncertainty contributes to the development of excessive worry and as a result of such worry generalized anxiety disorder develops as well (DeBruin, Rassin, & Muris, 2006). Worry is related to and initiated by anxiety feelings (DeBruin, 2006). Excessive worry and anxiety are considered the core characteristics of generalized anxiety disorder (GAD) and individuals who suffer from GAD find life hard to cope with because of worry and its resultant anxiety or distress (DeBruin, 2006). Generalized anxiety disorder (GAD) is a condition whose main feature is excessive worry (American Psychiatric Association, 2000). Worry can be defined as “a chain of thoughts and images negatively affect-laden and relatively uncontrollable” (Borkovec, Robinson, Pruzinsky, & DePree, 1983, P. 10). Aikins and Craske (2001) have considered worry as a way individuals use to cope with threatening situations, while Borkovec and Lyonfields (1993) considered it as a way to reduce somatic anxiety reaction and painful emotions.

### **Worry and perception of risk**

Worry can be referred to as “a reaction to the perception of threat” (DeBruin, 2006, p.10). Worry includes three functions: alarm, prompt, and preparation (Eysenck, 1992). When a threat is detected, the alarm function sends information about such threat to conscious awareness. Then, the prompt function triggers the creation of thoughts and images in response to the threat. Lastly, the preparation function assists the individual in coping with the threat by solving any problem related to it or preparing for any negative results (Eysenck, 1992). Despite the fact that the three functions help individuals react to threats more effectively, excessive worry seems to counteract effective reactions to threats because it interferes with cognitive processes which are needed for effective task performance (Zeidner, 1998).

Borkovec, Ray, and Stober (1998) argue that worry is related to information processing bias, and that it affects processing stages such as stimulus interpretation and meta-cognition (Matthews & Funke, 2007). Wells and Matthews (1994) suggest that anxiety, which is related to worry, impacts information processing. Individuals who worry excessively “might store more danger information in tight clusters, quickly having more threatening information at hand when experiencing possible threat” (DeBruin, 2006 p. 13). In other words, such individuals tend to have biases toward information processing. According to DeBruin (2006), these biases are in the domain of:

1) Attention: Individuals who worry excessively are sensitive to any signs of possible future threats and they pay more attention to such threats.

2) Interpretation: Individuals who worry a lot interpret uncertain or ambiguous situations in an emotional or threatening way.

3) Memory: Individuals who worry excessively normally experience a negative mood which facilitates the storage and the retrieval of threat-related information which increases feelings of anxiety.

Individuals with high IU and who worry more than the average person tend to perceive many situations as threatening if the outcome is uncertain (Koerner & Dugas, 2007). For example, excessively worried individuals tend to dedicate more mental effort and attentional resources to ambiguous situations and to personal issues (Matthews & Funke, 2007). In addition, Worry causes individuals to focus on finding solution to anticipated future threats or problems even those with low probability of occurrence (DeBruin, 2006). Because individuals who worry excessively cannot confirm the correctness of their solutions, they remain in a state of worry almost all the time because worry is intrusive and repetitive in nature (DeBruin, 2006).

### **Worry, risk perception, and behavior**

The relationship between worry, risk perception and behavior, particularly health and financial behavior is evidenced in many studies. Klein, Zajac, and Monin (2009) argue that worry mediates the relationship between risk perceptions and intentions to behave in a certain way to reduce risk. For instance, individuals who are worried about the flu are more likely to get the flu shot. A meta-analysis of 12 prospective studies that was conducted to examine the relation between worry about breast cancer and self-examination or utilizing mammography in a sample of 3342 women revealed that worry and breast cancer screening are associated as women who worried more about cancer were more likely to get screened (Hay, McCaul, & Magnan, 2006).

Brewer, Chapman, Gibbons, Gerrard, McCaul, and Weinstein (2007) suggest that a positive relation between risk perceptions and behavior was evidenced in multiple empirical studies and that this relation is even stronger in prospective studies, studies with higher quality risk measures and studies which have unskewed risk or measures of behavior. Sitkin and Pablo (1992) define risk perceptions as “a decision maker’s assessment of the risk inherent in a situation” and they argue that such perceptions influence the behavior of decision makers and cause them to ignore, underestimate or overestimate risk, and act accordingly. Further, they indicate that decision makers who “enjoy the challenge” of risk are more willing to undertake riskier actions. Risk perception can also influence investors’ behavior and willingness to invest in financial instruments which they have tried in the past (Chou, Huang, & Hsu, 2010). Thus, investors associate more risk with past investments if they were not successful, and as a result they avoid such investments. Similarly, investors re-invest in past investments if they were successful because they associate a lower degree of risk with these successful investments.

In his portfolio theory, Markowitz (1952) argued that investors demand higher returns on riskier investments to compensate for the extra risk. As such, investors classify an investment portfolio as efficient if it provides them with the highest possible return while assuming the lowest possible risk (Simons, 1999). Droms (1987) has indicated that risk tolerance plays a significant role in investors’ determination of an optimal assets composition in an investment portfolio and that investors evaluate the risk of an investment, its return, and their needs before making final investment decisions. Other scholars (e.g., Cooper & Kaplanis, 1994; Simons, 1999) have even gone farther and argued that investors prefer to invest in their home countries to reduce the risk (e.g., political uncertainties and unexpected currency fluctuation) associated with making international investments. Further, Chou *et al.* (2010) argue that investors receive multiple financial markets’ reports and they evaluate these reports using cognitive biases assigning degrees of risk to such reports before making financial investment decisions.

Risk perception does not only impact investors’ decision making and behavior, but it also affects financial providers’ behavior and decision making because they are contingent upon investors’ willingness to invest in relatively risky portfolios. For instance, fund managers who attempt to avoid having homogenous investment funds should be able to evaluate their investors’ risk tolerance (Jacobs & Levy, 1996). Schirripa and Tecotzky (2000) suggest that optimal portfolios can be created by dividing investors according to their risk tolerance. In other words, investors who have more risk tolerance should be encouraged to invest in riskier financial

investments. Likewise, investors who cannot tolerate higher risk investments should be directed to less risky ones.

### IUS scores' variance with manipulated levels of uncertainty

Interestingly, it has been shown that the scores of individuals on the IUS vary with the manipulated level of risk or uncertainty (low, moderate, & high) during testing for differences in tolerance for ambiguity (Ladouceur *et al.*, 1997). Ladouceur *et al.* (1997) found that participants' scores on the IUS were not related to the behavioral factors such as total task time examined when the task had very low and very high uncertainty levels. Nonetheless, they noticed that ambiguous situations with a moderate level of uncertainty had a positive relation with participants' scores on the IUS as it was evidenced by the increase of the number of marbles participants drew before making determining the ratio of black to white marbles in a given bag.

In short, it appears that when the level of risk in a particular situation is too low or too high, individuals' scores on the IUS tend have no or little relationship with the actual situation, but when the level of uncertainty is moderate, such scores tend to have a relation with the actual situation as evidenced by individuals' demand of more certainty cues before making a final decision.

### Experimental design

#### Sample selection and task

We chose a sample of 54 MBA students whose intolerance for uncertainty was measured using the Intolerance for Uncertainty Scale or IUS. The subjects were then told that they are portfolio managers and that one of their clients asked them to invest \$100,000 in his retirement account. The subjects were also asked to ignore their answers to the first scenario when considering the second scenario. The entire fund (\$100,000) must be allocated between the two investment options given the following two scenarios:

- 1) Choose between investing in U.S. government security whose risk of default is virtually zero and its expected rate of return is 5% or in ABC company whose stock has a long term annual return of 10% and an average long term risk.
- 2) Choose between investing in XYZ company stock with an expected long term return of 8% and with an average market risk (Beta equals 1) or in MNO company stock with an expected return of 16% and with twice the market risk (Beta equals 2).

### Results

Table 1 below shows Analysis of Variance (ANOVA) for Diff1 which is the difference between the dollar amount subjects invested in government securities (GS) and that invested in ABC company stocks. IUSC is a dummy variable used for IUS scores. It equals 1 if IU score is less than 68 (Low IU which means high tolerance for uncertainty) and 2 if IU score is more than 68 (High IU which means low tolerance for uncertainty).

**Table 1: ANOVA for Diff1**

Source	DF	SS	MS	F-value	Pr >F	R <sup>2</sup>
Model	1	11851.85	1185.85	15.6	0.0002	0.23
Error	52	39496.3	759.5			
Corrected	53	51348.15				
IUSC	1	11851.85	11851.85	15.6		

Diff1: The difference between \$ amount invested in GS and that invested in ABC.

IUSC: A dummy variable used for IUS scores. It equals 1 if IU score is less than 68 (Low IU) and 2 if IU score is more than 68 (High IU).

SS: Sum of square

MS: Mean square

Table 2 below shows Analysis of Variance (ANOVA) for Diff2 which is the difference between the dollar amount subjects invested in XYZ company stock and that invested in MNO company stocks. IUSC is a dummy variable used for IUS scores. It equals 1 if IU score is less than 68 (Low IU which means high tolerance for uncertainty) and 2 if IU score is more than 68 (High IU which means low tolerance for uncertainty).

**Table 2: ANOVA for Diff2**

Source	DF	SS	MS	F-value	Pr >F	R <sup>2</sup>
Model	1	5480.3	5480.3	4.28	0.0435	0.076
Error	52	66570.9	1280.2			
Corrected	53	72051.3				
IUSC	1	5480.3	5480.3	4.28		

Diff 2: The difference between \$ amount invested in XYZ and that invested in MNO.

IUSC: A dummy variable used for IUS scores. It equals 1 if IU score is less than 68 (Low IU) and 2 if IU score is more than 68 (High IU).

SS: Sum of square

MS: Mean square

Our main results are reported in Tables 3 and 4. Table 3 indicates that the mean of difference (\$GS - \$ABC) between the amount of capital invested in GS and that invested in ABC company is negative (-9.63) for subjects with low IU scores (tolerate more risk or uncertainty). This means that the subjects invested more capital in the more risky option which is ABC stock. Also, individuals with high IU scores (less tolerant of risky situations) invested more capital in the safer option which is GS. The mean of the difference of the amount invested in the two investment options is positive (20).

<b>Table 3: T-Test for Diff1</b>								
Variable	N	Mean	SD	Min	Max	DF	T-value	Pr
IUSC=1	27	-9.63	30.8	-100	40	26	-1.62	0.116
IUSC=2	27	20	23.8	-20	60	26	4.36	0.0002

Diff1: The difference between \$ amount invested in GS and that invested in ABC.

IUSC: A dummy variable used for IUS scores. It equals 1 if IU score is less than 68 (Low IU) and 2 if IU score is more than 68 (High IU).

Interestingly, Table 4 below shows that the mean of difference (\$XYZ - \$MNO) between the amount of capital invested in XYZ company and that invested in MNO company is positive (17.63) for subjects with low IU scores (more risk tolerance). This means that they invested more money in the less risky option which is XYZ stock. This result is consistent with Ladouceur *et al.* (1997) who found that when the level of risk in is too low or too high, individuals' scores on the IUS tend have no or little relationship with the actual situation. Table 4 also shows that individuals with high IU scores (less tolerant of risky situations) also invested more capital in the safer option which is XYZ. The mean of the difference of the amount invested in the two investment options is positive (37.7).

<b>Table 4: T-Test for Diff2</b>								
Variable	N	Mean	SD	Min	Max	DF	T-value	Pr
IUSC=1	27	17.63	37.47	-40	100	26	2.44	0.02
IUSC=2	27	37.7	37.006	-20	100	26	5.77	0.0001

Diff2: The difference between \$ amount invested in XYZ and that invested in MNO.

IUSC: A dummy variable used for IUS scores. It equals 1 if IU score is less than 68 (Low IU) and 2 if IU score is more than 68 (High IU).

### Concluding remarks

The study examined the effect of individual differences, as measured by the intolerance of uncertainty scale (IUS), on the way investors make investment decisions among securities with different risk levels. The results indicate that individuals who are less tolerant of risk invested more money in the safer government securities and less capital in ABC stock which had more risk associated with it. Interestingly and consistent with prior researches, the IU scores played little or no role when individuals had to choose between two risky stocks (XYZ and MNO) as individuals with more risk tolerance invested more money in the less risky stock which is XYZ. As expected, individuals with less risk tolerance invested more capital in the safer stock which is XYZ.

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