Stated Risk Preference Predicts Risk Appetite in Structured Investment

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Abstract: Risk receptiveness statements are increasingly applied in experiments and surveys to control for individual risk attitudes, and the evidence regarding the predictive power of such statements for incentivized risk-taking is accumulating. We report the results of framed field experiments showing that stated risk preference (SRP) links with increased appetite for risk in the context of yearly investment in simple structured deposits. Our adapted SRP task intentionally detaches from the context of financial investment, asking the subjects to rank their willingness to take risk in personal and professional life. Still, the certainty equivalents of the risk-receptive subjects are higher and they exhibit stronger appetite for substantial gains and more optimistic weighting of tail losses compared to the risk-averse subjects. The usability of SRP measures in financial advising is discussed in light of discrepancies between the results of distinct SRP studies.

Keywords: Risk tolerance; Stated risk preference; Retail structured investment; Reaching for returns; Prospect theory.

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1. Introduction

Risk receptiveness statements are increasingly applied in surveys and experiments to conveniently collect a measure of personal attitude to risk. The evidence regarding the predictive power of such statements for life course or incentivized laboratory risk-taking is frequently encouraging, but mixed (Charness et al. 2020). This note contributes to the stated risk preference (henceforth, SRP) literature, showing that SRP links with the willingness to invest in yearly framed field structured deposits and the correlations reflect in the estimated Cumulative Prospect Theory (CPT) parameters. While preceding studies illustrate that SRP links with behaviors in contexts where subjects exhibit typical risk and loss aversion (e.g., Vieider et al. 2015), this note shows that SRP has predictive power for choices in a setting where subjects consistently deviate from common features of decision under uncertainty or risk (Sonsino et al. 2021). Stated preference for risk links with strong underweighting of tail losses and more convex gain-side utility. The certainty equivalents of the strong SRP subjects significantly surpass the expected returns on the deposits.

2. Brief literature review

The German Socio-Economic Panel (SOEP; see Schröder et al. 2020 for a recent survey) customarily asks respondents to rank their general readiness to take risk on a discrete 0 to 10 scale, where 0 represents "*not at all willing to take risk*" and 10 stands for "*very willing to take risk*". Dohmen et al. (2011) pioneered the stated risk preference research, showing that the SOEP measure correlates with the willingness to take risk in an incentivized laboratory task and also predicts self-reported willingness to engage in risky behaviors such as stock investment, smoking, and active sports.[i] Later studies that extend the experimental examinations showed that risk receptiveness statements correlate with incentivized behavior in some tasks but not in others. The evidence is sometimes contradictory. Crosetto and Filippin (2016), for example, report a significant 0.3 ($p<0.01$) correlation between the SOEP measure and the Eckel and Grossman (2002; henceforth EG) risk preference measure. The same correlation however takes values 0.007 and 0.095 in two waves of the UKHLS survey analyzed by Galizzi et al. (2016). Charness et al. (2020) report that the SOEP links with the willingness to take risk in stylized incentivized laboratory scenarios, but it does not correlate with subjects' assessments of their willingness to take risk in diverse domains. Null results for laboratory risk-taking, however, are reported again in He (2018) where SOEP fails to correlate with risk-taking in the Bomb Risk Elicitation Task (BRET). He et al. (2018) interestingly show that ambiguity aversion explains a switch from risk preference in a stylized experimental task to risk neutrality or risk aversion in a SRP task. If ambiguity attitudes affect the response to SRP items, it is plausible to expect that such statements would show stronger predictive power for decisions under uncertainty compared to decisions under risk. Some representative surveys indeed find that SOEP-like risk tolerance measures link with life course uncertain choices, including selection into self-employment (Caliendo et al. 2014), portfolio risk-taking (Barasinska et al. 2012), and enrollment to higher education (Fossen and Glocker 2017). Gürdal et al. (2017) find that

SOEP shows stronger predictive power for the pension decisions of Turkish investors compared to several alternative risk preference measures, including an incentivized BRET.

Closer to the topic of the current note, two recent studies particularly explore the links between stated risk preference and incentivized lottery evaluations. Vieider et al. (2015) elicit certainty equivalents of 44 lotteries from almost 3000 subjects from 30 countries. The elicited certainty equivalents significantly correlate with the SOEP risk measure in most of the countries and between the 30 countries. The full sample correlations are about 0.2 for lotteries over gains compared to 0.1 for lotteries over losses (mixed lotteries are not included). The conjecture that the SOEP correlations are stronger for uncertain lotteries compared to risky lotteries is not supported by the results. Jaspersen et al. (2020) use the Tanaka et al. (2010) methodology to estimate the CPT preferences of 1730 subjects and explore the correlations between the SOEP measure and the estimated CPT parameters. SOEP significantly correlates with the loss aversion parameter and also correlates with the power of the loss-side utility function. The correlations with the other CPT estimates are insignificant. These two studies are discussed again, connecting to our current results, in Section 4. Section 3 briefly outlines the structured investment experiments that are analyzed in this note.

3. The structured investments experiments

The willingness to invest in retail-oriented structured deposits was examined in two framed field experiments where subjects with background in finance made investment choices for the twelve months following the experiment. A random lottery bonus was paid at the end of the twelve-month investment period.

The first experiment consisted of two main stages. At the first stage, the exchangeability method was used to elicit median (P50) and quartile (P25 and P75) forecasts for the performance of the FTSE index over the twelve-month investment period. At the second stage, the individual forecasts were substituted into twenty prototype deposits. A 100% capital protection deposit that pays 9% annual return if FTSE exceeds the P50 of the subject, was presented as paying 9% or 0% depending on whether FTSE increases by more than 10% when P50=10%. The certainty equivalents (henceforth: CEs) of twenty deposits were elicited in short sequences of binary choice problems, using a bisection algorithm. Subjects' preferences over the deposits were characterized in direct comparisons; e.g., attitude to gain-domain risk was tested by comparing the CEs of riskier (9% or 0%) and safer (6% or 3%) deposits and loss aversion was tested by comparing the response to (9% or -8%) and (1% or 0%) return combinations. CPT was estimated to summarize the data and gain more insight into subjects' preferences over the deposits.

The second experiment was almost identical to the first, except for switching from uncertain to risky deposits. The (9% or 0%) deposit of the preceding paragraph, for example, was presents as paying 9% or 0% with 0.5 probability. The instructions still used uncertain deposits to introduce the concept of retail structured investment, but explained

that for simplicity the experiment's yearly deposits will be presented in terms of probability distributions and the realized return will be drawn at the end of the investment period to determine the individual bonuses.

The results of both experiments reveal that the subjects strongly deviate from standard features of decision under uncertainty or risk, showing increased risk appetite in the context of retail structured investment. The direct comparisons and the CPT estimations show that the increased risk appetite manifests in two main channels: (a) An appetite for substantial gains, when the expected return is low; e.g., the CEs of a (9%,7%,0%,0%) deposit significantly surpass the CEs of a (6%,4%,3%,3%) deposit.[ii] (b) An underweighting of the tail loss event, where FTSE falls below the P25 forecast (or the respective 0.25 loss probability in experiment 2).

The results of the two experiments are discussed in detail in Sonsino et al. (2021). The next section of this note uses the symbol DEV for the proportional deviation of the elicited CE from the expected return (ER); i.e., DEV=100*(CE-ER)/ER. As the equality of the DEV-related statistics and the estimated CPT parameters across the two experiments could not be rejected, the next section pools the data, exploring the SRP correlations with the willingness to invest in the deposits across a sample of 134 subjects (N=73 in experiment 1 and N=61 in experiment 2). As in the 2021 paper, we draw a distinction between Gain-Only deposits that fully protect the investment capital and Gain-Loss deposits that mix gains and losses. Table 1 introduces the main variables and presents the median value of each variable.

Table 1: Variable definitions

Variable	**Definition**	**Median** (N=134)
DEV_{all}	Average DEV= $\frac{100*(CE-ER)}{ER}$ for all 20 deposits	-7.1%
DEV_G	Average DEV for the 9 Gain-Only deposits	+0.4%
DEV_L	Average DEV for the 11 Gain-Loss deposits	-9.7%
RFG (Reaching for gains)	Average $(\frac{CE(9,0)}{CE(6,3)}, \frac{CE(9,7,0,0)}{CE(6,4,3,3)})$	1.2^{***}
ρ_G	Estimated ρ_G, assuming $u(x) = x^{\rho_G}$ for $x>0$	1.1^{***}
λ	Prospect theory's loss aversion coefficient	1.9^{***}
$W^+(0.25)$	The decision weight of 0.25 tail gain	0.29^{***}
$W^-(0.25)$	The decision weight of 0.25 tail loss	0.20^{***}
POP (Probabilistic optimism)	$W^+(0.25)/W^-(0.25)$	1.31^{***}

Note: The asterisks in the right column represent the results of a sign-test of the hypothesis "*variable*=K", with K=1 for RFG, ρ_G, and POP, and K=0.25 for $W^+(0.25)$ and $W^-(0.25)$. The hypotheses $DEV_j=0$ could not be rejected for DEV_{all}, DEV_G and DEV_L. We use *** for p<0.01, ** for p<0.05, and * for p<0.1, where p denotes two-tailed significance.

4. The SRP correlations

The SRP question was presented to the subjects in the post experiment pen and pencil questionnaire. We choose to explicitly detach from the financial context of the experiments by using the following phrasing:

"*Rank your willingness to take risk in personal and professional life, not necessarily in portfolio investment, in 1-10 scale.*"

While the literature suggests that domain-specific SRP measures exhibit stronger correlation with the willingness to take risk in the respective domains compared to the general SRP (Dohmen et al. 2011; Galizzi et al. 2016), we preferred to disconnect from the investment context to prevent an anchoring of the SRP to the choices between the deposits and the risk-free rates in the computerized part of the experiments. If we used a finance-related SRP, asking subjects to rank their willingness to take risk in financial matters, the correlations between the stated risk preference and the DEV-related statistics or the estimated CPT parameters could have increased, but then we would not be able to rule out the possibility that the correlations are a *carry-over* artefact of the design (Charness et al. 2012).

The results of the SRP reveal that the sample can be equally divided to groups of *risk-averse* (SRP≤5) and *risk-receptive* (SRP≥6) subjects. The mean and median SRP were 5.5 with standard deviation 1.9. Table 2 reports the results of a median split, comparing the certainty equivalents and the estimated CPT parameters of the risk-averse and the risk-receptive subjects.

Table 2: Median split by SRP

	SRP ≤ 5 (N=67)	**SRP ≥ 6** (N=67)	**Sign-test**
DEV_{all}	-19.9%	+9.7%	p=0.02
DEV_G	-6.7%	+5.7%	p=0.11
DEV_L	-29.8%	+9.3%	p<0.02
RFG	+114%	+123%	p<0.01
ρ_G	1.08	1.19	p<0.05
λ	1.71	2.16	p=0.34
$W^+(0.25)$	0.28	0.29	p=0.12
$W^-(0.25)$	0.23	0.17	p<0.01
POP	109%	149%	p<0.01

Note: SRP represents the 1-10 stated risk preference. All other definitions are as in Table 1. The table presents the median for each group.

The upmost row of the table compares the DEV_{all} of the subjects in the two groups. The median is -19.9% for the risk-averse compared to +9.7% for the risk-receptive, and equality is rejected at p=0.02 in a Pitman test. The next two rows show that the risk-receptive

subjects exhibit stronger willingness to invest in Gain-Only and Gain-Loss deposits. The median-split difference, however, is only one-tail significant for the Gain-Only deposits ($p=0.11$), while showing significance at $p<0.02$ for the Gain-Loss deposits. The risk-receptive subjects also display stronger appetite for substantial gains (see the RFG row of the table). While CE(9%,0%)≥CE(6%,3%) for 84% of the risk-receptive subjects, the inequality holds for only 63% of the risk-averse subjects. The hypothesis CE(9%,0%)=CE(6%,3%) is sign-test rejected at $p<0.01$ for the risk-receptive, but it cannot be rejected for the risk-averse ($p=0.78$).

The lower panel of the table in addition shows that the SRP link with increased appetite for risk also reflects in some of the estimated CPT parameters. The estimated power utility function is significantly more convex and the underweighting of tail 0.25 losses is significantly stronger for the risk-receptive subjects. The difference in weighting of 0.25 tail gains is at the same direction, with the risk-receptive subjects exhibiting more optimistic weighting, but equality cannot be rejected ($p=0.12$). The median W+(0.25)/W-(0.25) ratios exceed one in both samples, but the hypothesis W+(0.25)/W-(0.25) >1 is rejected for the risk-receptive ($p<0.01$) but cannot be rejected for the risk-averse ($p=0.14$).

Web supplement A more closely illustrates that the SRP link with the certainty equivalents of the deposits shows for the N=84 males and the N=50 females, and manifests in experiments 1 and 2 separately. As commonly observed (Croson and Gneezy, 2009), the males in our sample exhibit stronger risk receptiveness compared to the females (median SRPs 6 and 4.5; $p<0.01$).[iii] Direct comparisons reveal that some of the SRP correlations with the structure investment variables are weaker for the females (see the DEV_{all} results in Table 3), but other examinations point to weaker results for the males (see the RFG results in the table). Since the results of direct comparisons (and background estimations) are mixed and the sample of females is 40% smaller than the sample of males, we refrain from discussing gender differences more closely. A similar comment applies to comparing the results with risky and uncertain deposits. Web supplement A illustrates that some of the SRP correlations are stronger in experiment 1, but other are stronger in experiment 2.

Table 3: Selected results for males and females [iv]

	Males (N=84)			**Females** (N=50)		
	SRP < 7 (N=49)	**SRP ≥ 7** (N=35)	**Pitman-test**	**SRP < 6** (N=33)	**SRP ≥ 6** (N=17)	**Pitman-test**
DEV_{all}	-20.2%	14.0%	p=0.002	-11.9%	11.9%	p=0.15
RFG	106%	123%	p=0.12	120%	155%	p=0.004

Note: The SRP≥7 (SRP≥6) cutoff levels produce the most significant differences for males (females).

Table 4: Regressions (N=134)

	(a)	(b)	(c)	(d)	(e)
Dependent Variable	DEV_{all}	DEV_{all}	$1_{DEV\geq 0}$	DEV_G	DEV_L
Intercept	-11.9** (5.5)	25.0 (29.0)	-0.48** (0.22)	-4.7 (3.2)	-17.8** (7.7)
$1_{SRP\geq 7}$	27.9** (9.4)	25.3** (10.3)	0.89** (0.37)	13.6** (5.6)	39.6*** (13.3)
Conscientiousness		-35.4 (27.2)			
Openness		11.5 (22.9)			
Neuroticism		-11.0 (24.0)			
Extraversion		10.1 (23.2)			
Agreeableness		-28.5 (25.2)			
R^2	0.06	0.09	-	0.04	0.06

Note: The table presents the estimated parameters with the standard deviations in parentheses. The asterisks follow the convention of Table 1. For model (b), the personality traits were standardized to 0-1 scale.

Table 4 presents the results of estimations using the indicator $1_{SRP\geq 7}$ to separate the N=45 (34%) most risk-receptive subjects from others. Model (a) shows that strong SRP increases the DEV_{all} by approximately 27.9%, from -11.9% to about 16% (a similar difference obviously shows in direct comparisons). In model (b), the strong SRP indicator is the only variable showing significance in regressions that control for the big five personality traits. $1_{SRP\geq 7}$ similarly emerges as the only significant effect in estimations controlling for other personal characteristics such as familiarity with the financial markets or academic background. The strong SRP indicator is also statistically significant in logistic regressions on an indicator for $DEV_{all}>0$ (model (c)). Indeed, the proportion of positive DEV_{all} is 38% for the subjects with SRP<7 compared to 60% for the subjects with SRP≥7. Models (d) and (e) illustrate again that the SRP link with more positive deviations of the certainty equivalents from the expected returns is stronger for Gain-Loss deposits compared to Gain-Only deposits. The estimated $1_{SRP\geq 7}$ coefficient is 13.6 (p=0.016) in the regressions on DEV_G, but almost three times larger 39.6 (p=0.004) in the regressions on DEV_L. Web supplements B and C present the results of alternative estimations, showing robustness.

The predictive power of the SOEP general risk preference measure for the willingness to invest in risky or uncertain lotteries was explored in the international study of Vieider et al. (2015; henceforth VDR2015) and the mixed on-line and in-person study of Jaspersen et al. (2020; henceforth JAS2020). Detailed comparison of the current results with these studies is pointless because of the differences in SRP measures, the context within which the lotteries or deposits are presented, and the sample size and characteristics. Still, it is interesting to point at a few qualitative differences between the results. VDR2015 elicit the

certainty equivalents of 44 lotteries that differ in domain (gain-only or loss-only) and source of uncertainty (risky lotteries with known probabilities or uncertain lotteries with unknown probabilities). The full sample (N=2879) correlations between the SOEP and the certainty equivalents of the lotteries are larger for gains compared to losses (0.201 for risky gains and 0.206 for uncertain gains, compared to 0.097 for risky losses and 0.099 for uncertain losses).[v] VDR2015 do not study mixed Gain-Loss lotteries, but it is intriguing to note that their evidence suggests that SOEP has stronger predictive power for Gain-Only lotteries compared to Loss-Only lotteries, while we find three-fold stronger SRP effects for mixed Gain-Loss lotteries compared to Gain-Only lotteries (Table 4). JAS2020 use an expanded version of the Tanaka et al. (2010) methodology to concisely characterize the CPT preferences of N=1700 subjects from a few multiple-choice tables. Their analysis shows that SOEP significantly correlates with CPT's loss aversion and with the curvature of the loss side utility function, but it does not correlate with the gain-side curvature or the probability weighting parameters. The JAS2020 results thus qualitatively differ from those of the current study, where the SRP significantly links with the curvature of the gain-side utility function and the weighting of loss-side probabilities. The JAS2020 results also apparently diverge from VDR2015 where the SOEP shows more predictive power for gain-domain lotteries compared to loss-domain lotteries. The discrepancies in results raise a concern regarding the meaningfulness of single-item stated risk preference measures. We discuss this issue further in the concluding section.

5. Concluding discussion

Risk research has converged to the view that individual risk preferences have a common component that extends across contexts, but domain-specificity may tilt behavior away from the overall disposition in applications (Einav et al. 2012; Highhouse et al. 2017). The SRP approach for the measurement of personal risk attitudes has been recently acclaimed in studies using psychology research methodologies. Frey et al. (2017) show that stated (propensity) risk preferences have stronger convergent validity compared to behavioral measures, arguing that statements capture the common risk preference component R better than behavioral measures. Frey et al. (2020) relatedly illustrate that risk preference statements capture the effects of gender, age, and other covariates, more effectively than behavioral measures. Steiner et al. (2019) and Arslan et al. (2020) report the results of process tracing studies exploring the cognitive roots underlying risk preference statements. The results propose that subjects integrate their personal risk-taking experiences in domains such as finance, relationships, careers, and personal safety, when forming their response to SOEP. Arslan et al. (2020) ironically conclude that the behavioral approach to estimating risk preferences appears to have found new foundations in research on stated risk preferences.

In terms of operationalization, a main advantage of SRP is that direct risk preference statements are not contaminated by demands on mental or numerical abilities (Millroth et al. 2020). Compared to incentivized risk preference tasks, SRP items do not consume the

cognitive resources of the experiment or survey participants that are spared for the main assignments. In experimental studies, the use of SRP to control for individual risk attitudes simplifies the procedure and saves on incentivization costs (Dohmen et al. 2011). Opponents of the stated risk preference approach still claim that inconsequential *cheap talk* SRP tasks cannot produce meaningful indicators for field behavior (cf., Deck et al. 2013). Charness et al. (2013) argue that researchers should be aware of the tradeoff between the convenience of using stated risk preference tasks and the possibility of gratuitously-expressed preference for risk.

While SRP controls may prove useful in laboratory experiments and surveys, single-item risk receptiveness statements are clearly too crude for use in financial advising and individual fitting of investment portfolios. Multi-item financial risk attitude questionnaires are routinely used by asset management firms to improve advisement and meet the *suitability* requirement of regulatory agencies (Kuzniak et al. 2015; Bachmann et al. 2018). However, the reliability of these questionnaires is repeatedly challenged (Roszkowski et al. 2005; Bachmann et al. 2018; Klement 2018). More encouraging results for financial risk preference statements emerge in studies using factor or principal component analysis to extract risk-tolerance indices from the surveys. Kapteyn and Teppa (2011), for example, show that two factors extracted from six SRP items show stronger predictive power for the portfolio risk-taking of Dutch DHS survey participants, compared to more direct risk preference measures (see also Alserda et al. 2019). Returning to the results of the current experiments, our positive findings for a single-item SRP that explicitly detaches from financial investment *a fortiori* suggest that by extracting risk attitude indices from multi-item questionnaires, risk research may develop profiling methods that would show more consistent results across studies and exhibit power in industry applications.

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[i] Dohmen et al. (2011) also examine domain-specific risk preference statements, showing that the SOEP-F item, asking subjects to rank their readiness to take risk in financial matters, shows stronger predictive power for investment in stocks than the general SOEP, but the domain-free SOEP shows the strongest all-rounds predictive power for risk-taking in distinct domains.

[ii] Quadruples (r1,r2,r3,r4) represent a deposit that pays the four r_j returns with 0.25 probability; (r1,r2) abbreviates (r1,r1,r2,r2). CE(r1,r2,r3,r4) and CE(r1,r2) represent the respective certainty equivalents.

[iii] SRP correlates with the openness trait (Pearson correlation ρ=0.39) and stated 1-7 familiarity with the market (ρ=0.38), but the openness and familiarity correlations with DEV_{all} are negligible 0.09 and -0.02.

[iv] The equality of the males' and females' DEV_{all} cannot be rejected (p=0.55), but the DEV_{all} of N=7 females at SRP=6 is positive +22.2% compared to negative -22.4% for the N=15 males at SRP=6.

[v] The mean within country correlations exhibit a similar pattern (0.179 for risky gains; 0.164 for uncertain gains; 0.089 for risky losses; 0.074 for uncertain losses) but the between-country correlations are slightly stronger for losses (see Table II in the paper). Similar results emerge for a SOEP-F item, asking subjects to rank their willingness to take risk in financial matters. Jaspersen et al. (2020) only examine the general SOEP.