Imperial College London
BUSINESS SCHOOL

Matteo M Galizzi, Marisa Miraldo, Charitini Stavropoulou



In sickness but not in wealth: Field evidence on patients' risk preferences in the financial and health domain

Discussion paper 2013/8

December 2013

In sickness but not in wealth: Field evidence on patients' risk preferences in the financial and health domain

Matteo M Galizzi[a*], Marisa Miraldo[b], Charitini Stavropoulou[c]

a. LSE, Behavioural Research Lab, LSE Health, and Department of Social Policy, London, UK, m.m.galizzi@lse.ac.uk
b. Imperial College London, Healthcare Management Unit, London, UK, m.miraldo@imperial.ac.uk
c. University of Surrey, Department of Health Care Management and Policy, Faculty of Business, Economics and Law, Guildford, UK, c.stavropoulou@surrey.ac.uk

* Corresponding author

Abstract: We conduct a field experiment to assess whether risk preferences significantly differ across the health and financial domains when they are elicited through the same paired-lotteries method. We administrate the Holt and Laury (2002) multiple price list (MPL) experimental tests to a sample of 300 patients attending outpatients' clinics in a university hospital in Athens, during the Greek financial crisis. Risk preferences in finance are elicited using paired-lotteries tests with hypothetical payments. The experimental tests are adapted to the health domain by framing the lotteries as risky treatments in hypothetical healthcare scenarios. Using Maximum Likelihood methods, we estimate the degree of risk aversion in both the financial and the health domain, allowing for the estimates to vary with individual observables. Despite being exposed to both health and financial distress, subjects in our sample tend to be less risk averse in the financial than in the health domain. Risk attitudes in the two domains are also associated to partly distinct characteristics: while married respondents are more risk averse in the wealth domain, subjects with higher education tend to be more risk seeking in the health domain. Subjects affected by chronic diseases appear more risk averse not only in health but also in financial decisions.

Key words: Behavioural experiments in health; Field experiments; Risk aversion.
JEL classification: I1, C93, D81.

Introduction

We report the results from an 'artefactual' field experiment (in the sense of Harrison and List, 2004) with 300 patients attending outpatients clinics in a Greek hospital during the financial crisis. We elicit their risk preferences within both the financial and the health domain using the same paired-lotteries method (Holt and Laury, 2002) with hypothetical payments. We estimate the degree of risk aversion, directly look at the similarities and differences in risk preferences across the two domains, and explore their links with a range of observable characteristics.

The work is motivated by the increasing interest in the stability of preferences among 'applied behavioural scientists' (in the sense of Kahneman, 2012). The traditional economics view assumes that individuals have stable preferences over time and across different situations, frames, and domains in life (Stigler and Becker, 1977).

In psychology, numerous studies have challenged the view that risk preferences are stable, documenting that preferences depend not only on the frame and context (Kahneman and Tversky, 1979; Hershey and Shoemaker, 1980; Hershey, Kunreuther, and Schoemaker, 1982; Slovic, 1987; Tversky and Thaler, 1990; Rabin and Thaler, 2001; Kahneman 2003a, 2003b), but also on a variety of personal feelings, emotions, and 'visceral' states (Loewenstein, 1996; Finucane et al., 2000; Loewenstein et al., 2000).

The literature, moreover, has provided ample evidence documenting intra-individual inconsistencies for risk preferences across different life domains (Jackson, Hourany, and Vidmar, 1972; MacCrimmon and Wehrung, 1990; Horvath and Zuckerman, 1993; Weber, Blais, and Betz, 2002; Hanoch, Johnson, and Wilke, 2006; Prosser and Wittenberg, 2007; Dohmen at al., 2011). Tests such as the Domain-Specific Risk-Taking scale (DOSPERT) have been used to explicitly differentiate between risk attitudes in six distinct domains: ethical, gambling, health/safety, investing, recreational, and social risk taking (Weber, Blais, and Betz, 2002; Blais and Weber, 2006). Similar tests measuring risk preferences in multiple life domains are the Risk Propensity Questionnaire (Rohrmann, 2005), and the Risk Propensity Scale (Nicholson et al., 2004), among others. Dohmen et al. (2011), for instance, considered the SOEP survey in Germany, which asks respondents to self-assess their willingness to take generic risks on a 0-10 Likert scale, "*in general*" and in five different domains, including financial and health decisions. Although responses were generally consistent with similar profiles of risk aversion, differences emerged across domains, with an average risk seeking score of 2.934 (out of 10) in health, compared to 2.406 in financial decisions.

Here we explore the possibility of measuring risk preferences across domains using an alternative experimental test that involves specific concrete trade-offs, instead of generic abstract attitudes. In particular, we elicit intra-individual risk preferences in the financial and health domain using variants of the same paired-lottery test originally proposed by Holt and Laury (2002). Together with the Gneezy and Potters (1997) and the Eckel and Grossman (2002) tests, the Holt and Laury (2002) method is one of the most widely used incentive-compatible tests to measure risk preferences among experimental economists. It is essentially a multiple price list (MPL) method where subjects are asked to choose the lottery they prefer in a series of pairs of lotteries.

In particular, we consider subjects attending out-patients clinics in a hospital in Greece during the current financial crisis. By its very construction, such a pool of subjects finds

itself within a 'naturally occurring' state of both financial and health distress. This peculiar condition makes most likely that the respondents perceive the risky trade-offs as realistic and vivid even in absence of actual incentive-compatible consequences for their responses.

Experiments with patients have also been considered by Prosser and Wittenberg (2007), who elicited certain equivalents in both health and money lotteries for 56 adult patients diagnosed with multiple sclerosis. To the best of our knowledge, ours is the first study to consider a relatively large pool of subjects (n=300) in a condition of both financial and health distress, and to elicit their risk preferences in both the financial and the health domain using the same MPL paired-lotteries experimental methods. Exploring different trade-offs measures for cross-domains preferences is timely and potentially promising since there seems to be no current 'gold standard' to measure risk attitudes with respect to health, and very few measures have been tested in healthcare settings (Harrison et al., 2005; Prosser and Wittenberg, 2007; van der Pol and Ruggeri, 2008; Young et al., 2008; Butler et al., 2012).

We find that risk preferences differ across the health and the financial domain even when they are elicited through an experimental test with the same structure; respondents in our sample of Greek patients manifested higher discomfort in considering risky choices in the health context. We also identified a number of similarities and differences in what explains risk preferences in the two domains.

The rest of the paper is organised as follows. Section 2 describes the methods of the study, and in particular the design of the experiment, the estimation of risk preferences in the financial and the health domain, and the related methodological questions. Section 3 presents the estimations' results. Section 4 discusses the findings and section 5 briefly concludes.

Methods

Design and structure of the experiment

The study took place in the outpatient clinics in the Laiko General Hospital in Athens, Greece, where one of the authors (CS) had previous research contacts. Laiko is a University Hospital, one of the country's largest general public hospitals, and, located in the centre of Athens, it covers the broader region of Attica.

Data were collected while patients were waiting to see their doctors in the outpatient clinics of the hospital, between 9am and 1pm. Patients who agreed to participate were given the questionnaire, which took approximately 20 minutes to complete. Patients were given both verbal and written instructions. The research assistant was sitting next to them, clarifying issues regarding the experimental tests and making sure that respondents clearly understood the questions.

The first part of the questionnaire assessed socio-demographic variables (e.g. age, sex, education, income brackets), individual life style and health habits (e.g. self-assessed health, drinking and smoking behaviour, physical exercise), and psychological traits (e.g. overconfidence). In the second part of the experiment we elicited individual risk preferences.

The questionnaire was developed in English and was linguistically validated in Greek following the guidelines of Acquardo et al. (2004) and Guillemin, Bombardier et al. (1993) on cross-cultural adaptation. It was first tested among 32 individuals in different age and education groups (see details in Appendix). The answers from this pilot are not included in the final analysis.

The study was approved by the Research Ethics Committee of Laiko Hospital on the 6th of August 2010 (protocol number ES 462). The fieldwork started in September 2010 and run in four waves over a period of fourteen months. Each wave lasted about 5 weeks. The period of data collection was of intense economic and political distress for Greece. A series of severe austerity measures were taken earlier that year (April 2010) when the country's deficit reached 12% of the GDP. In May 2010 the IMF and the EU agreed on the first bailout loan to Greece. During the months of the data collection, the Greek parliament voted a new austerity bill, after which a second 'bailout' loan was agreed with the IMF and the EU. The austerity measures were followed by a series of strikes and violent riots, while lack of political unity led to the resignation of the then Prime Minister and the formulation of a coalition government (for a brief timeline of the Greek economic crisis see http://www.guardian.co.uk/business/2012/mar/09/greek-debt-crisis-timeline).

Eliciting and estimating risk preferences in the financial and the health domain
We elicited individual risk preferences within the Expected Utility Theory (EUT) framework. In particular, following most experimental economics studies, we assume that the risk preferences can be represented by a constant relative risk aversion (CRRA) utility function (Holt and Laury, 2002; Andersen et al., 2008a; 2008b; 2010): the utility function of a subject in the financial domain, in terms of monetary payoffs *W*, is thus

$$U(W) = \frac{W^{1-r^w}}{1-r^w} \qquad (1)$$

Where r^w is the coefficient of constant relative risk aversion in the financial domain. Depending on the value of r^w a subject shows different degrees of risk aversion in the financial domain, that can be grouped in three main types:

1. If $r^w = 0$ risk neutral
2. If $r^w > 0$ risk averse
3. If $r^w < 0$ risk seeker

In a similar way, the utility of a subject within the health domain is defined in terms of days in full health *H*, and assumed to be $U(H) = \frac{H^{1-r^h}}{1-r^h}$, where r^h is the coefficient of constant relative risk aversion in the health domain.

As mentioned, we used the same MPL method by Holt and Laury (2002) to elicit risk preferences in both the finance and the health domains. In particular, we have used the standard paired-lotteries method to elicit risk aversion in the financial domain in terms of monetary outcomes, and we adapted it in terms of days in full health to estimate risk aversion in health. The Appendix reports a detailed description of the methodological questions that informed the design of the experimental tests. In particular, it discusses the several reasons why we opted for tests with hypothetical payments in both domains.

Briefly, each subject was asked two series of questions, separated by a questionnaire, the first one to elicit risk preferences in the finance domain, the second one to elicit risk preferences in the health domain. The pilot study suggested that lotteries were easier to understand if presented first in the finance domain. Each of the two series of questions asked the outpatients in the clinics to choose between two risky situations (lotteries), *A* and *B*, each having two outcomes, say, *1* and *2*. In the 9 pairs of risky situations proposed to subjects in either series, we varied both the probabilities p_{kj} and the payoffs associated to each outcome *k=1,2* of the two lotteries, either in monetary (W_{kj}) or in health (H_{kj}) terms, with *j=A,B*. The

probabilities varied from 0 to 100%, while the payoffs varied from €10 to €385 in the financial domain, and from 10 to 385 days in full health in the health domain. As discussed in greater detail in the Appendix, the correspondence of one day in full health with one Euro was not only a natural candidate, but it was also justified by the result of an exploratory willingness-to-pay experiment we run in the pilot. In Tables 1 and 2, we provide a representation of the set of choices presented to subjects in the financial and the health domain, respectively.

[Insert Table 1 here]
[Insert Table 2 here]

To empirically estimate risk preferences we have used Maximum Likelihood (ML) methods and followed Andersen et al. (2008b; 2010), and Harrison (2008), where the full details of the empirical strategy can be found. Here we briefly explain how subjects' choices have been used to estimate risk preferences, say, in the finance domain.

From (1) $U(W)$ is the utility that a subject perceives from getting a monetary payoff W. Under Expected Utility Theory, the expected utility by a subject of a given lottery $j=A,B$ is just the utility of each outcome $k=1,2$ in that lottery, weighted by the probability p_k of the outcome:

$$EU_j = \sum_{k=1,2} p_{kj} * U(W_{kj}) \qquad (2)$$

with $j=A,B$ and $k=1,2$. Clearly the expected utility depends on the subject's risk aversion parameter r^w, the variable that we want to estimate. Based on a candidate value of r^w a latent preference index $\Delta(EU)$ can be constructed. Importantly, our empirical model allows subjects in the outpatient clinics to make stochastic errors when comparing expected utilities. In particular, following Holt and Laury (2002) we include in our estimation a further parameter μ to capture the stochastic error, and we write our latent index as:

$$\Delta(EU) = \frac{(EU_A)^{1/\mu}}{(EU_A)^{1/\mu}+(EU_B)^{1/\mu}} \qquad (3)$$

Essentially, when $\mu \rightarrow 0$ the stochastic errors become negligible and the empirical specification reduces to a deterministic EUT choice, where the subject works out the difference between the perceived expected utilities from the two lotteries A and B. The latter index in such a case is thus simply the difference $\Delta(EU) = EU_A - EU_B$, which depends on the subject's latent risk preferences r^w. The subject then always chooses the lottery with higher expected utility: lottery A every time the latent index gets positive values, and lottery B otherwise. When, however, μ gets larger, $\mu \rightarrow \pm\infty$, the choice between the two lotteries becomes essentially random, with the value of the latent index function approaching ½ for any values of the expected utilities.

This latent index can be directly seen as a cumulative probability density function (*CDF)*, as it takes values within the range between 0 to 1, and equals ½ when the subject is indifferent between the two lotteries (Holt and Laury, 2002). In particular, we assume that the latent index $\Delta(EU)$ follows a normal CDF, so that $\Phi(\Delta(EU))$ can be thought to link the latent preferences and the binary choices observed in the experiment:

$$Prob\ (choosing\ lottery\ A) = \Phi(\Delta(EU)) \qquad (4)$$

Therefore, under the assumptions of Expected Utility Theory and of *CRRA* utility functions, the likelihood of observing a specific choice depends on the individual risk preference r^w, given the normal *CDF* linking the latent index to the observed choices. Since indifference responses were explicitly ruled out, the individual log-likelihood of choosing either lottery in each of the observed choices y_i, in our experiment is given by:

$$Ln\ L\ (r^w, \mu; y) = \sum_i ((ln\ \Phi(\Delta(EU))|\ y_i = 1\ ) + ((ln\ \Phi(1 - \Delta\ (EU))|\ y_i = 0\ ) \qquad (5)$$

where $y_i = 1(0)$ denotes the choice of lottery *A(B)* in the proposed pair of lotteries *i*. The above estimation procedure differs from a binary choice model such as a probit, in that it structurally estimates the latent index of the individual parameter r^W using the values of the probabilities and the outcomes as induced by the experimental lotteries, and the actual choices by the subjects observed in the experiment. In particular, we pooled together all the observations within each domain in order to estimate r^w and r^h: as, for each risk domain, our questionnaire collected 9 responses for 300 subjects, the resulting dataset comprised 2700 observations for either domain. We corrected for heteroskedasticity and autocorrelation of observations within the same subject, by treating the residuals from the same subject as potentially correlated, and computing cluster-robust standard errors of estimates.

Using Stata 11, we wrote a program to compute the expected utilities by the subjects and the latent index $\Delta(EU)$ and to construct the above log-likelihood function. The program passed into the log-likelihood function the data on the probabilities and monetary payoffs of the experimental lotteries and the observations on the preferred choices by the subjects. The log-likelihood function was then evaluated by Stata ML routine and maximized using the Newton-Raphson (NR) optimization technique (for a detailed treatment on maximum likelihood estimation using Stata, see Gould, Pitblado, and Sribney, 2006).

The above ML approach is sufficiently flexible to allow the *CRRA* coefficients r^w and r^h to vary with the individual observed characteristics (Andersen et al., 2008a-b; Harrison, 2008). In particular, define *X* as a vector of *m* observed characteristics, including socio-demographic controls, income and health variables, and other behavioural characteristics. The ML program can be adjusted to allow the *CRRA* parameters r^w (and r^h) to be linear functions of the *m* individual characteristics in the vector *X* such as:

$$r^w = \alpha_0 + \sum_m \gamma_m X_m \qquad (6)$$

If the vector *X* of observed characteristics is included, the above log-likelihood function becomes:

$$Ln\ L\ (r^w, \mu; y, X) = \sum_i ((ln\ \Phi(\Delta(EU))|\ y_i = 1; X\ ) + ((ln\ \Phi(1 - \Delta(EU))|\ y_i = 0; X\ ) \qquad (7)$$

Variables and main descriptive statistics

Table 3 presents a definition and the main descriptive statistics of the variables included in the analysis, namely standard socio-demographic and economic variables (*age, genderf, married, children, educ, income, finconstr*), self-assessed health (*sah*), and self-reported health conditions and behaviours (*chronic, smokerd, alcohol, gym*).

[Insert Table 3 here]

We also controlled for two psychological traits which are often used to measure overconfidence (Barber and Odean, 2002), namely the *better-than-average* and the *illusion*

of control attitudes. The better-than-average is the tendency to believe oneself to have superior characteristics to the average person, a potentially correlated, but clearly distinct, attitude from risk preferences. Following Bias et al. (2002, 2005) and Taylor and Brown (1988) we measure it using a simple test based on questions such as: *What percentage of people of your age have a better job than you because they have better skills*? Scores for each question were calculated in the form of a *(50- answer)/50* index and then averaged at an individual level. The final index (*BTA*) measures how much a subject felt better-than- (or worse-than-) average, ranging from -100 to +100 (feeling the worst and the best, respectively).

The second psychological trait was illusion of control, namely the feeling to have control over what in fact are largely random situations, a tendency which is intuitively associated with risk preferences. Subjects were asked to declare whether and how much they agree, on a 1 to 5 scale, with a number of statements, such as: *My forecasts are always correct.* Scores were then computed as *(5 – answer)/4* and averaged at an individual level. The final illusion of control index (*IC)* measures how much a subject suffers from illusion of control and takes values from 0 to 100.

The last variable is *round*. As mentioned above, data collection took place in a period during which the economic and financial situation in Greece progressively aggravated. To control for the possible effect of this situation, we included the variable *round* ranging from 1 to 4 indicating the wave in which the questionnaire was collected.

Results

We first present the coefficients of risk aversion in the wealth and the health domains, r^w and r^h, respectively, estimated using model (5). Results are presented in Table 4. As it can be seen, patients in our sample tended to be more risk averse in the health than in the finance domain.

The 'structural' estimation of the behavioural parameters shows that while respondents' choices were significantly risk averse in the health domain, in the financial domain we cannot reject the null hypothesis that subjects in our sample made choices consistent with risk neutral preferences (i.e. $r^w = 0$).

[Insert Table 4 here]

We next present the coefficients of risk aversion in the wealth (r^w) and health (r^h) domain estimated using model (7) that allows them to vary with the observable characteristics.

Risk preferences in finance

Table 5 shows all the specifications for the estimations of individual risk aversion in the *financial domain*. The analysis moves from model 1, which controls only for socioeconomic parameters, to model 2, in which we added the health characteristics, then model 3, where a number of health habits were included, and, finally, model 4, where the psychological traits were also controlled for.

[Insert Table 5 here]

Of all the socio-demographic characteristics, only marital status shows results that are robust across all specifications: married people were significantly more risk averse in the financial domain than the non-married. Education has in some specifications a, marginally significant,

negative effect, but the effect is not robust across all specifications. The variable for gender is significant in two specifications, suggesting that no significant gender differences exist in risk preferences in the financial domain for our sample of respondents.

When health characteristics are considered, self-assessed health is never significant. Interestingly, however, having a chronic health condition is consistently associated to risk preferences in finance: patients who had chronic conditions were significantly more risk averse in the financial domain.

From the health habits, respondents who reported to drink alcohol gave responses that tended to be compatible with higher risk aversion, while exercise and smoking did not show any significant association.

Finally, the more the patients suffer from illusion of control the more risk loving they tended to be. This finding provides a confirmation that our experimental test for risk preferences generally correlates well, and in the expected direction, with a common psychometric measure for illusion of control, a behavioural attitude that is intuitively associated with the way uncertainty is perceived by individuals.

We next turn to models 5-8 of Table 5, which controls for the round in which the data was collected (*round)*. *Round* was, in fact, in all specifications significant with a negative sign: subjects who were interviewed in later waves provided responses which were compatible with higher risk seeking in financial decisions than respondents in earlier waves. The effect is highly significant and robust across all specifications and robustness checks.

The effect of the gradual deterioration of the economy, however, appeared to have an asymmetric effect on the risk attitudes of respondents with different levels of financial stress. In particular, the inclusion of the variable *round* also turn *finconstr*, indicating how comfortable participants felt to cope with their current financial situation, into a significant variable in most specifications. Therefore, although the deterioration of the economic and political crisis in Greece made respondents generally less risk averse when deciding between financial options, it also made respondents already in financial distress, significantly *more* risk averse in financial decisions.

An interesting side finding is that, in the specifications controlling for the interviews' wave, *income* turns out not to be significant, while *finconstr* is. A possible interpretation is that, while income directly captures subjects' wealth, the financial constraint variable is more related to the subjective emotional state, or the general mood (for instance, anxiety), associated to how subject feel about the overall financial situation. The possible analogy between subjectively assessed health and objectively measured health outcomes may explain only part of the story, though. In fact, subjects may think of the overall financial situation as encompassing many other factors rather than simply income. The stability of future income flows, for instance, is likely to play a major role, and could have been under a specific threat for some subjects in our sample, due to the drastic austerity measures that often entailed cutting jobs and salaries.

Although the inclusion of *round* generally made the association with several variables (e.g. education, chronic condition, alcohol consumption) not statistically significant, across all models the significant effect of being married persists and is confirmed: married patients tended to be more risk averse in the financial context.

Risk preferences in health

For the sake of direct comparability, within the health domain we have replicated exactly the same specifications as for the financial domain. Table 6 presents the results in an analogous way to Table 5. The first four models are done without controlling for the effect of *round* while models 5-8 do.

[Insert Table 6 here]

The results in the health domain show both similarities and differences with the financial domain regarding the individual characteristics associated to risk preferences. Considering socio-demographic characteristics only, a quite different picture emerges with respect to the financial context. Unlike for financial decisions, education has the most robust effect in the health domain: patients with higher levels of education appeared significantly less risk averse in health. Since higher levels of education are typically associated with higher levels of income, this result is generally consistent with analogous findings that more affluent subjects tend to be more risk seeking (Harrison et al., 2008). However, it adds to this the specific observation that more affluent individuals also tend to be more risk seeking in health matters, as also confirmed by the sign of the income variable, although rarely significant. Another difference with respect to the financial domain concerns the marital status, whose significance is not robust across specifications.

An analogy with the financial domain emerges when the analysis controls for health status: patients with chronic diseases tend to be characterised by risk averse preferences also for health matters, while self-assessed health does not turn out to play any significant role in health decisions either.

Controlling for health habits leads to both analogies and differences between the financial and the health domains. On the one hand, subjects who drink alcohol seem to be characterised by responses compatible with more risk averse preferences also in the health domain. On the other hand, current smokers and respondents who exercise more tend to show more risk loving attitudes in the health domain.

Finally, also within the health domain, our experimental test to measure risk preferences seems to correlate well, and in the expected direction, with the measure for illusion of control, intuitively associated with risk perception. In particular, as for the financial domain, subjects who have higher illusion of control scores, tend also to be more risk seeking. Moreover, and differently from what found for the financial domain, the better-than-average attitude seems significantly associated with our experimental measure for risk preferences in health: subjects with higher better-than-average scores made choices consistent with more risk averse preferences within the health context, an interesting finding confirming that, as observed above, the two measures can indeed capture quite distinct behavioural traits.

As for the financial domain, we have replicated the analysis including the variable *round* to test any effect of the different times of data collection (models 5-8). Also in the health domain, *round* was significant in all specifications with a negative sign: subjects who were interviewed in later waves provided responses compatible with higher risk seeking in health matters than respondents in earlier waves.

Discussion

Our analysis shows that respondents in our pool were relatively more risk averse in health than financial matters. The result is qualitatively in line with the finding by Dohmen et al.

(2011) and is of particular interest given that Prosser and Wittenberg (2007) found that the 56 patients diagnosed with multiple sclerosis in their sample were essentially risk neutral in the health domain, while significantly risk averse in the financial one. Besides obvious differences in the two pools of subjects, as well as in the methods to measure risk preferences, in principle the differences in cross-domains risk attitudes could be partly due to the fact that our respondents were also exposed to financial distress.

In the financial domain, we found that patients with a chronic condition were significant more risk averse than those who did not report a chronic problem. This result confirms and qualifies the evidence by Prosser and Wittenberg (2007) that patients diagnosed with multiple sclerosis were significantly risk averse in financial matters. No gender differences were observed, a result which is in line with previous literature (Andersen et al., 2006; Harrison et al., 2007; Viscusi et al., 2011).

Drinking alcohol was associated with higher risk aversion in the financial domain but neither smoking nor exercise were. This latter finding is broadly consistent with Harrison et al. (2010), Dohmen et al. (2011), Galizzi and Miraldo (2012), Szrek et al. (2012), and Sutter et al. (2013) who also found not significant association between smoking status and risk preferences in financial decisions. What is more, and although smoking does not affect risk preferences in the financial domain, smokers in our sample are more risk seeking in the health domain. This finding is consistent with Dohmen et al. (2011) who found that the smoking status was significantly associated with (self-assessed) willingness to take risks in general and in the health domain, but not in financial matters. A possible speculation for the effect of exercise, refers to the observation that exercising and doing sports may require a pro-active state of mind which can be associated with risk-taking attitude.

A striking finding is the effect *round* in our analysis. Both in the financial and the health domain, respondents were more likely to be risk loving if they were interviewed at a later round of the study, when the recession was deeper. In health decisions, the effect of the gradual deterioration of the economy, appeared to have an asymmetric effect on the risk attitudes of respondents with different levels of financial stress. In particular, the inclusion of the variable *round* again turned *finconstr* into a significantly positive coefficient. Thus, although the aggravation of the crisis in Greece made respondents generally less risk averse in health decisions, it also made respondents already in financial distress, significantly *more* risk averse in health. This is in line with the latest evidence about the insurgence of health risky behaviours among the most deprived segments of the population (Kentikelenis et al., 2011; Paraskevis et al., 2013; WHO, 2013).

Conclusions

The goal of the work was to elicit the risk preferences of a sample of patients in both the financial and the health domain using the same MPL paired-lotteries experimental method, and to look at the similarities and differences across the two domains, as well as their links with observable characteristics.

We find empirical evidence that individual risk preferences may differ between the health and the financial domains even when they are measured using the same MPL paired-lotteries experimental method. When risk preferences are measured using the same MPL experimental test in both finance and health, similarities as well as differences emerge in the factors associated with risk preferences across domains.

The fact that risk preferences may differ across the health and the finance domains is generally in line with the current evidence (Weber et al., 2002; Blais et al., 2006; Prosser and Wittenberg, 2007; Dohmen et al. 2011). Our study qualifies and confirms these findings by using, across both domains, the same MPL experimental test involving concrete and specific trade-offs, instead of domain-specific tests or generic abstract attitudinal questions.

From a methodological perspective, conducting the same experimental MPL test with subjects in 'naturally occurring' field situations of both financial and health distress can contribute to bring closer together two research methods and streams of literature which have insofar proceeded along distinct paths: on the one hand, incentive-compatible experimental measures for risk preferences with real monetary stakes, and on the other, self-assessed attitudinal questions in generic, abstract, and detached health situations. The attempt to bridge the gap between these two approaches seems most needed at the moment. Despite its key importance for both research and policy purposes, in fact, there is no current 'gold standard' to measure risk attitudes with respect to health, nor to compare them across different contexts or domains (Harrison et al., 2005; Prosser and Wittenberg, 2007; Young et al., 2008; Butler et al., 2012).

From the perspective of bringing closer together the methods used in measuring risk preferences, an interesting question is related to whether the 'disciplinary' power of incentives, inherently associated with incentive-compatible tests, is sufficiently strong to realign individual responses on risk attitudes across the two domains. We envisage further research to answer this question in more controlled experimental settings.

Yet the results we have reported here suggest that examining how individual risk attitudes relate across different domains, and which factor is associated to them, seems a promising direction in attempting to understand how people make decisions involving both health and finance. Its implications are not only of scientific interest. The development of different metrics and methods to measure risk preferences in health and to compare them with their monetary analogous can prove useful to enrich the validity of the cost-effectiveness analyses and decision-making models in which they can be incorporated.

Understanding risk preferences in the health domain is also very important to allow a better exploration of how patients take healthcare decisions, such as adhering to medical decisions and seeking a second medical opinion. Evidence in this area is very limited.

References

Acquadro, C., Conway, K. Giroudet, C., Mear, I. (2004) Linguistic validation manual for patient-reported outcomes (PRO) instruments. Lyon, Mari Research Institute.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E. (2006) Elicitation using multiple price list formats. Experimental Economics 9(4), 383-405.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E. (2008a) Lost in Space: Are Preferences Stable? International Economic Review 49 (3), 1091-1112.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, E. (2008b) Eliciting Risk and Time Preferences. Econometrica 76 (3), 583-618.

Andersen, S., Harrison, G.W., Lau, M.I., Rutström, EE. (2010) Behavioral Econometrics for Psychologists. Journal of Economic Psychology, 31(4), 553-576.

Barber BM., Odean T. (2002) Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment. Quarterly Journal of Economics, 116, 261-292.

Bias, B., Hilton, D., Pouget, S. (2002) Psychological Traits and Trading Strategies. *C*EPR Discussion Papers 3195, C.E.P.R. Discussion Papers, 2002.

Bias, B., Hilton, D., Mazurier, K., Pouget, S. (2005) Judgmental Overconfidence, Self-Monitoring and Trading Performance in an Experimental Financial Market. Review of Economic Studies 72 (2), 287-312.

Blais, A.R., Weber, E.U. (2006) A domain-specific risk-taking (DOSPERT) scale for adult populations. Judgment and Decision Making 1(1), 33–47.

Butler, S., Rosman A., Seleski S., Garcia M., Lee S., Barnes J., Schwartz A. (2012). A Medical Risk Attitude Subscale for DOSPERT. Medical Decision Making, 7(2), 189-195.

Dohmen, T., Falk, A., Huffman, D., Sunde, W., Schupp, J., Wagner, G.G. (2011). Individual Risk Attitudes: Measurement, Determinants and Behavioral Consequences. Journal of the European Economic Association 9 (3), 522-550.

Eckel C, Grossman PJ (2002): Sex differences and statistical stereotyping in attitudes toward financial risk. *Evolution and Human Behaviour*, 23(4), 281-295.

Finucane ML, Alkahami A, Slovic P, Johnson SM (2000): The affect heuristic in judgments of risks and benefits. Journal of Behavioral Decision Making, 13, 1-17.

Galizzi, M.M., Miraldo, M. (2012) Are You What You Eat? Experimental Evidence on Health Habits and Risk Preferences. WP Imperial College Business School, Healthcare Management Group.

Gneezy U, Potters J (1997): An experiment on risk taking and evaluation periods. *Quarterly Journal of Economics*, 112(2), 631-645.

Gould, W., Pitblado, J., Sribney, W. (2006) Maximum Likelihood Estimation with Stata, Stata Press.

Guillemin, F., Bombardier, C., Beaton, D. (1993) Cross-cultural adaptation of health-related quality of life measures: Literature review and proposed guidelines. Journal of Clinical Epidemiology, 46(12), 1417-1432.

Gyrd-Hansen, D. (2003) Willingness-to-pay for a QALY. Health Economics 12(12): 1049-60.

Hanoch Y, Johnson J, Wilke A (2006): Domain specificity in experimental measures and participant recruitment: an application to risk-taking behavior. Psychological Science, 17, 300-304.

Harrison J.D., Young J.M., Butow P., Salkeld G., Solomon M.J. (2005). Is it worth the risk? A systematic review of instruments that measure risk propensity for use in the health setting. Social Science & Medicine 60(6):1385-96.

Harrison, G.W. (2008) Maximum Likelihood Estimation of Utility Functions Using Stata. Working Paper 06-12. Department of Economics, University of Central Florida.

Harrison, G.W., Lau, M.I., Rutström, E.E. (2007) Estimating risk attitudes in Denmark: A Field Experiment. Scandinavian Journal of Economics 109(2), 341–368.

Harrison, G.W., Lau, M., Rutström,E. (2010) Individual Discount Rates and Smoking: Evidence from a Field Experiment in Denmark. Journal of Health Economics 29, 708-717.

Harrison, G.W., List, J. (2004) Field Experiments. Journal of Economic Literature 42 (4), 1013-1059.

Harrison, J.D., Young, J.M., Butow, P., Salkeld, G., Solomon, M.J. (2005). Is It Worth the Risk? A Systematic Review of Instruments that Measure Risk Propensity for Use in the Health Setting. Social Science and Medicine 60(6), 1385-1396.

Hershey, J.C., Schoemaker, P.J.H. (1980) Risk Taking and Problem Context in the Domain of Losses: An Expected Utility Analysis. Journal of Risk and Insurance 47, 111-132.

Hershey, J.C., Kunreuther, H.C., Schoemaker, P.J.H. (1982) Sources of Bias in Assessment Procedures for Utility Functions. Management Science 28, 936-954.

Hirth, R.A., Chernew, M.E., Miller, E., Fendrick, M., Weissert, W.G. (2000) Willingness to Pay for Quality-Adjusted Life Year: in Search of a Standard. Health Economics 20, 332-342.

Holt, C.A., Laury, S.K. (2002) Risk aversion and incentive effects. American Economic Review 92 (5), 1644-1655.

Horvath P., Zuckerman M. (1993). Sensation Seeking, Risky Appraisal, and Risky Behavior. Personality and Individual Differences, 14(1), 41-52.

Jackson, D.N., Hourany L., Vidmar N.J., (1972). A Four-Dimensional Interpretation of Risk Taking. Journal of Personality. 40, 483-501.

Kahneman, D., Tversky A. (1979). Prospect Theory: An Analysis of Decisions Under Risk. Econometrica, 47, 262-291.

Kahneman, D. (2003a) A Psychological Perspective on Economics. American Economic Review 93, 162-168.

Kahneman, D. (2003b) Maps of Bounded Rationality: Psychology for Behavioural Economics. American Economic Review 95, 1449-1475.

Kahneman D (2012): Foreword, in Shafir E (2013). The Behavioral Foundations of Public Policy. Princeton University Press.

Kentikelenis, A., Karanikolos, M., Papanicolas, I., Basu, S., McKee, M., and Stuckler, D. (2011) Health Effects of Financial Crisis: Omens of a Greek Tragedy. The Lancet 328 (9801), 1457-1458.

Kind, P., Dolan, P. (1995). The Effect of Past and Present Illness Experience on the Valuations of Health States. Medical Care 33(4), AS255-AS263.

Loewenstein G. (1996). Out of Control: Visceral Influences on Behavior. Organizational Behavior and Human Decision Processes. 65(3): 272-292.

Loewenstein G, Hsee C, Weber E, Welch R (2000): Risk as feelings. Psychological Bulletin; 127(2): 267-286

MacCrimmon, K.R., Wehrung D.A. (1990). Characteristics of Risk Taking Executives. Management Science 36, 422-435.

Nicholson N., Soane E., Fenton-O'Creevy M., William P. (2004). Personality and Domain-Specific Risk Taking. Journal of Risk Research, 8(2), 157-176.

Paraskevis, S., Nikolopoulos G., Fotiou A., Tsiara C., Paraskeva D., Sypsa V., Lazanas M., Gargalianos P., Psichogiou M., Skoutelis A., et al. (2013). Economic Recession and Emergence of an HIV-1 Outbreak Among Drug Injectors in Athens Metropolitan Area: a Longitudinal Study. PLoS ONE, 8(11), e78941.

Pinto-Prades, J.L., Loomes, G., Brey, R. (2009). Trying to Estimate a Monetary Value for The QALY. Journal of Health Economics 28(3), 553-562.

Prosser, L.A., Wittenberg E. (2007). Do Risk Attitudes Differ Across Domains and Respondent Types? Medical Decision Making 27, 281-287.

Rabin, M., Thaler, R.H. (2001). Anomalies: Risk Aversion. Journal of Economic Perspectives 15, 219-232.

Rohrmann B. (2005). Risk Attitude Scales: Concepts, Questionnaires, Utilizations. Project Report, University of Melbourne: http://www.rohrmannresearch.net/pdfs/rohrmann-racreport.pdf.

Slovic P, 1972b. Information Procession, Situation Specificity, and the Generality of Risk-Taking Behavior. *Journal of Personality and Social Psychology*, 22, 128-134.

Slovic, P., (1987). Perception of Risk. Science, 236(4799), 280-285.

Stigler, G., Becker, G.S. (1977) De Gustibus Non Est Disputandum. The American Economic Review 67(2), 76-90.

Sutter M, Kocher MG, Glatzle-Rutzler D, Trautmann ST, 2013. Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior. *American Economic Review*, 103(1), 510-531.

Szrek H, Chao L, Ramlagan S, Peltzer K (2012): Predicting (un)healthy behavior: a comparison of risk-taking propensity measures. *Journal of Decision Making*, 7(6), 716-727.

Taylor, S.E., Brown, J.D. (1988) Illusion and well-being: A social psychological perspective on mental health. Psychological Bulletin 103, 193-210.

Tversky, A., Thaler, R.H. (1990) Anomalies: Preference Reversals. Journal of Economic Perspectives 4, 201-211.

van der Pol M., Ruggeri M. (2008). Is risk attitude outcome specific within the health domain? Journal of Health Economics. 27(3):706-17.

Viscusi, W., Phillips, O,. Kroll, S. (2011) Risky investment decisions: How are Individuals Influenced by their Groups? Journal of Risk and Uncertainty 43(2), 81-106.

Weber, E.U., Blais, A.R., Betz, N.E. (2002) A domain-specific risk attitude scale: measuring risk perceptions and risk behaviors. Journal of Behavioral Decision Making 15, 263–290.

WHO (2013). Correction to HIV Case Study in Greece Featured in WHO/Europe Report On Social Determinants of Health. World Health Organization Europe: http://www.euro.who.int/en/health-topics/communicable-diseases/hivaids/news/news/2013/11/correction-to-hiv-case-study-in-greece-featured-in-whoeurope-report-on-social-determinants-of-health

Young, A., Karpinski, M., Trelaven, D., Waterman, A., Parikh, C.R., Thiessen-Philbrook, H., et al., (2008). Differences in Tolerance for Health Risk to the Living Donor Among Potential Donors, Recipients, and Transplant Professionals. Kidney International, 73(10), 1159-1166.

Table 1: The set of choices between binary lotteries given to the patients in the financial domain

ID	*Lottery A*				*Lottery B*				*Your Choice*	
	P	*€*	*P*	*€*	*P*	*€*	*P*	*€*	*A*	*B*
1	10%	**200**	90%	**160**	10%	**385**	90%	**10**	A	B
2	20%	**200**	80%	**160**	20%	**385**	80%	**10**	A	B
3	30%	**200**	70%	**160**	30%	**385**	70%	**10**	A	B
4	40%	**200**	60%	**160**	40%	**385**	60%	**10**	A	B
5	50%	**200**	50%	**160**	50%	**385**	50%	**10**	A	B
6	60%	**200**	40%	**160**	60%	**385**	40%	**10**	A	B
7	70%	**200**	30%	**160**	70%	**385**	30%	**10**	A	B
8	80%	**200**	20%	**160**	80%	**385**	20%	**10**	A	B
9	90%	**200**	10%	**160**	90%	**385**	10%	**10**	A	B

Table 2: The set of choices between binary lotteries given to the patients in the health domain.

ID	*Treatment A*				*Treatment B*				*Your Choice*	
	P	*Days in full health*	*P*	*Days in full health*	*P*	*Days in full health*	*P*	*Days in full health*	*A*	*B*
1	10%	**200**	90%	**160**	10%	**385**	90%	**10**	A	B
2	20%	**200**	80%	**160**	20%	**385**	80%	**10**	A	B
3	30%	**200**	70%	**160**	30%	**385**	70%	**10**	A	B
4	40%	**200**	60%	**160**	40%	**385**	60%	**10**	A	B
5	50%	**200**	50%	**160**	50%	**385**	50%	**10**	A	B
6	60%	**200**	40%	**160**	60%	**385**	40%	**10**	A	B
7	70%	**200**	30%	**160**	70%	**385**	30%	**10**	A	B
8	80%	**200**	20%	**160**	80%	**385**	20%	**10**	A	B
9	90%	**200**	10%	**160**	90%	**385**	10%	**10**	A	B

Table 3: Description of variables

Variable	Variable description	Mean	Std. Dev.	Min	Max
Age	Age in years	39.62	12.91	18	74
Genderf	Female (0=no, 1=yes)	0.49	0.50	0	1
Educ	Level of education	5.59	1.63	1	8
Income	Income level (1= less than €600 …5=more than €2,000)	2.58	1.06	1	5
Finconstr	Constrained by my financial state (1=leaving comfortably…4=find it very difficult)	2.46	0.75	1	4
Married	Married (0=no, 1=yes)	0.34	0.47	0	1
Children	Having children (0=no, 1=yes)	0.34	0.47	0	1
Sah	Self-assessed health (1= very good…5=very bad)	2.40	1.16	1	5
Chronicd	Chronic condition (0=no, 1=yes)	0.17	0.38	0	1
Smokerd	Smoking daily or occassionally (0=no, 1=yes)	0.37	0.48	0	1
Alcohold	Drinking at least a unit of alcohol per week (0=no, 1=yes)	0.65	0.48	0	1
Gym	Number of hours of vigorous exercise per week	2.76	4.38	0	50
BTA	Better than average index	59.44	33.43	-72	100
IC	Illusion of control index	61.29	12.80	18.75	100
Round	Wave in which the questionnaire was collected			1	4

Table 4: Estimated CRRA degree of risk aversion in the financial and the health domains

Finance		**Health**	
Coefficient	-0.00579	Coefficient	0.131**
	(0.0578)		(0.0518)
Noise	116.9***	Noise	55.68***
	(33.99)		(13.85)
Observations	2700	Observations	2700

Standard errors in parentheses
* p<.10, ** p<.05, *** p<.01

Table 5: Risk Preferences in the Finance Domain

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8
Age	0.0010	0.0003	-0.0004	-0.0013	0.0024	0.0018	0.0015	0.0012
	(0.0019)	(0.0019)	(0.0019)	(0.0021)	(0.0022)	(0.0022)	(0.0022)	(0.0024)
Genderf	0.0180	0.0321	0.0540*	0.0585**	0.0234	0.0325	0.0451	0.0460*
	(0.0296)	(0.029)	(0.0296)	(0.029)	(0.0297)	(0.0283)	(0.0289)	(0.0276)
Educ	-0.0177*	-0.0126	-0.0180	-0.0228*	-0.0184	-0.0108	-0.0148	-0.0187
	(0.0108)	(0.011)	(0.011)	(0.0117)	(0.0125)	(0.0127)	(0.0123)	(0.0128)
Income	-0.0211	-0.0108	0.0052	0.0060	0.0029	0.0094	0.0162	0.0127
	(0.0173)	(0.017)	(0.0192)	(0.0183)	(0.0185)	(0.0188)	(0.0198)	(0.0187)
Finconstr	-0.0137	-0.0048	0.0069	0.0142	0.0421	0.0530*	0.0602**	0.0642**
	(0.0219)	(0.0243)	(0.0229)	(0.0217)	(0.0265)	(0.0298)	(0.0286)	(0.0281)
Married	0.0647*	0.0826**	0.0809**	0.108***	0.0568*	0.0744**	0.0643*	0.0822**
	(0.0384)	(0.0416)	(0.041)	(0.0407)	(0.0343)	(0.0365)	(0.0384)	(0.0379)
Children	0.0013	0.0041	-0.0043	-0.0058	-0.0754*	-0.0737	-0.0807	-0.0821
	(0.0435)	(0.0475)	(0.0505)	(0.0501)	(0.0431)	(0.0477)	(0.0507)	(0.0502)
Sah		0.0058	0.0161	0.0200		0.0098	0.0149	0.0171
		(0.0153)	(0.017)	(0.0172)		(0.016)	(0.017)	(0.017)
Chronicd		0.0928**	0.0914*	0.101*		0.0762	0.0727	0.0852
		(0.0448)	(0.0483)	(0.0533)		(0.049)	(0.0513)	(0.0571)
Smokerd			-0.0148	-0.0134			-0.0183	-0.0172
			(0.0322)	(0.0337)			(0.0327)	(0.0336)
Alcohold			0.0785**	0.0772**			0.0327	0.0325
			(0.0354)	(0.0345)			(0.0363)	(0.0349)
Gym			-0.0003	-0.0007			-0.0021	-0.0017
			(0.0023)	(0.0016)			(0.0019)	(0.0018)
BTA				0.0002				0.0004
				(0.0005)				(0.00047)
IC				-0.0029***				-0.0025**
				(0.001)				(0.0011)
Round					-0.0571***	-0.0560***	-0.0556***	-0.0544***
					(0.0122)	(0.0126)	(0.0136)	(0.0141)
Constant	0.1230	0.0220	-0.0769	0.1080	0.0255	-0.0862	-0.1200	0.0284
	(0.138)	(0.137)	(0.137)	(0.159)	(0.161)	(0.165)	(0.158)	(0.179)
Noise								
Constant	96.27***	99.71***	101.8***	101.1***	106.7***	106.4***	111.3***	111.5***
	(29.11)	(30.04)	(31.01)	(29.46)	(30.75)	(30.19)	(33.13)	(32.54)
Observations	2052	2052	1908	1908	2052	2052	1908	1908

Standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

Table 6: Risk Preferences in the Health Domain

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8
Age	0.0008	0.0004	-0.0006	-0.0017	0.00341*	0.00306*	0.0018	0.0019
	(0.0018)	(0.0018)	(0.0017)	(0.0018)	(0.00181)	(0.0019)	(0.0018)	(0.00207)
Genderf	-0.0225	-0.0126	0.0105	0.0043	0.0002	-0.0025	0.0118	0.0128
	(0.0307)	(0.031)	(0.0316)	(0.0302)	(0.0286)	(0.0275)	(0.0289)	(0.026)
Educ	-0.026**	-0.0294***	-0.0367***	-0.0501***	-0.0211**	-0.0204*	-0.0277**	-0.0385***
	(0.0107)	(0.011)	(0.0119)	(0.0126)	(0.0107)	(0.0106)	(0.0116)	(0.0122)
Income	-0.0307*	-0.0249	-0.0004	0.0048	0.0092	0.0108	0.0191	0.0131
	(0.0174)	(0.0179)	(0.0198)	(0.019)	(0.0174)	(0.0175)	(0.0187)	(0.0175)
Finconstr	-0.0258	-0.0288	-0.0168	-0.0154	0.0582**	0.0558**	0.0561**	0.0605***
	(0.0197)	(0.0223)	(0.022)	(0.0207)	(0.023)	(0.0239)	(0.0231)	(0.022)
Married	-0.0016	-0.0039	0.0360	0.0760**	0.0280	0.0225	0.0482	0.0663**
	(0.0358)	(0.0366)	(0.0368)	(0.0359)	(0.03)	(0.0303)	(0.0316)	(0.029)
Children	-0.0212	-0.0199	-0.0320	-0.0364	-0.149***	-0.150***	-0.145***	-0.145***
	(0.0436)	(0.0447)	(0.0493)	(0.0462)	(0.0426)	(0.0432)	(0.0447)	(0.0439)
Sah		-0.0067	-0.0044	-0.0059		0.0062	0.0095	0.0050
		(0.0142)	(0.0144)	(0.0151)		(0.0139)	(0.0141)	(0.0139)
Chronic		0.0756*	0.0425	0.0724*		0.0330	0.0056	0.0312
		(0.0425)	(0.0443)	(0.0431)		(0.0337)	(0.0338)	(0.0336)
Smokerd			-0.0538	-0.0533*			-0.0604*	-0.0506*
			(0.0329)	(0.0315)			(0.0319)	(0.0303)
Alcohol			0.0897**	0.0924***			0.0479	0.0310
			(0.0359)	(0.0343)			(0.0324)	(0.0312)
Gym			-0.0047***	-0.0038**			-0.0058***	-0.0039**
			(0.00168)	(0.0017)			(0.00161)	(0.0016)
BTA				0.0012***				0.0014***
				(0.0004)				(0.0004)
IC				-0.0033***				-0.0034***
				(0.0009)				(0.0009)
Round					-0.0910***	-0.0907***	-0.0862***	-0.088***
					(0.011)	(0.0113)	(0.012)	(0.0116)
Constant	0.382***	0.402***	0.296**	0.494***	0.1260	0.1200	0.1390	0.329**
	(0.1250)	(0.1270)	(0.1310)	(0.1530)	(0.129)	(0.127)	(0.127)	(0.153)
Noise								
Constant	56.90***	57.55***	67.50***	70.91***	77.79***	78.14***	83.59***	81.99***
	(14.53)	(14.54)	(17.00)	(16.91)	(18.23)	(18.21)	(19.37)	(18.66)
Observations	2052	2052	1908	1908	2052	2052	1908	1908

Standard errors in parentheses

* p<.10, ** p<.05, *** p<.01

Appendix. Details of experimental tests and methods

As discussed, in the MPL paired-lotteries experiment we opted to not make use of any incentive-compatible payment mechanism. While such payment is commonly used in experimental economics to truthfully elicit preferences, the nature of our research question and design constrains its use. First, the implementation of incentive-compatible outcomes related to risky choices in outpatient clinics was, understandably, a major concern for the hospital's Ethics Committee to secure ethical approval to the project.

Second, implementing real payments for the chosen lotteries within the financial domain, while making the outcomes within the health domain only hypothetical, would imply the introduction of a confounding factor in the design that would hinder the attribution of the observed differences in choices to the different domains.

Moreover, from a methodological perspective, as discussed, the use of experimental tests involving specific trade-offs, rather than generic and abstract questions allows to "road-test" the extension of the MPL method to measure risk preferences in domains other than monetary outcomes, and to contribute to bridge the gap between incentive-compatible tests for risk preferences with money, on the one hand, and self-reported measures for risk attitude in abstract health contexts, on the other.

Finally, opting for hypothetical payments makes our results closely comparable with the previous findings by Prosser and Wittenberg (2007) and Dohmen et al.(2011), who also looked at risk attitudes in different domains by comparing standard gamble or Likert scale responses, respectively.

In order to elicit risk preferences within the health domain, we needed to transform the Holt and Laury (2002) financial paired lotteries method into an analogous framework for health outcomes. The main objective of this task was to vary the domain in which risk preferences were elicited, while keeping unaltered the structure and all other characteristics of the MPL elicitation test, thus producing a closely comparable set of experimental data across domains (see Tables 1 and 2).

In particular, within the health domain, the binary lotteries were presented as pairs of different healthcare treatments, both characterized by some risk. The healthcare context was chosen to ensure a vivid and realistic representation of the hypothetical alternatives by patients attending outpatient clinics, and is fully in line with the choice between two "drugs" by Prosser and Wittenberg (2007). Participants, in fact, were told that each treatment in the pair of options was expected to provide some amount of health benefits with some probability, and a lower amount of health benefits with the complementary probability. In analogy to the financial domain, one treatment (A) was presented as characterized by a lower variance, in terms of smaller difference between health benefits, than the risky treatment (lottery B). The series of proposed pairs of healthcare treatments only differ with respect to the probabilities of occurrence for the higher health benefits. Thus, for low probabilities, treatment A typically had the higher expected health benefit, while treatment B gave the higher expected health benefits for high probabilities.

Concerning the exact nature of health benefits, the natural candidate for the equivalent of an extra unit of money in the health domain was an extra unit of *time in full health*. This is fully consistent with the conceptual framework of economic evaluation of healthcare: in cost-

utility analysis (CUA), in fact, health benefits are typically evaluated relatively to the benchmark of a unit of time in "full health", whose benefit in terms of utility is usually standardized to one. In the monetary domain, this closely corresponds to standardizing to one the utility of one unit of income/money, as usually assumed in microeconomics. The choice of time in full health as the natural equivalent of money in the health domain is also in line with Prosser and Wittenberg (2007), who framed the health benefits for their specific pool of patients diagnosed with multiple sclerosis as "relapse-free" days.

Importantly, by considering patients in hospital clinics, who were by definition not yet "satiated" in their level of time in full health, we ensured that a lottery in the health domain providing an extra unit of time in full health was perceived as associated to a strictly positive benefit by all subjects. To emphasize this, in the experimental test we also made clear that, once the effects of the health treatments was gone in the health scenario, subjects were intended to go back to the health status they were currently experiencing. This is also in close analogy to the test by Prosser and Wittenberg (2007).

On the other hand, a direct comparability of the "non satiation" state between the two domains was secured, by design, through considering a sample of respondents in the middle of an economic and financial crisis. Although risky outcomes were only hypothetical in the monetary domain too, the actual involvement in a "natural" situation of general financial distress ensured that the perceived benefit associated to the idea of receiving a hypothetical extra unit of money was positive for each subject. Our peculiar pool of Greek patients, "naturally" experiencing, to some extent, both health and financial distress, was thus the best imaginable shot at accessing a sample of subjects in the field who were unlikely to feel satiated in both money and time in full health. This aspect of our experiment thus maximised the likelihood of inducing subjects to mentally represent the risky situations depicted in the tests in concrete and tangible terms, and to exert a credible level of cognitive effort in their responses, even in presence of hypothetical outcomes.

The conversion rate between one unit of money and of time in full health was another key consideration in our methodological discussion. Our main objective was to choose lengths of time in full health that were conspicuous and realistic for some hypothetical healthcare treatments. A natural and intuitive choice was to use days in full health as unitary interval in the health domain. The implicit conversion rate between the financial and the health domain of one euro per day in full health was based on several considerations.

First, the objective of the experimental design was to present to subjects a series of risky situations that were intuitively perceived as analogous in all other aspects but their domain. From this perspective the correspondence of one euro to one day seemed the most natural option. Moreover, and importantly, what really matters when comparing the outcomes across the financial and the health domains, is not their values *per se*, but their marginal impact on the subjects' current state in each domain. From this perspective, the two risky situations are hypothetically adding on the top of a subject's income and days in full health, one euro and one day in full health, respectively. For an average subject in our sample the magnitude of the effects across domains seems reasonably comparable. It should, in fact, be kept in mind that the patients in our pool were approached while attending outpatient clinics: therefore, although not being in full health, they were clearly not affected by serious conditions that could severely impair their daily life, or radically reduce their expectations about the future availability of days in full health.

Second, one could argue that the exact unit of measure chosen in each domain is of little practical relevance within our analytical framework, given that we have opted for CRRA utility functions for both the wealth and the health domains. The degree of risk aversion in the CRRA specification, in fact, is, by definition, invariant to the absolute scale of the values in the selected lotteries in finance (e.g. in euro, pounds, or dollars), or in health (e.g. days, weeks, or months).

Third, and crucially, the implicit rate of conversion was based on the evidence from a pilot experiment run with a sample of patients from the same hospital having similar characteristics to the respondents in our experiment. As discussed, prior to finalizing the design of the main fieldwork, we conducted a pilot experiment involving 32 subjects attending a sub-set of outpatient clinics at the Laiko Hospital. In addition to checking the comprehension and general validity of the questionnaire, the aim of the pilot was also to gather information about the description of their current health states by the respondents, using the Euroqol EQ-5D classification, and to obtain estimate of the approximate "rate of substitution" between money and days in full health by patients.

In the pilot, subjects were first asked to self-assess their own health on the usual 1-5 scale and to describe their current health states using the EQ-5D system, rating 5 distinct health-related dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression) using 3-values scales (no, moderate, or severe problems).

The EQ-5D has been extensively used in health economics as it allows to summarise each health state using a 5-digits index, e.g. 11121 for a person who does not have any problem (level 1) except a moderate pain or discomfort in the fourth dimension (level 2). It also allows attaching quality-of-life "tariffs" to each of the 243 possible scenarios as estimated from preferences over health states from representative samples of the general population (Kind and Dolan 1995).

Approximately half of the subjects in the pilot experiment were then given a questionnaire containing the experimental questions to elicit risk preferences in the finance domain first, followed by the questionnaire, and the tests for risk preferences in the health domain, while the order was reversed for the other half of the respondents. This manipulation allowed us to gather informal insights on the general comprehension of the paired-lotteries tests: when interacting with the research assistants, participants seemed to better understand the structure of the choice between healthcare treatments when they had previously answered analogous MPL tests with money. The final choice of presenting to all subjects the risky lotteries in finance before the ones in health was informed by this feedback from the pilot, as well as by the analogous design by Prosser and Wittenberg (2007).

Finally, subjects took part into a final questionnaire designed to elicit their "willingness-to-pay" for one day in full health. The test reproduced the ones proposed by Gyrd-Hansen (2003) and, in particular, the design by Pinto-Prades, Loomes and Brey (2009).

The results from the pilot experiment proved useful to gather insights to finalise the design of the main experiment. First, as expected for outpatients, most subjects described themselves as affected by health conditions characterized by only moderate pain or discomfort, anxiety or distress, in health states corresponding to the "very mild" ones (e.g. 21111, 12111, 11211, 11121, 11112) or the "relatively mild" ones (e.g. 12211, 12121, 11122, 22121, 22112, 21222, 11311).

The quality-of-life tariffs estimated from the Time Trade-Off (TTO) method associated to these health states vary in the range between 0.556 (state 11311) and 0.883 (state 11211), with 1 being, by definition, the value attached to full health and 0 to death. We computed an average quality-of-life tariff for patients in our pilot as the average of the tariffs in each EQ-5D state weighted by the relative number of respondents (out of the 32 interviewed) who describe themselves as affected by that state, which returned a value of 0.751.

In addition, the answers to the test designed by Pinto-Prades, Loomes and Brey (2009) to elicit the WTP for 4 months in full health indicated that virtually all subjects' maximum WTPs were included in the range between €25 and €50 a month, corresponding to a maximum expense of about €300-600 a year. The average WTP for the medicine B in the pilot sample was €42.4 a month, corresponding to an expenditure of €509 a year, roughly the amount of the basic monthly wage in Greece. As this maximum amount was traded by subjects in our pilot in exchange of 4 hypothetical months in full health, the monetary value attached to one day in full health was about €4.24. This figure seems in line with the evidence from Spain by Pinto-Prades, Loomes and Brey (2009) who experimentally elicited and estimated the mean WTP to avoid 3 days in a health status characterized by a moderate pain or discomfort (state 11121 in EQ-5D) in €12.5. Incidentally, it should be noticed, however, that both figures are less directly comparable with alternative estimates for other countries using different methods: the estimated monetary value for one quality-adjusted-life-year (QALY) typically span within a range between DKK88,000 (about €12,000) in Denmark ((54) eliciting WTP for a QALY) and US$24,777 (about €18,000) in the US ((56) using the human capital estimate method). These alternative estimates implicitly attach to one day in full health a monetary value ranging from about €33 to about €50.

The monetary value of about €4.24 attached to one day in full health thus served as reference figure to estimate the additional amount of money that gives a marginal utility to subjects in our sample equal to the marginal utility of receiving one additional day in full health, so to keep the "marginal rate of substitution" between the lotteries in the finance and health domain as close as possible to 1. In fact, the marginal utility attached by patients to the idea of receiving a hypothetical extra day in full health is the marginal benefit of moving from their actual health state to a state of full health for one day. If, consistently with the Cost Utility Analysis approach and the construction of the quality-adjusted-life-year (QALY) measure, the utility per day is measured in terms of quality-of-life, the marginal utility of an additional day in full health is the difference between the quality-of-life tariff in full health and the one for the current health state, that is 1-0.751=0.249. Therefore, the monetary value associated to such a marginal utility can be estimated at about 0.249*(€4.24) = €1.06, suggesting that an additional euro added to the individual "mental account" in the finance domain had approximately the same marginal utility of a hypothetical additional day in full health in the health domain. This finding provided a further argument supporting our choice to use payments in euro for the monetary lotteries corresponding to the number of days in full health in the health lotteries.

Finally, while the implicit marginal rate of substitution between money and one day in full health is based on the estimated average WTPs of subjects in the pilot experiment, the analysis allows to control for individual heterogeneity of the respondents to the main field experiment, since we have included direct questions assessing the baseline individual levels of the health status, as well as of the income and financial conditions.

This paper has been produced by the Health Management Group
at Imperial College Business School

Copyright © the authors 2013
All rights reserved

ISSN: 1744-6783

Imperial College Business School
Tanaka Building
South Kensington Campus
London SW7 2AZ
United Kingdom

T: +44 (0)20 7589 5111
F: +44 (0)20 7594 9184

www.imperial.ac.uk/business-school