Risk Receptiveness Statements Correlate with an Appetite for Risk in Structured Investment

Doron Sonsino, Yaron Lahav, Yefim Roth

Abstract: Direct risk receptiveness statements are increasingly applied in experiments and surveys, but the evidence regarding the predictive power of such measures for incentivized risk-taking is mixed. We report the results of experiments showing that stated risk receptiveness links with increased appetite for risk in the valuation of structured deposits. The certainty equivalents of the risk-receptive subjects are higher and they exhibit more optimistic weighting of tail losses.

Keywords: Stated risk receptiveness; Retail structured investment; Reaching for returns; Prospect theory

JEL classifications: C90, G11, G40

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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 incentivized risk-taking behavior is generally encouraging, but mixed (Dohmen et al., 2011; Vieider et al., 2015; Crosetto and Filippin, 2016; He, 2018; 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.

2. 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, 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, 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 surpass

the CEs of a (6%,4%,3%,3%) deposit.[1] (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. (2020). The next section of this note uses the symbol DEV for the deviation of the elicited CE from the expected return (ER); i.e., DEV=100*(CE-ER)/ER. As the equality of the DEV 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 2020 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 I presents the main variables and reports the results for the complete sample.

Table I: 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[***]
$W^+(0.25)$	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.

3. The SRP correlations

The SRP question was presented to the subjects in the post experiment questionnaire. We choose to explicitly detach from the financial context of the experiment 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.*"

The median SRP was 5.5 (with standard deviation 1.9), so the sample can be equally split by separating the relatively risk-receptive subjects (SRP≥6) from the relatively risk-averse

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[1] 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.

(SRP<6). Table II reports the results of the median split, comparing the certainty equivalents and the estimated CPT parameters of the risk-receptive and the risk-averse.

Table II: Median split by SRP

	SRP < 6 (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: 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 deposits and in Gain-Loss deposits. The 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 (see Jaspersen et al., 2020 for related, but rather different, findings).[2] The risk-receptive subjects also display stronger appetite for substantial gains (see the RFG row of the table); e.g., the median CE(9%,7%,0%,0%) is 4.5% compared to median CE(6%,4%,3%,3%) of 3.75% and equality is rejected at p<0.01. The lower panel of the table, moreover, 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).

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[2] Jaspersen et al. (2020) explore the correlations between SRP and CPT preferences in a neutral context. Their SRP correlates with the curvature of the loss utility function and loss aversion, but does not correlate with the curvature of the gain utility function and probability weighting. The losses on our retail structured deposits did not exceed 10% and the estimations assumed linear loss utility.

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, the males in our sample exhibit stronger risk receptiveness compared to the females (median SRPs 6 and 4.5; p<0.01).[3] 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 III), 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.

Table III: Selected results for males and females [4]

	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 IV reports the results of estimations using the indicator $1_{SRP≥7}$ 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% (as observed 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. $1_{SRP≥7}$ 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 $1_{SRP≥7}$ 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.

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

[4] 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.

Table IV: Regressions on DEV (N=134)

	(a)	(b)	(c)	(d)	(e)
Dependent Variable	DEV	DEV	$1_{DEV \geq 0}$	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 personality traits are standardized to 0-1 scale. The parentheses present the standard deviations and the asterisks follow the convention of Table I.

4. Discussion

A main advantage of SRP measures over incentivized risk preference tasks is that SRP does not consume the cognitive resources of the subject, that are spared for the main assignments (Millroth et al., 2020). Another virtue is the low costs compared to incentivized elicitations. While preceding studies illustrate that SRP links with behaviors in contexts where subjects exhibit typical risk and loss aversion, this note shows that SRP has predictive power for choices in a setting where subjects deviate from common features of decision under uncertainty or risk. SRP links with stronger 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.

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