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Risk Preferences Around the World

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We present results from a large-scale international survey on risk preferences conducted in 53 countries. In all countries, we find, on average, an attitude of risk aversion in gains and of risk seeking in losses. The degree of risk aversion shows significant cross-country differences. Moreover, risk attitudes in our sample depend not only on economic conditions but also on cultural factors, as measured by the Hofstede dimensions individualism and uncertainty avoidance. The data may also serve as an interesting starting point for further research on cultural differences in behavioral economics.

Data, as supplemental material, are available at http://dx.doi.org/10.1287/mnsc.2013.1869.

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1. Introduction

Risk preferences are a key element of economic behavior. They determine a broad range of economic decisions, including insurance purchases, asset allocation, and strategic decisions by firms. Research on risk preferences has therefore been at the center of the field of economics in general and the field of finance in particular.

The purpose of our study is to analyze whether there are international differences between risk preferences and, if so, to what extent they correlate with economic or cultural factors. These differences are important for institutions offering insurance and investment products in multiple countries, and they may help explain international differences in the cost of capital, equity premiums, and other parameters of financial markets.

To measure these cross-country differences, we conduct a survey on risk attitudes in 53 countries. The large number of countries allows us to study whether the cross-country variation of risk attitudes is systematic and whether it can be predicted by macroeconomic or cultural factors. Moreover, we follow a key idea of prospect theory by distinguishing risk attitudes in the gain and loss domain. Our main finding is that there are substantial cross-country differences in risk attitudes that depend not only on economic conditions but also on cultural factors, as measured by uncertainty avoidance, which is one of Hofstede's cultural dimensions. More specifically, we observe the following:

1. Participants from richer countries (as measured by gross domestic product (GDP) per capita) are more risk averse in gains but tend to be more risk seeking in losses, where the latter effect is less robust.

2. Higher uncertainty avoidance corresponds to more risk aversion in gains but more risk seeking in losses.

3. Finally, we confirm that men more so than women are, in general, less risk averse in gains—also in an internationally diversified sample. Additionally, men tend to be less risk seeking in losses than women, but the difference is much smaller.

In the next section, we discuss the extant literature and its relationship to our work. In §3, we describe the methodology of our survey, and in §4, we present the results. Section 5 discusses the potential limitations and concerns of our study. Section 6 concludes and discusses current and potential work using our survey data.

2. Literature Review

There are some studies on cross-national comparisons of risk attitudes. However, these studies tend to compare only a few countries that vary in more than one factor, making it difficult to reach clear conclusions about the importance of cultural differences in explaining risk preference variation. For example,

Bontempo et al. (1997) suggest that uncertainty avoidance in a country may influence risk perception, in that gains are less capable of reducing perceived risk. However, this study only examined Hong Kong, Taiwan, the United States, and the Netherlands. There may be other confounding factors that account for the observed pattern. Although Taiwan has higher uncertainty avoidance scores, it is also less individualistic and less wealthy than the other Western countries.[1] Most other studies also investigated fewer than five countries. For example, some studies compared only Chinese and Americans (Fan and Xiao 2006; Hsee and Weber 1999; Wang and Fischbeck 2004, 2008). Weber and Hsee (1998) compare risk perception of subjects from four countries (China, the United States, Germany, and Poland), and Harrison et al. (2010) compare three countries (India, Ethiopia, and Uganda). The two largest cross-country data samples on risk preferences thus far have been collected by Statman (2008), who includes 22 countries, and Vieider et al. (2012), who include 30 countries. Both studies found that participants from wealthier countries tend to be more risk averse, which is similar to our results. However, in contrast to our study, neither study measured the risk attitudes in gains and losses separately. Additionally, the number of countries in our current study is larger.

Although the scope of other international studies on risk attitudes is not as broad as ours, our findings relate to them in several ways. The economic factor most often investigated in international studies on risk aversion is wealth, but the empirical findings on the relationship between wealth and risk attitudes are mixed. Some of these studies found that poor people are more risk averse or more loss averse (Fafchamps and Pender 1997, Liu 2013, Nielsen 2001, Tanaka et al. 2010), some found that wealthier people are more risk averse (Statman 2008, Wik and Holden 1998, Yesuf and Bluffstone 2008), and others found little relationship between risk attitudes and wealth (Binswanger 1981, Mosley and Verschoor 2005).

In addition to economic factors, the impact of culture has increasingly gained attention in economics and finance (Chui et al. 2010, Guiso et al. 2006). In general, it is difficult to measure and quantify culture. Often, the cultural dimension framework proposed by Geert Hofstede, one of the most influential cross-cultural researchers, is used in economics. Hofstede has investigated cultural values through large-scale cross-national surveys and identified five cultural dimensions (Hofstede 2001). In our study, we focus on two of these dimensions, individualism and uncertainty avoidance, which are considered to be the most relevant to risk preferences.

According to Hofstede (2001), the individualism dimension reflects the degree to which individuals are integrated into groups. There are two possible but opposite hypotheses regarding how individualism can influence risk preferences. On the one hand, in an individualistic society, personal achievement and individual values are stressed, which may lead to overconfidence and overoptimism (Chui et al. 2010). As a consequence, risk-seeking attitudes can be cultivated. The United States, for example, has a highly individualistic culture, whereas East Asian countries, such as Japan and China, are typical collectivistic societies. This corresponds to the popular belief that Americans tend to be more risk seeking than East Asians. On the other hand, in contrast to such stereotypes, it has been found that countries with collectivistic cultural traditions tend to perceive less financial risk and appear to be less risk averse (Bontempo et al. 1997, Fan and Xiao 2006, Hsee and Weber 1999, Wang and Fischbeck 2008). The "cushion hypothesis," proposed by Hsee and Weber (1999), explains these phenomena: the strong social network in a collectivistic society provides a "cushion" against potential financial catastrophe and therefore induces more risk-seeking behavior. A recent survey conducted in 22 countries by Statman (2008) suggests that people from more individualistic countries have a lower propensity to take risks.

The second cultural dimension that we investigate is measured by the uncertainty avoidance index (UAI). This index captures the extent to which a society can tolerate an uncertain or ambiguous situation. Intuitively, one may infer that a high UAI corresponds to risk aversion and that a low UAI is associated with risk seeking, but Hofstede (2001, p. 148) has emphasized that "*uncertainty avoidance does not equal to risk avoidance*" (italics in the original). Hofstede further explains that people in uncertainty-avoiding cultures may paradoxically take risks, such as starting fights, to reduce ambiguity.

Finally, our study differs from the literature not only in its scope but also in its methodology. In the past, the question of how to measure risk preferences has been addressed using quite different research methodologies. The most prominent of these include laboratory experiments that infer risk preferences from individuals' choices between simple lotteries. These experiments have shown that there are persistent discrepancies between the predictions of rational models (expected utility theory) and empirical data (see Starmer 2000 for a literature survey). In particular, it is often observed that risk attitudes

[1] In this respect, it is interesting to see that cross-national differences in risk preferences seem to persist even under identical macroeconomic conditions; e.g., Bartke (2007) observes significant differences in risk aversion among different nationalities of foreigners living in Germany. The number of nationalities that he can study in this sample, however, is too small for an in-depth analysis.

depend on whether the payoffs are in the gain or loss domain, consistent with prospect theory (Kahneman and Tversky 1979, Tversky and Kahneman 1992), whereas expected utility theory has been found to be insufficient for describing the risk attitudes of most people (see Wakker 2010 for a comprehensive review of prospect theory). This implies that an adequate measurement of risk preferences should use more than one parameter to reflect risk attitudes.

Numerous studies have applied rigorous laboratory experiments to measure prospect theory parameters. (See Rieger and Wang 2006 for a summary of typical parameter values estimated from laboratory experiments.) Some researchers have also designed various parameter-free approaches to circumvent certain constraints and confounding factors induced by parametric forms (Abdellaoui 2000, Abdellaoui et al. 2007, Bleichrodt and Pinto 2000, Gonzalez and Wu 1999, Wakker and Deneffe 1996). In addition, a few more recent field studies have adopted the framework underlying prospect theory to elucidate the more complicated features of risk attitudes of the general public. Harrison et al. (2010) have examined the risk attitudes of poor people in Ethiopia, India, and Uganda; Tanaka et al. (2010) the risk attitudes of farmers in Vietnam; Liu (2013) the risk attitudes of cotton farmers in China; and Booij and van de Kuilen (2009) the risk attitudes of a representative sample of Dutch households. In the next section, we explain our research methodology.

3. Methodology

3.1. Participants

Our survey, the International Test on Risk Attitudes (INTRA), was conducted by the University of Zurich, Switzerland, in collaboration with various universities worldwide (see Appendix C for a list).

The survey was conducted with undergraduate students at more than 60 universities in 53 countries. A total of 6,912 university students participated in our survey. Most participants were first- or second-year undergraduate students from the departments of economics, finance, or business administration. The average age of the participants was 21.5 years (SD = 3.8), and 53% were male.

3.2. Questionnaire and Survey Procedure

Each participant filled out a questionnaire that included 14 decision-making questions (3 time preference questions, 1 ambiguity aversion question, and 10 lottery questions); 19 questions based on the Hofstede Values Survey Module (Hofstede and McCrae 2004); a happiness question; and some information about the participant's personal background, nationality, and cultural origin. The questionnaire was translated into local languages for each country by professional translators or translators with economics backgrounds. The amount of monetary payoff in the questions was adjusted according to each country's purchasing power parity and the monthly income and expenses of the local students. The local currency was used. The participants were told that there were no right or wrong answers to the questions and that the researchers were only interested in their personal preferences and attitudes. In most cases, the survey was conducted during the first 15–20 minutes of a regular lecture under the monitoring of the local lecturers and experimenters. The response rate was therefore very high (more than 90%). To minimize experimenter effects, standardized oral introductions were translated into the local languages following the same procedure as the questionnaires and were then read aloud by the local lecturer.

We measured risk preferences by eliciting the participants' willingness to pay for hypothetical lotteries. Six of the lotteries were solely about gains with different probabilities (where one of the lotteries had a very high gain), two were solely about losses, and two mixed-outcome lotteries were included to elicit loss aversion (not reported in this paper). The gain lotteries were formulated similar to the following:[2]

> Imagine you are offered the lotteries below. Please indicate the *maximum* amount you are willing to pay for the lottery:

40% chance	Win \$0
60% chance	Win \$100

> I am willing to pay at most \$—— to play the lottery.

The loss lotteries were formulated as follows:

> The following lotteries involve losses. Imagine you have to play these lotteries, unless you pay a certain amount of money beforehand. What is the *maximum* amount you would be willing to pay to *avoid* playing the lottery? This corresponds to buying insurance that saves you from suffering potential losses.

40% chance	Loss of \$80
60% chance	No loss, no win

> I am willing to pay at most \$—— to avoid the lottery.

Table 1 summarizes the eight lotteries in the questionnaire. They were chosen to cover the main decision situations (lotteries in gains or losses). In the gain domain, the winning probabilities (low/medium/

[2] The versions given in local currencies were based on this U.S. dollar version.

Table 1 Payoffs for the Lotteries in Our Survey

Lottery	Outcome A ($)	Pr(A)	Outcome B ($)	Pr(B)	Expected value ($)
1	10	0.1	100	0.9	91
2	0	0.4	100	0.6	60
3	0	0.1	100	0.9	90
4	0	0.4	10,000	0.6	6,000
5	0	0.9	100	0.1	10
6	0	0.4	400	0.6	240
7	0	0.4	−80	0.6	−48
8	0	0.4	−100	0.6	−60

high) and the stakes (low/high) were varied, and one question with only strictly positive outcomes was included.[3] The design aimed to cover all of these cases with a minimum of questions because the length of the survey was limited.

In the questionnaire, we also used the following Ellsberg-type question to measure the degree of ambiguity aversion.

> Please imagine the following offers and mark your choice:
>
> In an urn, there are 100 balls with three colors (red, yellow, and blue). Thirty balls are red, whereas the remaining 70 consist of yellow and blue balls.

30 balls	70 balls	
Red	Yellow	Blue

> Imagine a ball is randomly drawn from the urn. You are offered the following two lotteries. Which lottery would you prefer?
>
> A. If the color of this ball is red, you win $100; otherwise, you win nothing.
>
> B. If the color of this ball is yellow, you win $100; otherwise, you win nothing.

A choice of lottery A was considered as ambiguity-averse behavior. (The full English-version questionnaire is available at http://www.financial-economics.de/INTRA-questionnaire-USA-version.pdf.)

3.3. Data Quality and Selection

A good measure for checking the quality of the collected data on risk preferences is "violation of internality," i.e., stated certainty equivalents that are lower than the lowest possible outcome or higher than the highest possible outcome.[4] One must distinguish between *strong* and *weak* violations: in strong violations, values on the boundary of the interval (maximum or minimum payoff of the lottery) are considered violations as well, whereas they are permitted in the weak violations. For theoretical reasons, the strong definition looks appropriate. However, there are two practical limitations. First, if, for example, the certainty equivalent is only slightly larger than the lowest outcome, the difference might be smaller than the smallest currency unit (e.g., one cent), so the answer would seem to violate strong internality, although the subject does *not* actually violate this internality. Second, this effect might become even more important because subjects round their answers for convenience. If the subjects' true certainty equivalent, for instance, were only a few cents, they may not state that accurately but instead just respond by writing $0. Therefore, we can only claim with confidence that violations of *weak* internality are a sign of a wrong answer.[5]

Looking at the number of violations of weak internality in our survey shows that—particularly given the difficulties that subjects often encounter with numerical questions—the data quality is surprisingly good: all in all, only 4.1% of all answers to the lottery questions violate weak internality, and 15.1% violate strong internality. In the following regression, we include all data, regardless of violations of internality, but to avoid our analysis being affected by outliers, we excluded the relative risk premia (as defined in the following section) at the highest and lowest 5% levels. As robustness checks, we repeated the same analysis, where instead of excluding the extremely high and low relative risk premia, we excluded all subjects that violated weak or strong internality at least once (or, in another robustness check, more than twice) or replaced their answers with the appropriate minimum or maximum lottery outcomes. In other robustness checks, we repeated the analysis without the lottery with the most violations of internality (lottery 1) and without all lotteries involving relatively small probabilities (lotteries 1, 3, and 5, which involve

[3] We have used willingness to pay (WTP) for both gain and loss lotteries. As one anonymous referee noted, WTP may be interpreted as loss and can lead to a higher degree of risk aversion because of loss aversion (Bateman et al. 2005). Because our main interest is on the relative differences across countries rather than on the absolute degree of risk attitude, this should not affect our further results to a great extent.

[4] There has been some discussion in the literature that argues that the violation of internality is an indicator of response errors. Although Gneezy et al. (2006) report violations of internality resulting from the uncertainty effect, they note that two essential conditions are required: between-subject treatments and the objects in the lotteries "have a different currency than the pricing currency or the comparison alternative" (p. 1300). In our survey, neither of these conditions is satisfied. As Gneezy et al. (2006, p. 1300) notes, "The application of internality is transparent and compelling when a decision-maker is asked to price a lottery with a high prize of $200 and a low prize of $100." Therefore, we interpret the cases of violation of internality as an indicator of the lack of comprehension or mistakes, but not of behavioral anomalies.

[5] In fact, subjects who violated weak internality at least once also showed, on average, an inferior response to other items in our questionnaire: the number of missing answers for these subjects was nearly twice as high as for subjects who did not have internality violations. The difference was significant; $p < 0.001$.

a probability of 10%) to exclude the potential influence of probability weighting. In all these cases, the empirical results were similar.

3.4. Relative Risk Premium

To assess risk preferences in a robust way, we compute relative risk premia for the lotteries and derive two indices corresponding to risk aversion in gains and risk seeking in losses. To do this, we compute the relative risk premium (RRP) for each lottery question using the standard formula:

$$RRP = \frac{EV - CE}{|EV|},$$

where EV is the expected value of the lottery and CE denotes the certainty equivalent that has been provided by the participant. The RRP is positive whenever a person is risk averse and negative when a person is risk seeking. Based on the RRP for these lotteries, we can now define the following two indices:

1. The *RRP in gains* is defined by taking the average RRP over lotteries 1–6.

2. The *RRP in losses* is defined by taking the average RRP over lotteries 7 and 8.

A larger RRP means *more* risk aversion (or *less* risk seeking).

Reliability checks of the RRP measurement are provided in Appendix B.

4. Results

4.1. Descriptive Results on Relative Risk Premium

The estimated country median values for the two RRP indices can be found in Table 2. Prospect theory would predict (at least for moderate probabilities, as in most of our lotteries) that subjects are risk averse in gains and risk seeking in losses—that is, that RRP in gains is positive and that RRP in losses is negative. Both conditions were found in approximately three-quarters of the participants.[6] The average RRP in gains (winsorized) is 0.657 (median = 0.755), in losses −0.395 (median = −0.444); both are significantly different from zero (one-sample t-test, $p < 0.001$).[7]

[6] Note that, although prospect theory also predicts risk seeking in gains and risk aversion in losses for small probabilities because of probability overweighting, in our lotteries, the probabilities of winning or losing are mostly moderate and large probabilities (e.g., 60% or 90%).

[7] The absolute value of the RRP in losses is significantly smaller (paired t-test, $p < 0.001$). However, the numbers are difficult to compare because the lotteries differ.

Table 2 Median Relative Risk Premium and Degree of Ambiguity Aversion at the Country Level

	RRP			
Country	Gains	Losses	Ambiguity aversion	*N*
Angola	0.64	−0.32	0.40	57
Argentina	0.74	−0.34	0.59	58
Australia	0.65	−0.44	0.48	151
Austria	0.65	−0.63	0.39	150
Azerbaijan	0.44	−0.27	0.54	122
Belgium	0.66	−0.35	0.72	46
Bosnia-Herzegovina	0.77	−0.61	0.53	74
Canada	0.77	−0.33	0.63	84
Chile	0.67	−0.17	0.68	100
China	0.56	−0.35	0.67	256
Colombia	0.87	−0.67	0.50	147
Croatia	0.76	−0.69	0.60	115
Czech Republic	0.65	−0.49	0.78	49
Denmark	0.64	−0.17	0.59	73
Estonia	0.91	−0.63	0.51	126
Finland	0.73	−0.32	0.46	124
France	0.54	−0.43	0.54	138
Georgia	0.56	−0.17	0.53	38
Germany	0.80	−0.54	0.47	540
Greece	0.66	−0.77	0.59	58
Hong Kong	0.93	−0.72	0.64	101
Hungary	0.83	−0.54	0.61	262
India	0.68	−0.54	0.82	61
Ireland	0.86	−0.53	0.48	194
Israel	0.83	−0.63	0.58	127
Italy	0.80	−0.35	0.53	81
Japan	0.76	−0.54	0.62	274
Lebanon	0.94	−0.88	0.61	101
Lithuania	0.88	−0.67	0.42	105
Luxembourg	0.77	−0.44	0.48	44
Malaysia	0.64	−0.81	0.59	99
Mexico	0.93	−0.72	0.62	89
Moldova	0.44	−0.32	0.56	100
Netherlands	0.44	−0.17	0.57	88
New Zealand	0.67	−0.64	0.53	91
Nigeria	0.69	−0.60	0.65	93
Norway	0.74	−0.46	0.46	192
Poland	0.78	−0.35	0.63	270
Portugal	0.61	−0.29	0.60	137
Romania	0.62	−0.24	0.65	339
Russia	0.88	−0.73	0.62	162
Slovenia	0.83	−0.53	0.52	96
South Korea	0.55	−0.39	0.58	105
Spain	0.72	−0.23	0.60	45
Sweden	0.65	−0.21	0.50	65
Switzerland	0.78	−0.45	0.57	483
Taiwan	0.66	−0.54	0.67	100
Tanzania	0.04	−0.02	0.57	60
Thailand	0.60	−0.52	0.80	44
Turkey	0.63	−0.18	0.62	133
United Kingdom	0.72	−0.49	0.61	62
United States	0.78	−0.43	0.42	72
Vietnam	0.67	−0.33	0.70	131
Total				6,912
Mean	0.70	−0.46	0.58	
SD	0.15	0.19	0.09	

Notes. Positive RRPs imply risk aversion; negative RRPs imply risk seeking. Ambiguity aversion is measured by the percentage of participants who chose the unambiguous lottery in each country.

4.2. Regression Analysis

In this section we study the relationship between economic and cultural factors and risk preferences. When studying cross-country variations, it is important to check whether they are actually large enough to justify further investigation or whether they may be artifacts resulting from substantial between-subject variation. A one-way analysis of variance (ANOVA) test reveals significant between-country differences for both RRP in gains ($F(52, 5834) = 9.77$, $p < 0.001$) and RRP in losses ($F(52, 6020) = 7.43$, $p < 0.001$). Variations between cultural clusters are also large, as an ANOVA test on the level of cultural clusters of countries (see §4.2.6) reveals, for both RRP in gains ($F(8, 5878) = 11.47$, $p < 0.001$) and RRP in losses ($F(8, 6064) = 5.41$, $p < 0.05$). Therefore, there is a substantial cross-country and cross-cultural variation that justifies further investigation.

We focus on the two risk attitude indices (RRP gains and RRP losses), as defined in §3.4. We apply weighted least squares (WLS) regressions to correct for heteroscedasticity; in these we use the inverse of the variance in each country as weights. Repeating the regressions with unweighted ordinary least squares did not lead to significant changes in the results.

A small proportion (approximately 11%) of our subjects were not studying economics or business administration. As robustness checks, we have repeated the regressions without these students, which did not influence the results significantly. Similarly, we have checked whether students studying in a foreign country (approximately 12% of our subjects) would affect the results, but we did not find significant deviation when omitting them. Therefore, in both cases, we refrained from including these variables as controls in the reported regressions.

In the following section, we discuss the regression results. All of the regression results are, if not stated differently, WLS regressions and are reported with standardized coefficients and t-values in parentheses. As independent variables, we use age, gender, log(GDP/capita), individualism (IDV) and UAI,[8] both as the country average and as individual deviation from this average, and finally dummy variables for cultural regions (e.g., Anglo-American).

[8] We use the data obtained from our survey. The classical data by Hofstede (2001) have a positive correlation with our data (49% for UAI and 25% for IDV, $N = 36$), which is statistically significant for UAI ($p < 0.01$). The low correlation for the IDV measure can be explained by several fast-changing countries that showed substantial differences between Hofstede's and our (more recent) measurements. In particular, fast-developing Asian countries, such as China, Vietnam, Taiwan, and Thailand, as well as Turkey and Romania, are much more individualistic in our data than in the (older) data of Hofstede. This observation would be an interesting starting point for further investigations.

4.2.1. Gender and Age. Table 3 shows a significant and robust gender effect: female subjects tend to be more risk averse in gains, which supports most previous studies (Agnew et al. 2008, Borghans et al. 2009, Byrnes et al. 1999, Croson and Gneezy 2009, Dohmen et al. 2011, Hartog et al. 2002, Schubert et al. 1999, von Gaudecker et al. 2011).

Concerning the pure-loss lotteries, Table 4 indicates that females are more risk seeking in losses than are males. Together with the findings regarding risk attitude in gains, our results are consistent with Schubert et al. (1999) and Fehr-Duda et al. (2006) in that females appear more risk seeking in losses and more risk averse in gains for abstract gambles with medium probability ranges; this is inconsistent with Levin et al. (1988), in which women are found to be more risk averse in both winning and losing frames. In contrast, both Booij and van de Kuilen (2009) and Fehr-Duda et al. (2006) find no gender difference in utility curvature in gains and losses, suggesting that the observed differences in risk attitudes may be driven by loss aversion (Booij and van de Kuilen 2009, Brooks and Zank 2005, Schmidt and Traub 2002) or probability weighting (Fehr-Duda et al. 2006). From the standardized coefficients in regression models, we also observe a smaller magnitude of gender difference in losses than in gains. Therefore, the gender differences of risk attitude in losses are generally less conclusive, and further investigation is needed to test to which extent such results can be generalized (see Croson and Gneezy 2009 and Eckel and Grossman 2008 for summaries of gender difference of risk preference in gains and losses).

Although the effect of age on risk preferences is not our focus here, we observe that older participants tend to be less risk averse in gains, in line with findings by Dohmen et al. (2011), but more risk seeking in losses. Taking age into the regression is meant as a control, not as means to detect the age dependency of risk attitudes, because the age distribution of our sample is (not surprisingly) very skewed (a minimum of 16 years and a maximum of 62 years of age, but only 0.7% were older than 40). The gender distribution, however, was rather even (as mentioned above, 53% male and 47% female). Thus significant coefficients in the regression results will indeed point to gender differences—at least in the subpopulation of undergraduates.

4.2.2. Wealth. GDP per capita is used as a generic proxy for wealth of the subjects (which we could not measure on an individual level) as well as for the overall development and stability of the country. It is difficult to disentangle these factors, as the collinearity in our sample would be too high. We have, however, replaced GDP per capita with the human development index, which did not change the

results significantly. The results also did not change when we added more controls, such as inflation rate, financial development, or measurements for macroeconomic or political stability, which were taken from a World Bank database and from the global competitiveness report by Porter and Schwab (2008).

We find a significant wealth effect at the country level for risk attitudes in gains. Participants from richer countries tended to be more risk averse (see Table 3). This result supports previous studies by Statman (2008), Vieider et al. (2012), Wik and Holden (1998), and Yesuf and Bluffstone (2008) but contradicts results by Fafchamps and Pender (1997), Nielsen (2001), Binswanger (1981), and Mosley and Verschoor (2005). It seems that participants from wealthier countries tend to be more risk seeking in losses, but only after controlling for cultural dimensions (see Table 4).

4.2.3. Individualism. Previous data by Statman (2008) (which do not distinguish between risk attitudes in gains and losses) suggest that higher degrees of individualism correspond to a smaller willingness to take risks. In gains, we find the opposite pattern in our (larger) data sample after controlling for GDP per capita—namely, that a higher individualism score at the country level predicts less risk aversion (Model 2 in Table 3). However, this effect disappears when we control for UAI (Model 4 in Table 3).

In losses, we find that participants from more individualistic (and less collectivistic) countries tend to be more risk averse (i.e., less risk seeking). These participants have a higher RRP in losses (although the effect becomes statistically insignificant after controlling for UAI).

4.2.4. Uncertainty Avoidance Index. We also find a strong and robust influence of culture, as measured by Hofstede's uncertainty avoidance index. As expected, a higher UAI is associated with a higher degree of risk aversion in gains (Models 3 and 4 in Table 3). However, a higher UAI also correlates with more risk seeking in losses (Models 3 and 4 in Table 4). It is interesting to see that a higher degree of uncertainty avoidance is associated with a higher degree of irrational preferences (to the extent that risk aversion for gains and risk seeking for losses can be considered as irrational; see Rabin 2000). This result shows that equalizing UAI with risk aversion is an oversimplification, as noted by Hofstede (2001) (see §2). It also highlights how distinguishing risk attitudes in gains and losses under a framework such as prospect theory can help us gain more insights into risk preferences.

4.2.5. Ambiguity Aversion. The country-level degree of ambiguity aversion is measured by the percentage of participants who chose the unambiguous offer (lottery A in the question described in §3.2), as reported in the fourth column in Table 2. The proportion of ambiguity-averse participants ranged from 82% in India to 39% in Austria. Table 5 shows the correlations between ambiguity aversion measures, risk attitudes in gains and losses, and the uncertainty avoidance cultural dimension at the individual level. The risk attitudes in gains and losses are negatively correlated, implying that individuals who are more risk averse in gains tend to be more risk seeking in losses ($\rho = -0.346$, $p < 0.001$); this supports the reflection hypothesis by Kahneman and Tversky (1979).

Consistent with the previous regression results, higher uncertainty avoidance corresponds to more risk aversion in gains ($\rho = 0.088$, $p < 0.001$) and more risk seeking in losses ($\rho = -0.059$, $p < 0.001$). It is interesting to see that ambiguity aversion is corre-

Table 3 Regression Results for Risk Preferences in Gain Lotteries

	Model 1	Model 2	Model 3	Model 4
Age	−0.070***	−0.062***	−0.040***	−0.041***
	(−5.271)	(−4.649)	(−3.044)	(−3.087)
Gender (male = 1)	−0.144***	−0.146***	−0.129***	−0.129***
	(−10.879)	(−11.053)	(−9.834)	(−9.747)
Log GDP/capita	0.068***	0.082***	0.106***	0.104***
	(5.106)	(5.950)	(7.837)	(7.510)
IDV, country average		−0.050***		0.009
		(−3.569)		(0.610)
IDV, ind. difference		−0.004		−0.001
		(−0.313)		(−0.076)
UAI, country average			0.154***	0.158***
			(11.189)	(10.610)
UAI, ind. difference			0.049***	0.049***
			(3.741)	(3.738)
N	5,587	5,587	5,587	5,587
Adjusted R^2 (%)	2.9	3.1	5.2	5.2
	Model 5	Model 6	Model 7	Model 8
Age	−0.07***	−0.062***	−0.041***	−0.041***
	(−5.283)	(−4.654)	(−3.047)	(−3.087)
Gender	−0.143***	−0.146***	−0.129***	−0.128***
	(−10.827)	(−11.003)	(−9.770)	(−9.687)
Log GDP/capita	0.067***	0.083***	0.106***	0.105***
	−5.078	(5.933)	(7.831)	(7.513)
Ambiguity aversion	0.01	0.011	0.014	0.014
	(0.779)	(0.805)	(1.052)	(1.052)
IDV, country average		−0.051***		0.009
		(−3.605)		(0.576)
IDV, ind. difference		−0.004		0.000
		(−0.269)		(−0.028)
UAI, country average			0.155***	0.158***
			(11.235)	(10.646)
UAI, ind. difference			0.049***	0.049***
			(3.750)	(3.750)
N	5,573	5,573	5,573	5,573
Adjusted R^2 (%)	2.9	3.1	5.2	5.2

***Significant at the 1% level.

Table 4 Regression Results for Risk Preferences in Loss Lotteries

	Model 1	Model 2	Model 3	Model 4
Age	−0.006	−0.015	−0.021	−0.023*
	(−0.486)	(−1.115)	(−1.623)	(−1.734)
Gender (male = 1)	0.084***	0.085***	0.075***	0.076***
	(6.357)	(6.439)	(5.683)	(5.730)
Log GDP/capita	0.000	−0.019	−0.026*	−0.030**
	(0.010)	(−1.362)	(−1.907)	(−2.164)
IDV, country average		0.067***		0.023
		(4.830)		(1.488)
IDV, ind. difference		0.013		0.011
		(0.976)		(0.855)
UAI, country average			−0.109***	−0.099***
			(−7.994)	(−6.506)
UAI, ind. difference			−0.032**	−0.031**
			(−2.409)	(−2.389)
N	5,770	5,770	5,770	5,770
Adjusted R^2 (%)	0.7	1.0	1.8	1.8
	Model 5	Model 6	Model 7	Model 8
Age	−0.007	−0.015	−0.022	−0.023*
	(−0.498)	(−1.122)	(−1.631)	(−1.740)
Gender	0.085***	0.085***	0.076***	0.076***
	(6.407)	(6.484)	(5.734)	(5.778)
Log GDP/capita	0.001	−0.018	−0.025*	−0.029**
	(0.065)	(−1.293)	(−1.845)	(−2.096)
Ambiguity aversion	0.007	0.007	0.006	0.006
	(0.547)	(0.493)	(0.429)	(0.433)
IDV, country average		0.066***		0.022
		(4.782)		(1.462)
IDV, ind. difference		0.014		0.012
		(1.064)		(0.939)
UAI, country average			−0.108***	−0.099***
			(−7.958)	(−6.477)
UAI, ind. difference			−0.032**	−0.031**
			(−2.414)	(−2.391)
N	5,758	5,758	5,758	5,758
Adjusted R^2 (%)	0.6	1.0	1.8	1.8

*Significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

lated with neither risk attitudes in gains and losses nor the uncertainty avoidance cultural dimension. A *t*-test also shows no significant differences of RRP in gains and losses and of UAI between participants who showed ambiguity aversion and those who did not. Further regression results show no significant effects of ambiguity aversion on risk attitudes in gains and losses (Models 5–8 in Tables 3 and 4). All of these results support the hypothesis that attitudes toward ambiguity and risk are indeed two distinct aspects of preferences (Borghans et al. 2009, Ellsberg 1961) and that ambiguity aversion differs from Hofstede's UAI.

4.2.6. Cultural Clusters. We also decompose our sample into eight cultural clusters, similar to the classification scheme suggested by Chhokar et al. (2008): African countries (sub-Sahara), Anglo-American countries, Germanic/Nordic countries, South and East Asian countries, Latin American countries, Latin European countries, Eastern European countries, and Middle Eastern countries (including the Maghreb). The assignment to cultural clusters was not based on the country where the survey was taken but on a question that asked whether subjects felt they belonged to a culture other than the one encompassing their place of residence. In total, 12% of the subjects chose this option. In this way, we ensured that students from different ethnic backgrounds (exchange students or immigrants) could be categorized correctly. Participants who stated other cultural regions (or who did not specify their different cultural roots) were categorized as "others" and formed the benchmark of our regressions in which dummy variables were added for the eight cultural clusters. The results suggest that although there are a substantial amount of cross-cultural differences not covered by Hofstede's cultural dimensions, most effects reported in the previous sections are robust when adding cultural cluster dummy variables.

Table 5 Pearson Correlations Between Risk and Ambiguity Attitudes and Uncertainty Avoidance Measures

	RRP gains	RRP losses	Ambiguity aversion
RRP losses	−0.346***		
p-value	<0.001		
N	5,329		
Ambiguity aversion	0.013	0.0026	
p-value	0.35	0.85	
N	5,139	5,139	
Uncertainty avoidance	0.088***	−0.059***	−0.0004
p-value	<0.001	<0.001	0.97
N	5,165	5,165	5,155

***Significant at the 1% level.

5. Discussion

There could be two major concerns regarding our survey methodology. The first concern is that we used only university students as subjects; they are not representative of the total population. However, there are several advantages to this sample selection:

1. Most of our participants were first- and second-year economics students. They understood the numerical formulation of lottery questions better than the general public but were still able to answer the questions intuitively.

2. Economics students can also be expected to play an important role later in life in economic and financial markets in each country and globally. The risk preferences we study here are relevant to those finance-related activities, and our data can therefore be useful for research in this area. We will discuss such applications in §6.

3. The most important reason our sample may have advantages, however, has already been noted by Hofstede (1991). To make a cross-national comparison, it is important to recruit homogeneous, comparable groups from each country to control background variables as much as possible. In this way, our approach has an advantage over representative samples. The same approach has also been used in recent research in behavioral economics (see, e.g., Herrmann et al. 2008).

The second methodological concern is that because we asked hypothetical questions without offering real monetary incentives, participants may not have been motivated to give thoughtful answers.

To test whether monetary incentives may lead to systematically different results, we conducted a small pilot study at the University of Zurich for selected lottery questions before the start of the full survey. The pilot study did not show significant differences. The details are reported in Appendix A.

Although an incentive-compatible design is considered a crucial prerequisite for most experimental economists, Bardsley et al. (2009) advocate a more pluralistic view, emphasizing that it is important to consider whether the incentive scheme is suitable to the specific research objective. Furthermore, they "caution against a presumption that all tasks in worthwhile economics experiments must feature material rewards" (Bardsley et al. 2009, p. 285). It has been found that other factors, such as task complexity and capability of the subjects, are also important, which is part of the reason we chose economics students for our survey (as mentioned above). A review of 74 experiments by Camerer and Hogarth (1999) suggests that, on average, financial incentives have no effect on mean performance but do reduce the variance. In particular, in the context of the lottery tasks similar to our survey, incentives do not eliminate those anomalies that deviate from expected utility theory.

International experimental studies with real monetary incentives do exist, but these studies are typically based on a much smaller sample of countries (see, e.g., Herrmann et al. 2008, who conducted experiments in 16 cities around the world). Vieider et al. (2012) recently conducted an ambitious and challenging large-scale experimental study with real monetary incentives in 30 countries. Such studies are valuable, but they lack the flexibility to implement lotteries with high stakes and lotteries in the loss domain.[9] Our survey, by comparison, allows us to study the cross-country differences in larger stakes and in losses under the prospect theory framework. To summarize, we agree with Peter Wakker's statement in his recent book: "...[Real incentives are highly desirable for descriptive purposes and should be used whenever possible. Descriptive studies exist, however, where the implementation of real incentives in not possible, so that hypothetical choice then should be used nevertheless" (Wakker 2010, p. 138).

Finally, there are advantages to the nonincentive, in-class survey (the types that we conducted). Laboratory experiments usually suffer from smaller sample sizes and self-selection biases. In our case, it was possible to obtain a large sample size. Moreover, nearly all students of the class where the survey was conducted took part. This high participation rate avoided the typical self-selection bias that voluntary experiments may manifest.

Another issue that we must address is that the survey was conducted mainly in 2008 and 2009, but data for a few countries were collected later, up to 2012. This might raise concerns about the potential impact of the global financial crisis on risk preferences. We cannot exclude such an impact. However, if there was an impact, it must have been substantially smaller than the between-country variations that we measured because we did not detect any systematic differences between the data collected before and after the onset of the financial crisis. This may be because we did not frame our questions as investment but as (more neutral) lottery questions.

6. Conclusion

We have presented results from the largest international survey on risk preferences. The differences in risk preferences that we have measured are large—between both countries and cultural regions. We found coherent effects from not only economic factors on risk preferences but also cultural differences, as measured by the Hofstede dimensions. Another important aspect of our results is that, although the influence of culture on risk preferences is large, the fundamental feature of risk aversion in gains and risk-seeking behavior in losses, as suggested by prospect theory, seems to be prevalent globally.

Our results provide an interesting starting point for further studies. On the one hand, our data on risk preferences can be used to understand differences in economic behavior across countries. On the other hand, the data are a starting point for understanding the emergence of risk preferences and how they are affected by personal traits, society, and cultural roots. Differences in economic behavior are often a result of differences in risk preferences. This is, for instance, the case wherever financial decisions are important. Some applications of our data are therefore readily

[9] Many of the countries in the study by Vieider et al. (2012) exhibit risk-seeking preferences in gains, which is at odds with the prevalent empirical findings. It is not clear why this is observed.

found in this domain. Two recent examples include the following:

• Breuer et al. (2012) demonstrate, based on our data, that risk preferences are correlated with dividend policies of companies in a way that has been forecasted by behavioral models (Shefrin and Thaler 1988).

• Rieger and Wang (2012) show that ambiguity aversion, as measured in our INTRA data, can explain parts of cross-country variations in the historical equity premium, as has been suggested by Chen and Epstein (2002) and Gollier (2011).

Many other applications are possible wherever preferences under risk and uncertainty play a role in explaining economic phenomena.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2013.1869.

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Appendix A. Pilot Study on Effects of Monetary Incentives

The experiment consists of two sessions with a between-subject design on monetary incentives:

1. For the session with monetary incentives, 36 subjects (23 men and 13 women) were recruited via an announcement by the Institute of Empirical Economics at the University of Zurich.

2. Fifty subjects (35 men and 15 women) participated in the session without monetary incentives at the beginning of an economic class.

Table A.1 Pretest Comparing Incentive and Nonincentive Lotteries in Gains

	Without monetary incentive ($N = 50$)		With monetary incentive ($N = 36$)		Difference	
Lotteries ($[p_1, x_1; p_2, x_2]$)	Mean	SD	Mean	SD	t	Sig. (two-tailed)
[0.10, 10; 0.90, 100]	47.9	27.6	56.1	25.9	−1.393	0.167
[0.40, 0; 0.60, 100]	23.6	15.7	27.3	16.0	−1.053	0.295
[0.40, 0; 0.60, 400]	94.0	89.5	92.6	64.1	0.078	0.938

All participants were undergraduate students in the fields of economics, business, and finance. The average age of the subjects was 22.3 (SD = 2.8) for the monetary incentives group and 24.9 (SD = 5.8) for the group without monetary incentives. The lottery questions were part of a bigger survey (including the questions on cultural dimensions, time preferences, and ambiguity aversion). The session lasted approximately 20–30 minutes.

The procedure for the nonincentive group was the same as described in §3. For the group with monetary incentives, we followed the Becker–DeGroot–Marschak procedure (Becker et al. 1964). Because it is difficult to impose real financial losses on the subjects, we only focused on the lotteries with positive payoffs. Three lotteries were included in our questionnaire, as listed in the first column in Table A.1. The payoffs are in experimental currency units, with 10 units being equivalent to 1 Swiss franc. The expected payoff per subject was 13 francs, which is compatible to the hourly wage of a student job on campus. We instructed the participants that each of them would play one randomly chosen lottery from these lotteries by throwing dice at the end of the session.

To determine the real payoffs they could obtain, we informed the participants about the following two-stage payment procedure regarding the lottery questions in the questionnaire. At the end of the experiment, one lottery was chosen randomly for each participant. The lottery $[p, x_1; 1-p, x_2]$ promised a minimum monetary prize of x_1 with probability p and a maximum prize of x_2 with probability $1-p$. The participant then threw two 10-sided die at one time, determining a number between 00 and 99. This number N was used to generate a random price $x_1 + x_2(N/100)$ for the lottery that the participant would play. The experimenter then checked the price that the participant offered for that particular lottery. If the willingness to pay to play the lottery was higher than or equal to the random price, the participant would play the lottery. If the willingness to pay was lower than the random price, the participant would obtain the amount of money equal to this random price.

Table A.1 shows that no significant differences were observed for the elicited certainty equivalent between two treatments for all three lotteries. We also did not find any significant difference of variance between the two treatments.

Appendix B. Reliability Check of Relative Risk Premium Measures

To test the reliability for the RRP measures in gains and losses, Cronbach's alpha has been computed (excluding

responses that violated weak internality), leading to values of 0.632 and 0.944, respectively. Eliminating lottery 5 (the lottery with a low probability for a high stake, in which the certainty equivalent may be influenced by probability weighting) would increase the reliability of the first scale to 0.890, but for consistency, we decided to keep the original formulation of all of the lotteries. For a second robustness check, we used a factor analysis of the eight nonmixed lotteries. The two extracted components corresponded well to the gain and loss lotteries, respectively. Using these components instead of the above-defined RRPs, the results of the following sections were similar.

As a consistency test, we checked the correlation of our RRP in gains with the two measures for the "propensity to take risk" (in income and portfolio decisions) in the data of Statman (2008). In this study, Statman asks subjects two questions on risk. The first one was

> Suppose you are the only income earner in the family, and you have a good job guaranteed to give you and your current family income every year for life. Now you are given an opportunity to take a new and equally good job. The new job has a 50/50 chance to increase by 50 percent your standard of living each year during your lifetime. However, the new job also has a 50/50 chance to reduce by X percent your standard of living each year during your lifetime. Circle the maximum X percent reduction in standard of living you are willing to accept.

Possible answers ranged from 3% to 30%. The second question was similarly stated but was in terms of a portfolio decision rather than an income decision. The overall correlation coefficients between Statman's two risk measures and our median RRP in gains (using all subjects) were -0.68 and -0.64, which were both significant at the 1% level (with $N = 20$ countries in the intersection of both studies). This significance demonstrates the reproducibility of the results and their robustness against changes in the survey methodology.

Appendix C. Universities Participating in INTRA

The following universities participated in the survey: Catholic University of Angola; Universidad Torcuato Di Tella (Argentina); Universität Innsbruck (Austria); Alpen-Adria-Universität Klagenfurt (Austria); University of Adelaide (Australia); Khazar University (Azerbaijan); Catholic University in Leuven (Belgium); Pan-European University Apeiron (Bosnia-Herzegovina); University of Windsor (Canada); University of British Columbia (Canada); Fudan University (China); Peking University (China); Renmin University of China; Universidad de Chile; Universidad de los Andes (Colombia); Business College VERN' (Croatia); CERGE-EI (Czech Republic); University of Southern Denmark; University of Copenhagen (Denmark); Tallinn University of Technology (Estonia); University of Helsinki (Finland); Universität Hamburg (Germany); Universität Trier (Germany); Universität Konstanz (Germany); Otto-von-Guericke-Universität Magdeburg (Germany); University of Thessaly (Greece); Chinese University of Hong Kong; Hong Kong Baptist University; University of Pécs (Hungary); Indian Institute of Technology Kanpur; Ben-Gurion University of the Negev (Israel); National University of Ireland, Maynooth; Università degli Studi di Venezia (Italy); Foreign Trade University (Vietnam); Doshisha University (Japan); American University of Beirut (Lebanon); Vilnius University (Lithuania); University of Luxembourg, University of Malaya (Malaysia); Universidad de Guanajuato (Mexico); MAES Kishinev (Moldova); Massey University (New Zealand), University of Ibadan (Nigeria), Norwegian School of Economics; Universidade de Lisboa (Portugal); Bucharest Academy of Economic Studies (Romania); Russian Customs Academy Vladivostok (Russia); University of Ljubljana (Slovenia); Seoul National University (South Korea); Universidad Pablo de Olavide (Spain); University of Zurich (Switzerland); National Sun Yat-sen University (Taiwan); University of Dar es Salaam (Tanzania); Chulalongkorn University (Thailand); Middle East Technical University (Turkey); Boğaziçi University (Turkey); Keele University (United Kingdom); Emory University (United States); Santa Clara University (United States); and Princeton University (United States).

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