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The Value of Financial Knowledge

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Research Questions

SUBJECTIVE VALUE OF FK: WILLINGNESS TO PAY

- What determines demand for financial education?
- Who is willing to pay (more) for financial education?

OBJECTIVE VALUE OF FK: EFFECTIVENESS

- Do individuals improve their financial decision-making when they acquire financial education?
- Who benefits most from financial education?

Experimental Setup

- Survey experiment with Asking Canadians in Fall 2021
- 2,005 subjects aged 25 to 80
- Rewards: Participation fee & Return from Allocation Task 2 with a 30\$ endowment



Survey Questions



1. Portfolio Allocation



Self-Assessment



Willingness to Pay



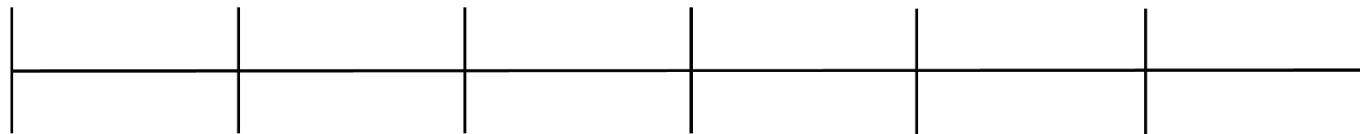
Educational Treatment



2. Portfolio Allocation



Payoff



1. Endowment

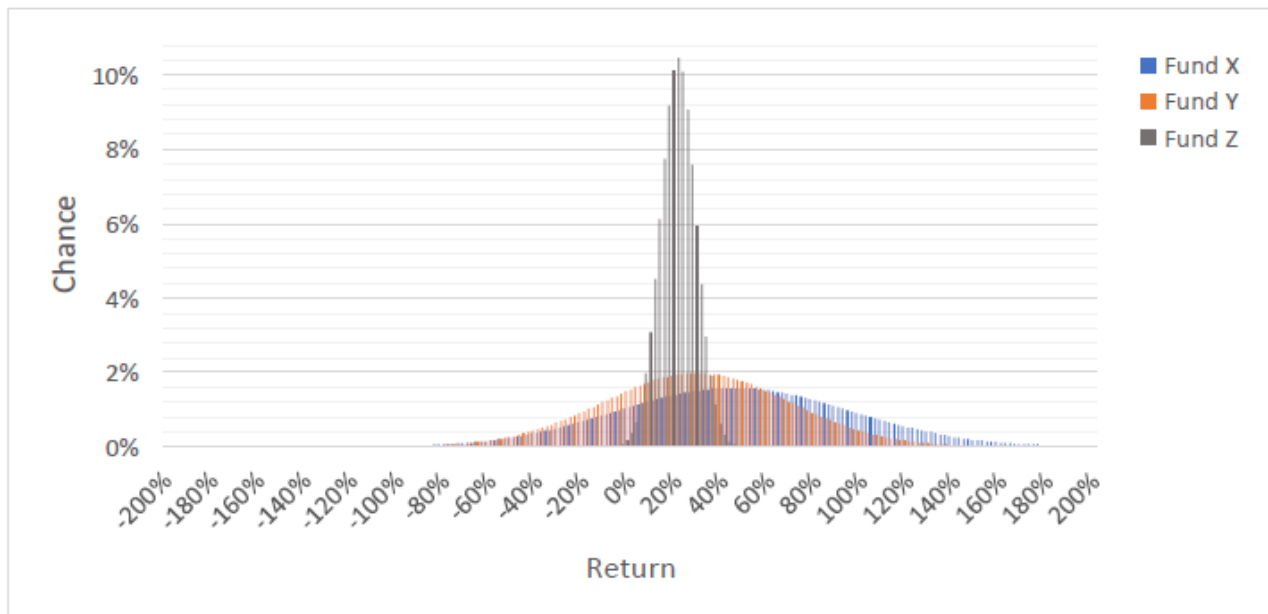
2. Endowment



Retirement and Savings Institute

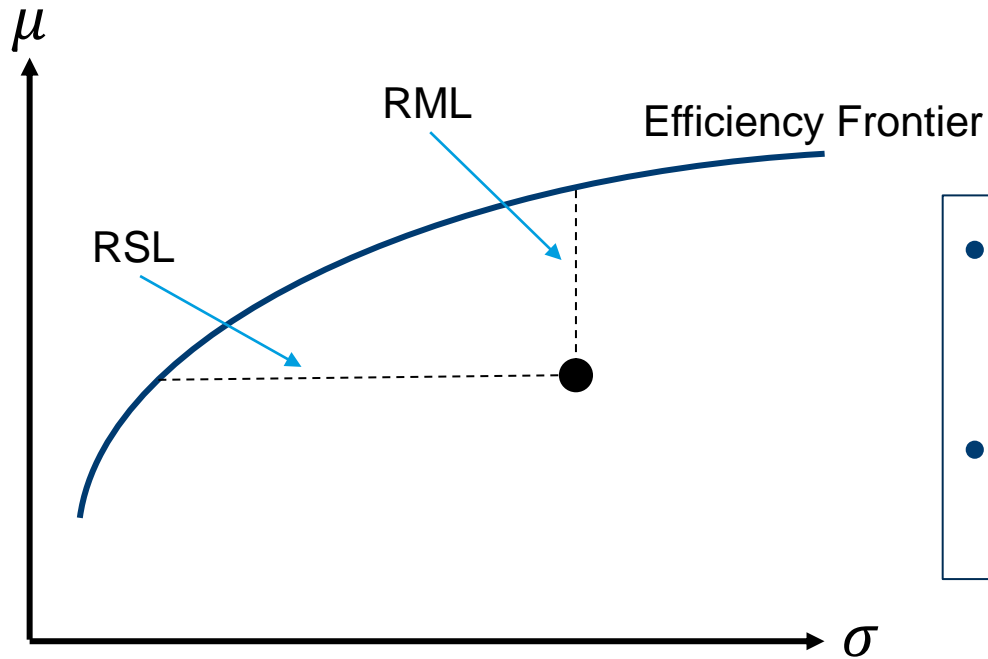
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Portfolio Allocation Task 1



Funds	Expected 5-year Return (%)	5-year Variability (%)
Fund X	44.4	50.2
Fund Y	27.5	40.3
Fund Z	18.9	7.6

Task 1: Efficiency Measures



- $RML_i = 1 - \frac{S_i}{S_{\mu,i}^*} = 1 - \frac{\mu_i}{\mu_i^*}$

- $RSL_i = 1 - \frac{S_i}{S_{\sigma,i}^*} = 1 - \frac{\sigma_i}{\sigma_i^*}$



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Task 1: Determinants of Performance



	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mean ₁	Standard Deviation ₁	Sharpe Ratio ₁	RML ₁	RSL ₁	1/K ₁	Return Chasing ₁
Female	0.002 (0.311)	0.332 (0.552)	0.014 (0.020)	0.359 (0.284)	0.286 (0.558)	-0.022 (0.020)	0.026 (0.015)
College or some university	-0.218 (0.462)	0.023 (0.821)	0.002 (0.029)	0.530 (0.423)	0.979 (0.830)	-0.059* (0.028)	-0.005 (0.022)
Bachelor degree or more	-0.781 (0.463)	-0.575 (0.822)	0.039 (0.029)	1.097** (0.423)	1.631* (0.830)	-0.034 (0.028)	0.004 (0.022)
Financial Literacy Score	0.006 (0.217)	0.163 (0.385)	0.001 (0.014)	0.229 (0.198)	0.484 (0.389)	-0.065*** (0.012)	-0.001 (0.010)
Cognitive Ability Score	-0.570*** (0.171)	-0.909** (0.303)	0.042*** (0.011)	0.136 (0.156)	0.102 (0.307)	-0.006 (0.011)	-0.001 (0.008)
Numeracy Score	-0.324 (0.201)	-0.606 (0.357)	0.027* (0.013)	0.046 (0.184)	-0.074 (0.361)	-0.021 (0.014)	-0.000 (0.010)
Financial knowledge: high	0.684 (0.523)	1.334 (0.928)	-0.003 (0.033)	0.010 (0.478)	-0.564 (0.938)	-0.053 (0.037)	0.053* (0.023)
Financial knowledge: very high	0.525 (0.837)	1.041 (1.487)	-0.047 (0.053)	0.098 (0.766)	0.210 (1.503)	-0.023 (0.056)	0.004 (0.041)
Has traded stocks	0.712* (0.346)	1.243* (0.615)	-0.010 (0.022)	-0.161 (0.317)	-0.559 (0.621)	-0.052* (0.023)	0.045** (0.016)
_cons	34.083*** (1.172)	27.873*** (2.081)	1.299*** (0.074)	0.203 (1.071)	0.935 (2.102)		
Mean	31.679	26.056	1.374	3.883	7.628	0.244	0.108
N	1993	1993	1993	1993	1993	1993	1993
r2	0.055	0.045	0.054	0.029	0.024		
chi2						177.675	54.232

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Willingness to Pay for Education



- Real trade-off between paying for education or spending money on Allocation Task 2
- **24.5% of participants do not want an educational intervention, even if it is provided at no cost**
- The average reported willingness to pay is \$2.90 (~10% of the endowment)
- 43.1% received the “treatment”

	(1)	(2)
	Reject treatment	Willingness to pay (≥ 0)
Ability to apply treatment: yes	-0.067** (0.025)	0.399*** (0.111)
Ability to apply treatment: dk	0.005 (0.026)	0.091 (0.149)
Exp. higher return in task 2: yes	-0.129*** (0.026)	0.338** (0.119)
Exp. higher return in task 2: dk	0.017 (0.025)	0.056 (0.142)
Female	-0.029 (0.020)	0.073 (0.094)
College or some university	0.042 (0.030)	-0.112 (0.142)
Bachelor degree or more	0.059 (0.030)	-0.221 (0.141)
ln(Household income)	0.020** (0.006)	-0.017 (0.021)
Financial Literacy Score	-0.045*** (0.013)	-0.029 (0.073)
Cognitive Ability Score	0.017 (0.011)	0.046 (0.051)
Numeracy Score	-0.055*** (0.015)	-0.066 (0.058)
Financial knowledge: high	0.010 (0.037)	-0.499** (0.154)
Financial knowledge: very high	0.038 (0.051)	-0.519* (0.247)
_cons		3.112 (4.379)
Mean	0.245	2.909
N	1592	1202
chi2	426.906	
r2		0.080

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The Educational Treatment



The value of diversification

- Verbal and graphical illustration of hypothetical 3-fund allocation task, where funds have same expected return and standard deviation
- Portfolio's standard deviation decreases when endowment is spread equally across all funds (relative to investing everything in a single fund) while expected return is unchanged

The value of high risk adjusted portfolio returns

- Illustration and example of a 3-fund allocation task
- Treatment suggests first to build a portfolio by using 1/K, and then shows how to increase the expected return while keeping standard deviation unchanged:
 - Calculate risk-adjusted returns of each fund: $\frac{\text{Expected Return}}{\text{Standard Deviation}}$
 - Allocate more money to funds with higher risk-adjusted returns.

Task 2: Efficiency & Welfare Measures



- Change in efficiency

$$\begin{aligned}\Delta E_i &= \mathbb{I}(\Delta RML_i < 0)\mathbb{I}(\Delta RSL_i = 0) \\ &+ \mathbb{I}(\Delta RML_i = 0)\mathbb{I}(\Delta RSL_i < 0) \\ &+ \mathbb{I}(\Delta RML_i < 0)\mathbb{I}(\Delta RSL_i < 0)\end{aligned}$$

- Preference independent change in welfare:

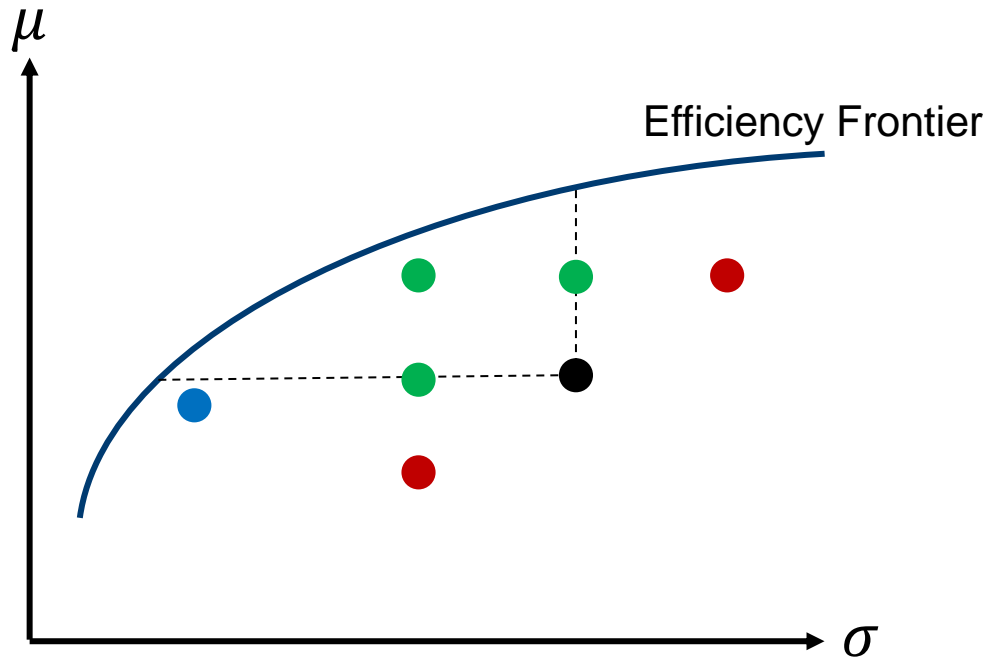
$$\begin{aligned}\Delta W_i &= \mathbb{I}(\Delta \mu_i > 0)\mathbb{I}(\Delta \sigma_i = 0) \\ &+ \mathbb{I}(\Delta \mu_i = 0)\mathbb{I}(\Delta \sigma_i < 0) \\ &+ \mathbb{I}(\Delta \mu_i > 0)\mathbb{I}(\Delta \sigma_i < 0)\end{aligned}$$



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Task 2: Efficiency & Welfare Measures



- First Allocation
- No Improvement
- Efficiency Improvement
- Efficiency & Welfare Improvement



Task 2: Treatment Effect on Portfolio Allocation



	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Δ Sharpe Ratio	Δ RML	Δ RSL	Δ 1/K	Δ Return chasing	Δ Efficiency	Δ Welfare
Received treatment	-0.007 (0.021)	-0.842 (0.456)	-1.101 (0.910)	0.496*** (0.059)	0.271* (0.115)	0.196*** (0.032)	0.029* (0.014)
_cons	-0.021 (0.060)	-0.209 (1.294)	-0.894 (2.581)				
Controls	X	X	X	X	X	X	X
Mean	0.039	-0.410	-0.517	0.489	0.473	0.342	0.035
N	1592	1592	1592	395	163	1592	1592
r2	0.027	0.024	0.019				
chi2				213.890	68.560	168.536	55.810

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Summary of Results / Conclusion

WILLINGNESS TO PAY

- **One quarter** of participants **does not want to receive** the educational **treatment**, even if it was free of charge
- The average reported **willingness to pay** is **~10%** of the endowment
- **WTP is driven by expectations** about ability to transform financial information from intervention into a higher return
- Higher **revealed sophistication** (e.g., financial literacy) **increases the willingness** to receive the educational treatment
- Higher **self-reported financial knowledge** **decreases** the willingness to pay for it

EFFECTIVENESS

- **Treatment increases heterogeneity** in portfolio allocations
- Standard performance measures can miss the treatment effect of financial education on portfolio decisions → **We develop two novel measures** of 1) Pareto improvement of portfolio efficiency 2) preference-independent welfare improvement
- **Treatment increases likelihood** to achieve these types **of performance improvement** by almost 20 and 3 p.p., respectively



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Backup

Task 1: Descriptive Statistics

Table 2: Performance in Allocation Task 1

	N	mean	sd	min	median	max
Mean ₁		31.679	6.498	18.9	30.264	44.4
Standard Deviation ₁		26.056	11.480	7.410	21.605	50.2
Sharpe Ratio ₁		1.374	0.412	0.682	1.401	2.704
RML ₁		3.883	5.861	0	1.375	33.086
RSL ₁		7.628	11.473	0	3.365	59.852
One over K ₁		0.244	0.430	0	0	1
Return Chasing ₁		0.108	0.310	0	0	1
N	1993					

WTP: Determinants

	(1)	(2)	(3)
	Reject treatment	Willingness to pay (≥ 0)	Willingness to pay
Ability to apply treatment: yes	-0.067** (0.025)	0.399*** (0.111)	0.508*** (0.110)
Ability to apply treatment: dk	0.045 (0.026)	0.091 (0.149)	-0.083 (0.133)
Exp. higher return in task 2: yes	-0.129*** (0.026)	0.338** (0.119)	0.588*** (0.117)
Exp. higher return in task 2: dk	0.017 (0.025)	0.056 (0.142)	-0.072 (0.129)
Female	-0.029 (0.020)	0.073 (0.094)	0.138 (0.091)
College or some university	0.042 (0.030)	-0.112 (0.142)	-0.187 (0.135)
Bachelor degree or more	0.059 (0.030)	-0.221 (0.141)	-0.307* (0.135)
ln(Household income)	0.020** (0.006)	-0.017 (0.021)	-0.060** (0.022)
Household income missing	0.128*** (0.022)	-0.154 (0.140)	-0.573*** (0.117)
Financial wealth	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Financial Literacy Score	-0.045*** (0.013)	-0.029 (0.073)	0.150* (0.063)
Cognitive Ability Score	0.017 (0.011)	0.046 (0.051)	0.012 (0.050)
Numeracy Score	-0.055*** (0.015)	0.066 (0.058)	0.061 (0.059)
Financial knowledge: high	0.010 (0.037)	-0.499** (0.154)	-0.446** (0.153)
Financial knowledge: very high	0.038 (0.051)	-0.519* (0.247)	-0.482* (0.236)
St. market knowledge: high	-0.000 (0.046)	-0.109 (0.194)	-0.107 (0.192)
St. market knowledge: very high	0.054 (0.071)	-0.141 (0.354)	-0.250 (0.336)
Has traded stocks	-0.047* (0.024)	0.008 (0.100)	0.141 (0.100)
Has studied economics	0.016 (0.022)	0.149 (0.099)	0.090 (0.096)
Mean ₁	-0.069 (0.045)	-0.001 (0.180)	0.114 (0.180)
Standard Deviation ₁	0.035 (0.022)	-0.002 (0.090)	-0.055 (0.089)
Sharpe Ratio ₁	-0.067 (0.150)	-0.151 (0.619)	0.066 (0.611)
RML ₁	-0.037 (0.021)	0.040 (0.084)	-0.024 (0.086)
RSL ₁	0.005 (0.005)	0.004 (0.020)	-0.004 (0.020)
One over K ₁	0.083** (0.030)	-0.165 (0.144)	-0.392** (0.136)
Return Chasing ₁	0.102 (0.081)	-0.105 (0.350)	-0.434 (0.343)
_cons		3.112 (4.379)	-1.096 (4.373)
Mean	0.245	2.909	2.196
N	1592	1202	1592
chi2	426.906		
r2		0.080	0.200

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Self-Assessment: Determinants

	(1)	(2)	(3)	(4)
	Ability to apply treatment: yes	Ability to apply treatment: dk	Exp. higher return in task 2: yes	Exp. higher return in task 2: dk
Female	-0.078** (0.025)	0.049* (0.020)	-0.027 (0.025)	0.024 (0.022)
College or some university	0.051 (0.038)	-0.027 (0.028)	0.036 (0.038)	-0.026 (0.032)
Bachelor degree or higher	0.051 (0.038)	-0.043 (0.029)	0.038 (0.038)	-0.059 (0.032)
ln(Household income)	0.010 (0.006)	0.007 (0.006)	0.006 (0.006)	0.022** (0.007)
Household income missing	-0.181*** (0.032)	0.128*** (0.022)	-0.136*** (0.032)	0.130*** (0.025)
Financial wealth	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Financial Literacy Score	0.071*** (0.018)	-0.036** (0.013)	0.065*** (0.018)	-0.058*** (0.014)
Cognitive Ability Score	0.007 (0.013)	0.007 (0.012)	0.023 (0.014)	0.001 (0.013)
Numeracy Score	0.046** (0.016)	-0.024 (0.015)	0.041* (0.016)	-0.008 (0.015)
Financial knowledge: high	0.176*** (0.043)	-0.020 (0.039)	0.067 (0.043)	-0.070 (0.043)
Financial knowledge: very high	0.015 (0.065)	-0.061 (0.063)	-0.040 (0.066)	-0.106 (0.067)
Mean	0.462	0.193	0.467	0.269
N	1592	1592	1592	1592
chi2	272.890	164.537	256.316	219.204



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Self-Assessment: Determinants

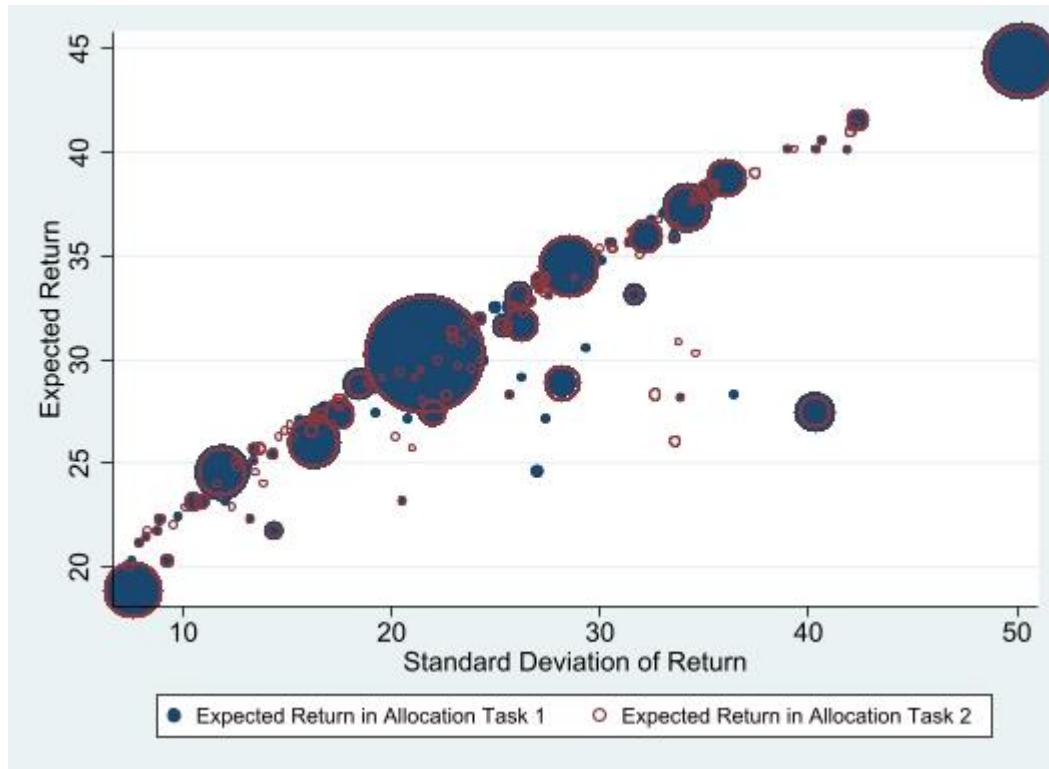
	(1)	(2)	(3)	(4)
	Ability to apply treatment: yes	Ability to apply treatment: dk	Exp. higher return in task 2: yes	Exp. higher return in task 2: dk
St. market knowledge: high	-0.104 (0.054)	0.005 (0.049)	-0.103 (0.054)	0.040 (0.054)
St. market knowledge: very high	-0.094 (0.092)	0.011 (0.089)	-0.110 (0.084)	0.146 (0.087)
Has traded stocks	0.030 (0.027)	-0.039 (0.024)	0.074** (0.027)	-0.070** (0.026)
Has studied economics	0.075** (0.026)	-0.076** (0.023)	0.060* (0.026)	-0.047 (0.025)
Mean ₁	0.022 (0.049)	-0.005 (0.042)	0.082 (0.050)	-0.131** (0.048)
Standard Deviation ₁	-0.005 (0.025)	-0.008 (0.021)	-0.038 (0.025)	0.058* (0.023)
Sharpe Ratio ₁	0.183 (0.168)	-0.231 (0.147)	0.195 (0.170)	-0.336* (0.164)
RML ₁	-0.009 (0.023)	0.008 (0.020)	0.014 (0.024)	-0.043* (0.021)
RSL ₁	0.011 (0.005)	-0.005 (0.005)	0.011* (0.005)	-0.005 (0.005)
One over K ₁	-0.029 (0.038)	-0.032 (0.031)	-0.073 (0.038)	0.024 (0.033)
Return Chasing ₁	-0.102 (0.094)	0.148 (0.085)	-0.145 (0.094)	0.179 (0.091)
Mean	0.462	0.193	0.467	0.269
N	1592	1592	1592	1592
chi2	272.890	164.537	256.316	219.204

Task 2: Descriptive Statistics

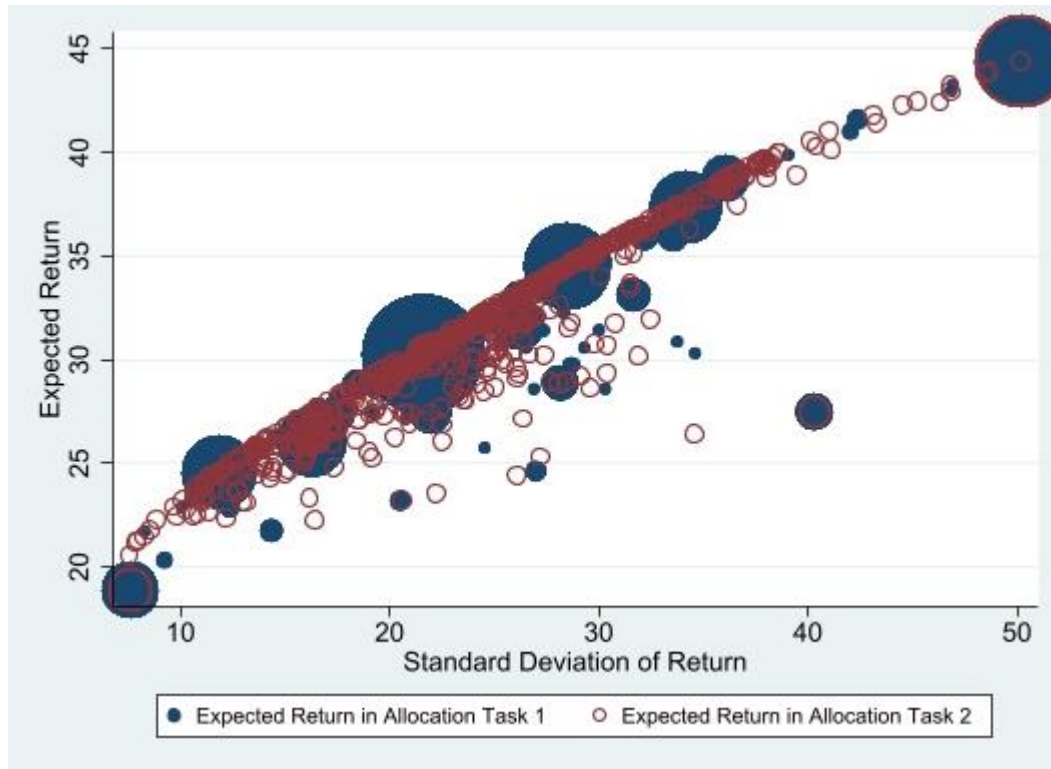
Table 8: Performance in Allocation Task 2

	N	mean	sd	min	median	max
Mean ₂	1592	31.458	6.036	18.9	30.264	44.4
Standard Deviation ₂	1592	25.327	10.577	7.410	22.337	50.2
Sharpe Ratio ₂	1592	1.384	0.390	0.682	1.346	2.721
RML ₂	1592	3.468	5.142	0	1.375	33.086
RSL ₂	1592	7.072	10.292	0	3.365	59.852
One over K ₂	1592	0.164	0.370	0	0	1
Return chasing ₂	1592	0.077	0.266	0	0	1
Δ Sharpe Ratio	1592	0.039	0.276	-0.726	0	2.644
Δ RML	1592	-0.410	5.966	-33.086	0	31.711
Δ RSL	1592	-0.517	11.876	-59.852	0	57.051
Δ One over K	395	0.509	0.501	0	1	1
Δ Return chasing	165	0.473	0.501	0	0	1
Δ E	1592	0.342	0.474	0	0	1
Δ W	1592	0.035	0.184	0	0	1

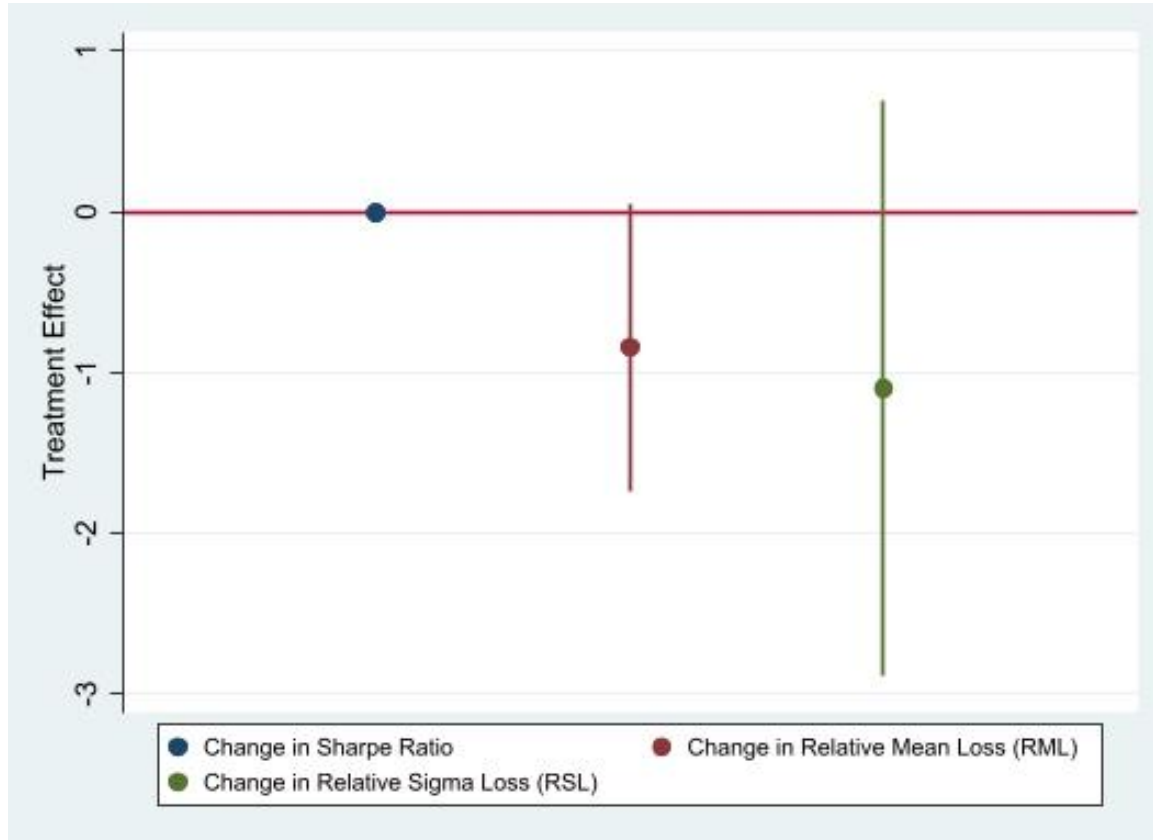
Task 2: Portfolio Allocations Across Participants



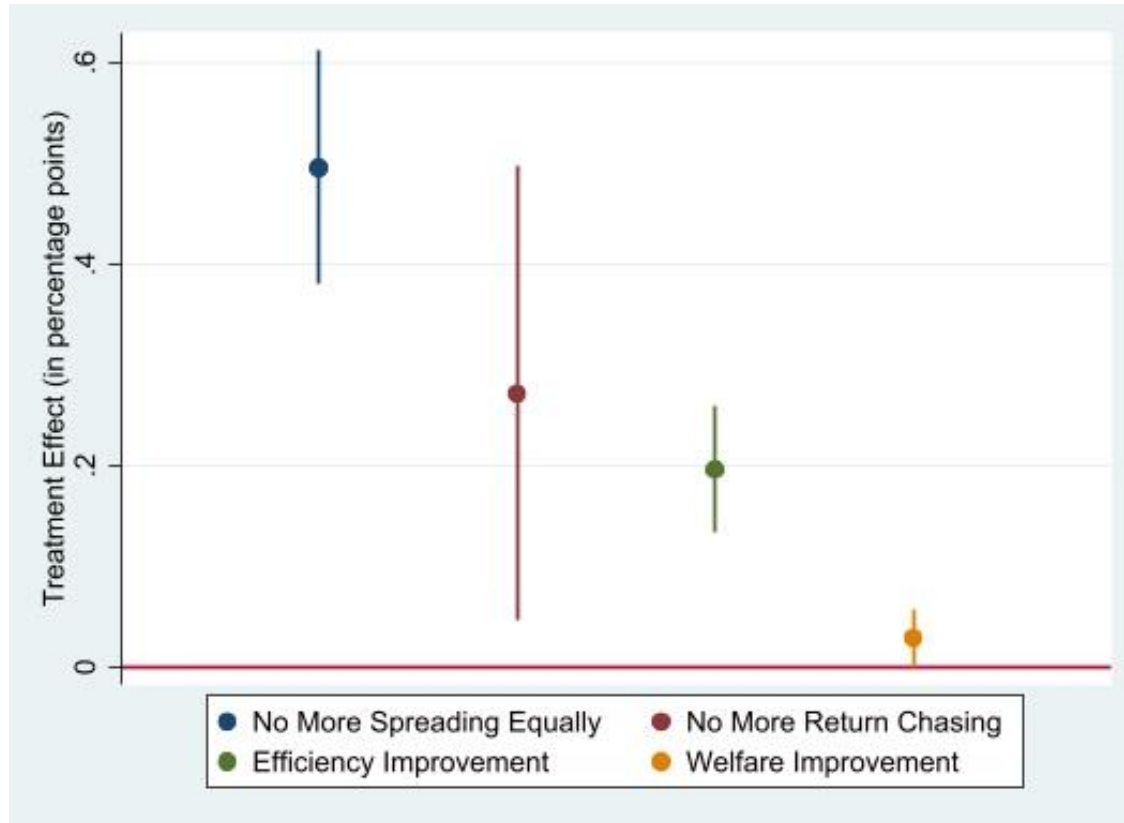
Task 2: Portfolio Allocations Across Participants



Task 2: Treatment Effect on Portfolio Allocation



Task 2: Treatment Effect on Portfolio Allocation



After Task 2: Descriptive Statistics – Treatment Questions

Table 10: Performance Questions about Treatment

	N	mean	sd	min	median	max
Treatment Score		2.334	0.786	0	3	3
Q: Return chasing		0.727	0.445	0	1	1
Q: Risk-adjusted returns		0.826	0.379	0	1	1
Q: One over K		0.781	0.414	0	1	1
<i>N</i>	1592					

After Task 2: Treatment Effect on Questions

Table 11: Regressions of Performance in Questions about Treatment

	(1)	(2)	(3)	(4)
	Treatment Score	Q: Return chasing	Q: Risk-adjusted returns	Q: One over K
Received treatment	0.161** (0.054)	0.146*** (0.032)	0.008 (0.030)	0.011 (0.031)
_cons	2.891 (1.856)			
Controls	X	X	X	X
Mean	2.334	0.727	0.826	0.781
N	1592	1592	1592	1592
r2	0.227			
chi2		173.175	174.774	214.015

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Selection Effects?

The overall test statistic for the joint hypothesis that all coefficients (except the coefficient for willingness to pay) in column 2 are zero provides a test of randomness.

The respective p-value is 0.5219. Therefore, the results in column 2 confirm that controlling for willingness to pay is sufficient to eliminate selection effects.

	(1)		(2)	
	Received treatment		Received treatment	
Willingness to pay			0.154***	(0.002)
Female	0.010	(0.026)	-0.006	(0.018)
College or some university	-0.057	(0.039)	-0.030	(0.026)
Bachelor degree or higher	-0.080*	(0.039)	-0.031	(0.026)
ln(Household income)	-0.014*	(0.006)	-0.006	(0.004)
Household income missing	-0.105**	(0.034)	0.049	(0.025)
Financial wealth	0.000	(0.000)	-0.000	(0.000)
Financial Literacy Score	0.063***	(0.019)	0.019	(0.014)
Cognitive Ability Score	0.015	(0.014)	0.005	(0.009)
Numeracy Score	0.009	(0.017)	-0.007	(0.011)
Financial knowledge: high	-0.083	(0.044)	-0.020	(0.029)
Financial knowledge: very high	-0.095	(0.069)	0.009	(0.046)
St. market knowledge: high	-0.119*	(0.056)	-0.079*	(0.037)
St. market knowledge: very high	-0.056	(0.096)	0.005	(0.066)
Has traded stocks	0.072**	(0.028)	0.033	(0.019)
Has studied economics	0.030	(0.027)	-0.008	(0.019)
Mean ₁	0.098	(0.052)	0.053	(0.034)
Standard Deviation ₁	-0.052*	(0.026)	-0.031	(0.017)
Sharpe Ratio ₁	-0.008	(0.173)	-0.061	(0.118)
RML ₁	0.033	(0.025)	0.021	(0.016)
RSL ₁	0.000	(0.006)	-0.001	(0.004)
One over K ₁	-0.118**	(0.039)	-0.038	(0.026)
Return Chasing ₁	-0.085	(0.097)	0.027	(0.067)
Mean	0.431		0.431	
N	1592		1592	
chi2	150.397		1154.095	