

How does household portfolio diversification vary with financial sophistication and financial advice?

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# The quality of household investment decisions

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- ▶ Increasing individual responsibility for financing retirement
- ▶ Are all households equipped to take “good” decisions?
- ▶ U.S. established Consumer Financial Protection Bureau

# Roadmap to Saving and Investing

Click the pins below to navigate your way through the Roadmap to Saving and Investing.



## Diversify Your Investments

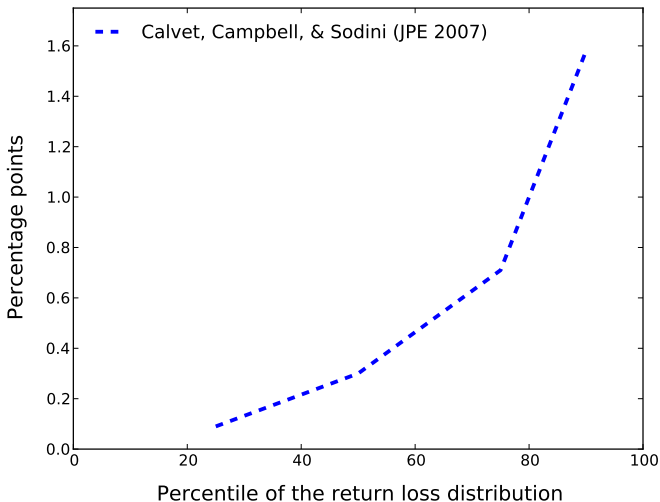
Diversification can be neatly summed up as, "Don't put all your eggs in one basket." The idea is that if one investment loses money, the other investments will make up for those losses. Diversification can't guarantee that your investments won't suffer if the market drops. But it can improve the chances that you won't lose money, or that if you do, it won't be as much as if you weren't diversified.

For more information on diversification, see [Asset Allocation](#).

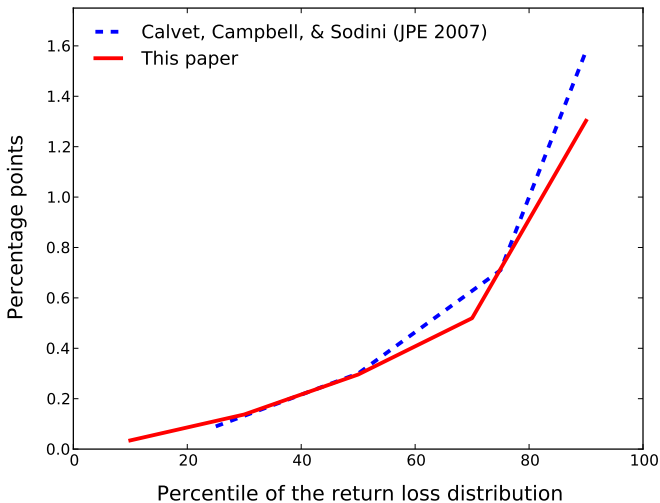


Diversification is a smart investment strategy. It can improve the chances that you won't lose money, or that if you do, it won't be as much

## Expected annual return on the financial portfolio lost due to underdiversification, by percentile



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- ▶ Uses quantile regressions to find out how the upper percentiles vary with covariates
- ▶ Shows the influence of the key characteristics identified by literature and policy
  - ▶ Financial literacy
  - ▶ Financial advice
- ▶ Demonstrates that the highest risk of large diversification losses on the financial portfolio is incurred by ...
  - ▶ ... investors with low numerical-financial skills ...
  - ▶ ... who rely on their own judgement

## Portfolio diversification

- Measuring portfolio diversification

- Data on household portfolio composition

- Descriptive statistics on portfolio characteristics

## How do investment outcomes vary in the population?

- Empirical implementation

- Main estimates

- Robustness of results

- Are detailed diversification measures worth it?

## Conclusions and connection with further research

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# Estimating risk and expected returns

- ▶ Setting
  - ▶ Cross-section of investors
  - ▶ Observe asset identifiers and portfolio weights
  - ▶ Time series of returns on each asset
- ▶ Expected returns notoriously difficult to measure
- ▶ Impose CAPM to obtain  $\mu_h = \mathbb{E}[r_h^e]$  and  $\sigma_h^2 = \mathbb{V}[r_h^e]$

## Measuring diversification losses

- ▶ Sharpe ratio,  $k \in \{b, h\}$

$$S_k = \frac{\mu_k}{\sigma_k}$$

- ▶ Relative Sharpe ratio loss

$$RSL_h = 1 - \frac{S_h}{S_b}$$

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$$RSL_h = 1 - \frac{S_h}{S_b}$$

- ▶ Return loss

$$\begin{aligned} RL_h &= \omega_h \cdot (S_b \cdot \sigma_h - \mu_h) \\ &= \mu_b \cdot \omega_h \cdot \beta_h \cdot \left( \frac{RSL_h}{1 - RSL_h} \right) \end{aligned}$$

# DNB Household Survey

- ▶ Internet-administered survey of Dutch households

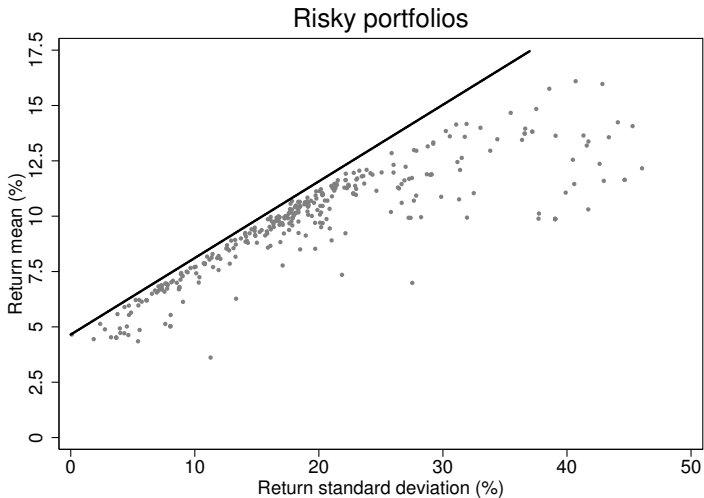
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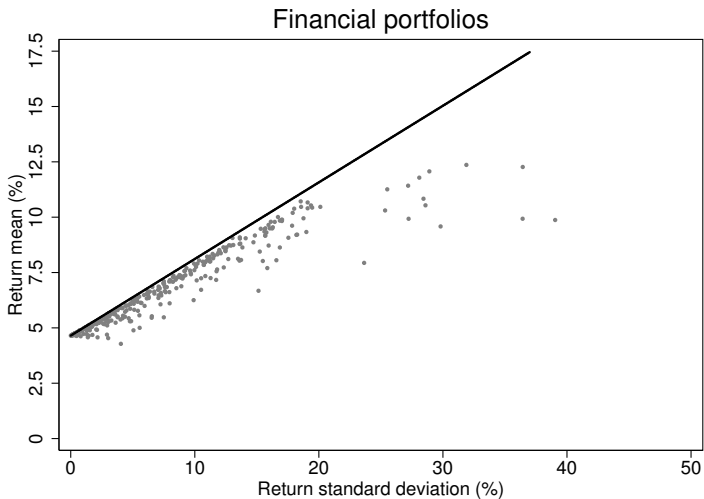
# DNB Household Survey

- ▶ Internet-administered survey of Dutch households
- ▶ Enormous amount of detail on wealth components
- ▶ Households report holdings of stocks and mutual funds
  - ▶ Names
  - ▶ Quantities

# Portfolios in the mean-standard deviation plane

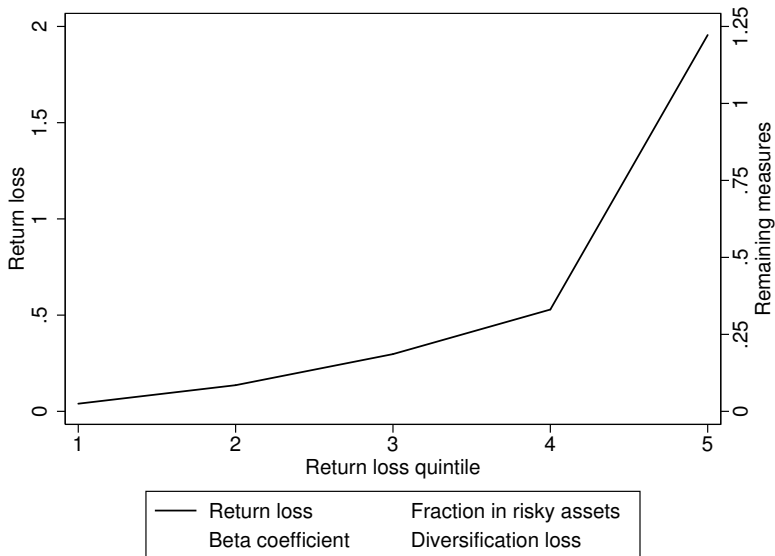


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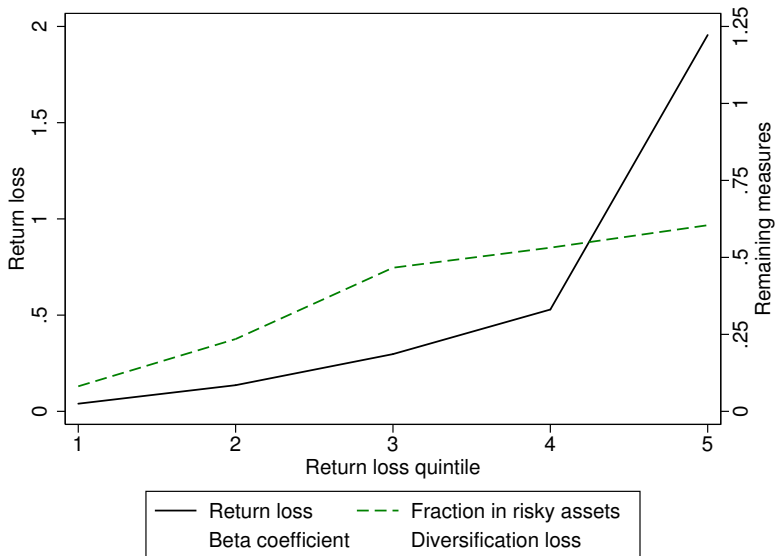




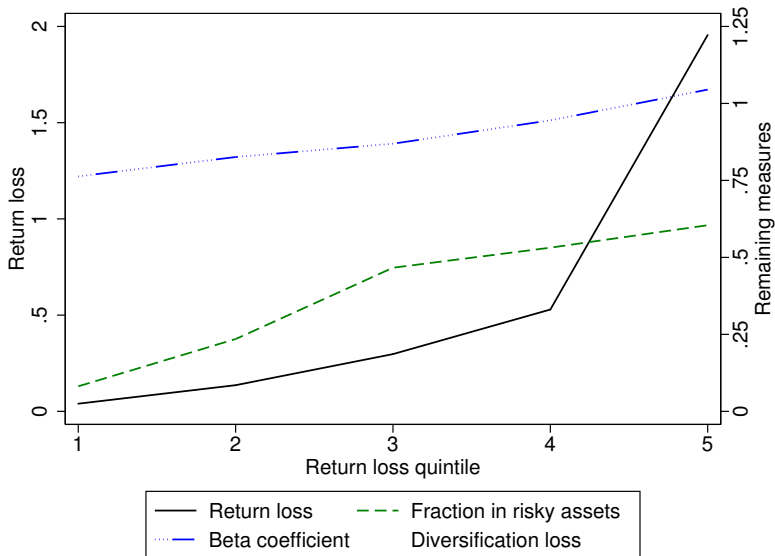
# Distribution and decomposition of the return loss



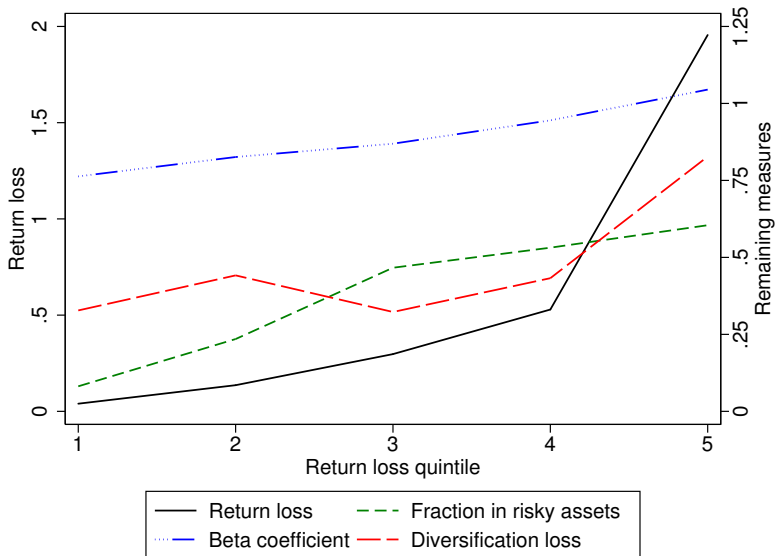
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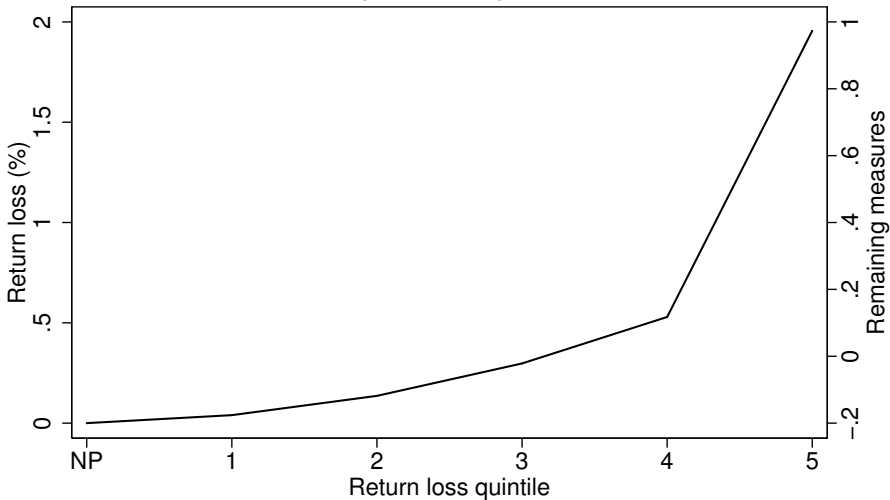


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- ▶ Quantile regressions

## Return loss, percentage of fin. assets



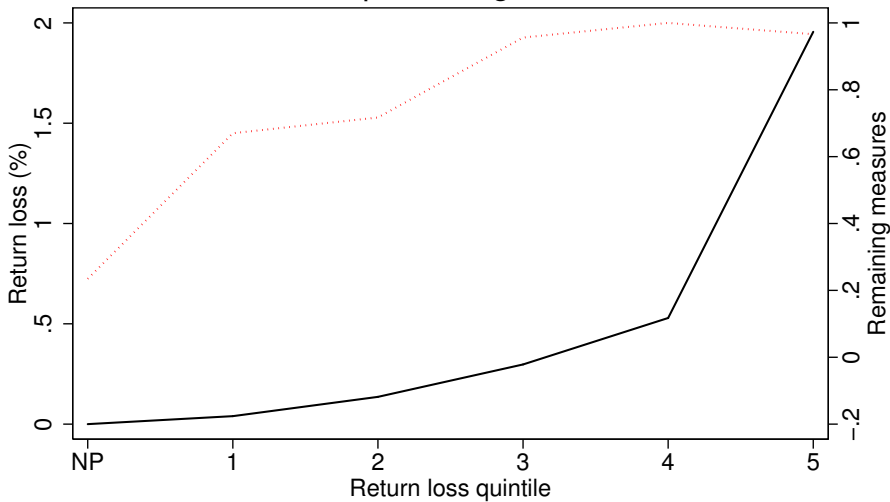
— Return loss (%)

Financial numeracy index

Fin. assets (1 = EUR 97423)

Fin. advice: Own judgment

## Return loss, percentage of fin. assets



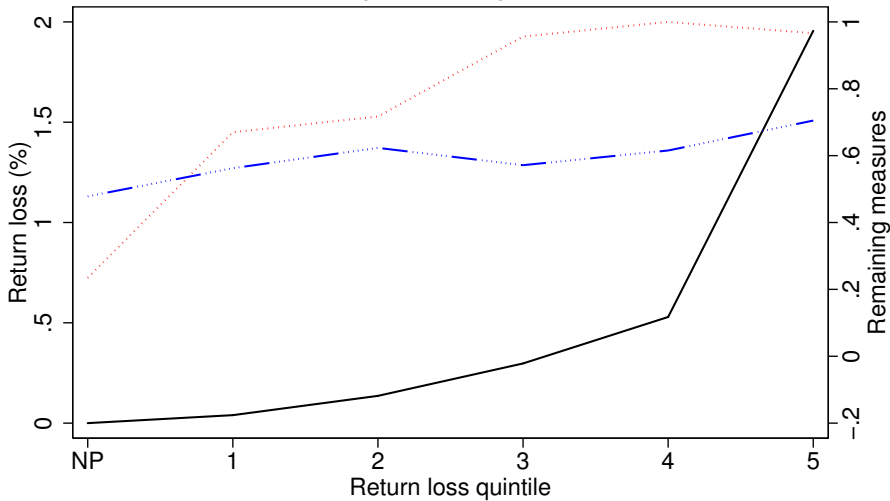
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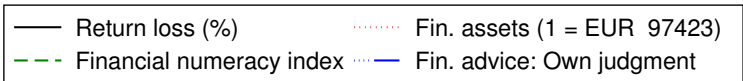
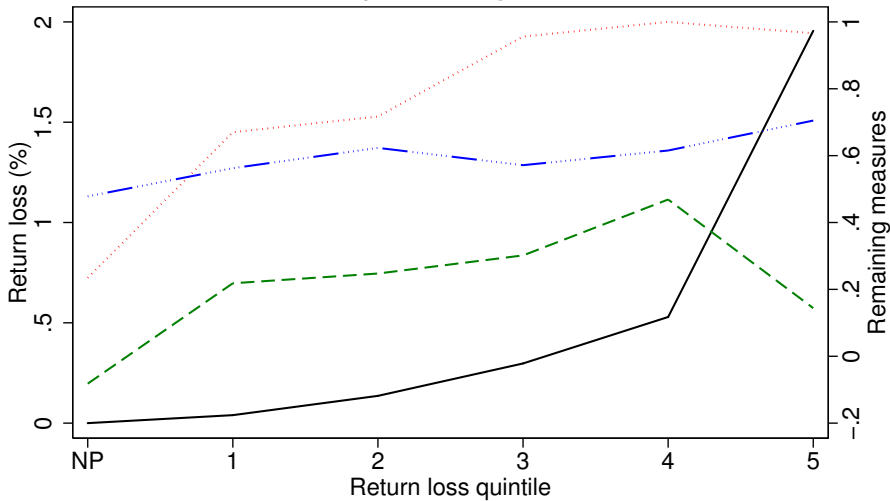
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Financial numeracy index      - - - - - Fin. advice: Own judgment

## Return loss, percentage of fin. assets



## Contributors to return loss

	OLS	P10	P30	P50	P70	P90
External advice $\times$ fin. numeracy	0.04 (0.05)	-0.01 (0.02)	0.04 (0.03)	0.05 (0.06)	0.08 (0.13)	0.17 (0.48)
Financial advice: Own judgment	0.49** (0.19)	-0.00 (0.02)	0.06 (0.04)	0.02 (0.07)	0.33** (0.14)	1.34** (0.53)
Own fin. judgment $\times$ fin. numeracy	-0.68* (0.38)	-0.01 (0.02)	-0.02 (0.03)	0.01 (0.06)	-0.40*** (0.12)	-1.46*** (0.44)
Higher vocational education	0.12 (0.15)	0.01 (0.02)	0.02 (0.04)	0.05 (0.07)	0.06 (0.15)	0.01 (0.56)
Academic education	0.01 (0.15)	-0.01 (0.02)	-0.04 (0.04)	-0.05 (0.08)	0.07 (0.18)	0.01 (0.64)
Age 41-64	-0.13 (0.20)	0.01 (0.03)	0.02 (0.05)	0.12 (0.09)	0.11 (0.19)	-0.39 (0.69)
Age 65+	-0.04 (0.24)	0.04 (0.03)	0.13** (0.05)	0.23** (0.10)	0.30 (0.21)	-0.24 (0.77)
Log financial assets	-0.01 (0.07)	-0.00 (0.01)	-0.01 (0.02)	-0.03 (0.03)	-0.05 (0.06)	-0.11 (0.23)
Constant	0.59 (0.75)	0.03 (0.09)	0.20 (0.16)	0.49 (0.30)	0.76 (0.64)	2.26 (2.35)

*Source:* CentERpanel, Datastream, Euroinvestor, own calculations. The dependent variable is the return loss as a percentage of total financial assets; see Section I.C for details. The number of observations is 274. The OLS

## Contributors to return loss, all respondents

	P75	P80	P85	P90	P95
External advice $\times$ fin. numeracy	0.00 (0.02)	0.00 (0.03)	0.01 (0.04)	0.00 (0.09)	-0.00 (0.24)
Financial advice: Own judgment	0.04 (0.03)	0.06 (0.04)	0.10* (0.05)	0.20 (0.12)	0.63* (0.33)
Own fin. judgment $\times$ fin. numeracy	0.02 (0.02)	0.03 (0.03)	0.05 (0.04)	0.07 (0.09)	-0.60*** (0.23)
Higher vocational education	0.06 (0.04)	0.07 (0.05)	0.08 (0.06)	0.07 (0.15)	0.40 (0.38)
Academic education	-0.01 (0.05)	-0.00 (0.06)	0.00 (0.08)	-0.04 (0.18)	-0.01 (0.48)
Age 41-64	0.01 (0.04)	-0.01 (0.05)	-0.02 (0.07)	-0.02 (0.16)	-0.01 (0.41)
Age 65+	0.07 (0.05)	0.09 (0.06)	0.10 (0.08)	0.13 (0.18)	0.46 (0.47)
Log financial assets	0.06*** (0.01)	0.08*** (0.01)	0.09*** (0.02)	0.12*** (0.05)	0.20 (0.12)
Constant	-0.49*** (0.12)	-0.60*** (0.14)	-0.65*** (0.19)	-0.90** (0.44)	-1.43 (1.16)

*Source:* CentERpanel, Datastream, Euroinvestor, own calculations. The dependent variable is the return loss as a percentage of total financial assets; see Section I.C for details. The number of observations is 925; standard errors are in parentheses. All estimates are based on a cross section of households.

## Results are robust to ...

- ▶ Including financial knowledge
  - ▶ No significant influence
  - ▶ Diversification question by itself is significant



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- ▶ Excluding mutual fund fees

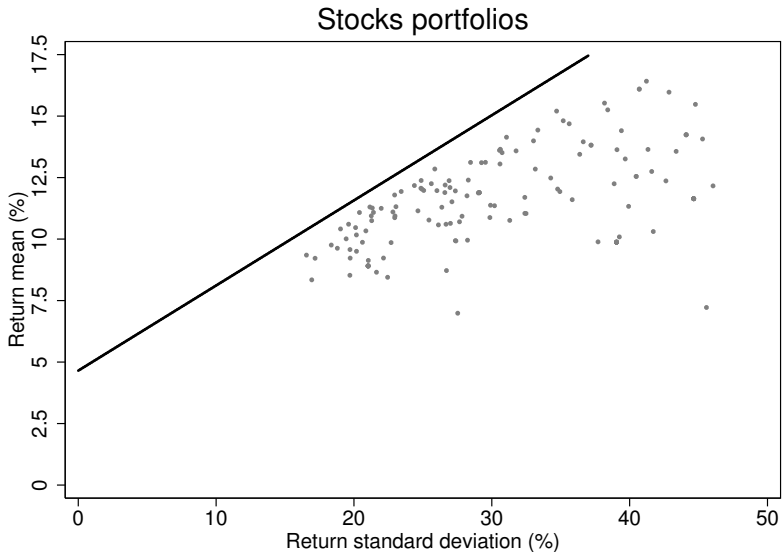
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- ▶ Splitting up the financial advice categories
- ▶ Adding risk aversion, gender, various other controls
- ▶ Excluding mutual fund fees
- ▶ Using different benchmark returns

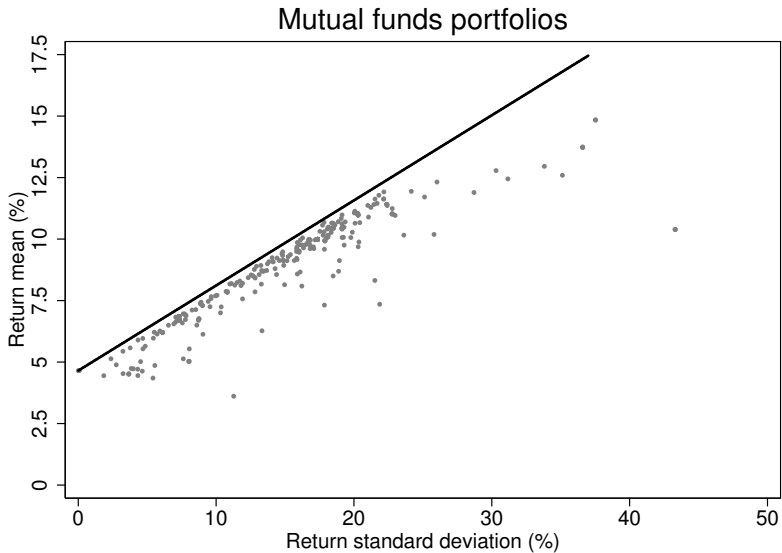
## Typical data on household portfolios

1. Very detailed stocks portfolios (Finland, brokers)

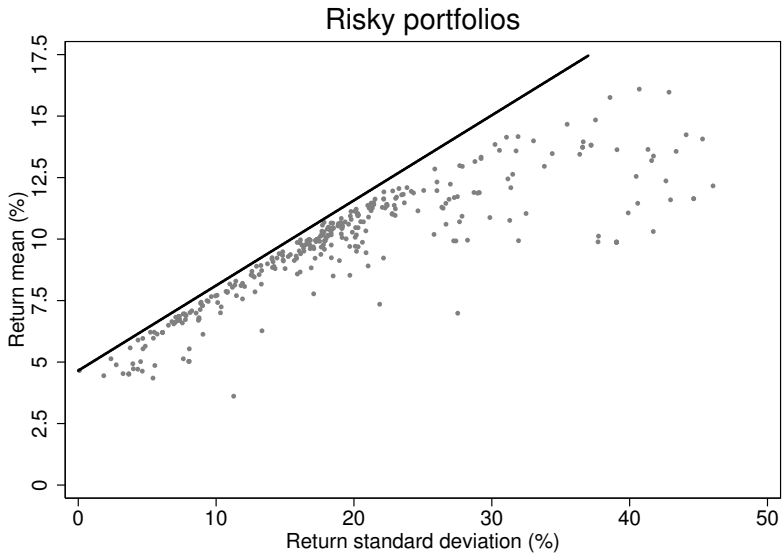
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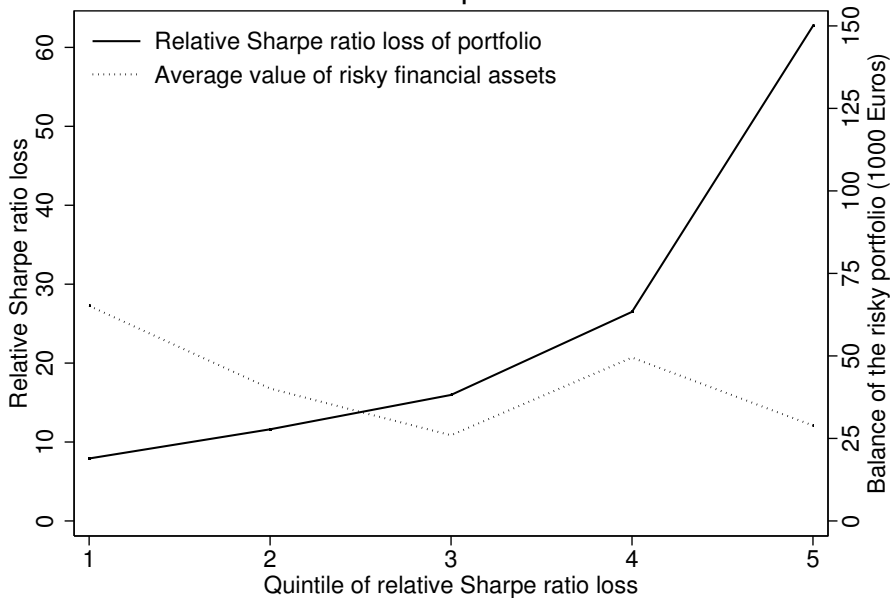




# Typical data on household portfolios

1. Very detailed stocks portfolios (Finland, brokers)
2. Coarse self-reports (surveys)
  - ▶ Number of stocks held
  - ▶ Whether owner of mutual funds
  - ▶ Amount invested in each category

## Relative Sharpe ratio loss



## Measure preferred by Calvet, Campbell, & Sodini (2009 AEAPP)

$$\frac{\text{€ shares}}{\text{€ mutual funds}}$$

- ▶ Correlation with RSL = .22
- ▶ OLS only shows financial advice effect
- ▶ Quantiles meaningless

## Measure of Guiso & Jappelli (2009 WP)

$$\frac{1 - \nu_h}{\min \{1, N_h^{\text{shares}}\}}$$

- ▶  $\nu_h$  – Fraction of the risky portfolio invested in mutual funds
- ▶  $N_h^{\text{shares}}$  – Number of shares held directly

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- ▶  $\nu_h$  – Fraction of the risky portfolio invested in mutual funds
- ▶  $N_h^{\text{shares}}$  – Number of shares held directly
- ▶ Correlation with RSL = .34
- ▶ OLS only shows financial advice effect
- ▶ At  $q_{70}$ , similar patterns as before emerge

## Portfolio diversification

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- Descriptive statistics on portfolio characteristics

## How do investment outcomes vary in the population?

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## Conclusions and connection with further research

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  - ▶ Advice and numeracy substitutes – knowledge unrelated
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  - ▶ Overconfidence?
  - ▶ Low diversification an optimal strategy?
- ▶ Detailed measures reveal more interesting patterns than commonly constructed ones



# CAPM implementation

1. Regress asset  $j$ 's excess return on benchmark excess return

$$r_{j,t}^e = \beta_j \cdot r_{b,t}^e + \varepsilon_{j,t}$$

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$$\mu_J = \beta_J \cdot \mu_b$$

$$\Sigma_J = \beta_J \beta_J' \cdot \sigma_b^2 + \mathbb{E} [\varepsilon_{J,t} \varepsilon_{J,t}']$$

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3. Portfolio weights lead to household portfolio moments

$$\mu_h = \theta_h' \mu_J$$

$$\sigma_h^2 = \theta_h' \Sigma_J \theta_h$$

# Portfolio variables in the DHS

Level 0	Level 1	Level 2	Level 3	Level 4
Mutual funds	Mutual and growth funds	Risky financial assets	Total financial assets	Total assets
Growth funds	Mutual and growth funds	Risky financial assets	Total financial assets	Total assets
Shares	Shares	Risky financial assets	Total financial assets	Total assets
Bonds (sovereign, corporate, mortgage)	Bonds and options	Risky financial assets	Total financial assets	Total assets
Options	Bonds and options	Risky financial assets	Total financial assets	Total assets
Checking account with positive balance	Checking and savings accounts	Safe financial assets	Total financial assets	Total assets
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Saving certificates	Checking and savings accounts	Safe financial assets	Total financial assets	Total assets
Saving or endowment insurance policy	Cash value of insurances	Safe financial assets	Total financial assets	Total assets
Mortgage-related life insurance	Cash value of insurances	Safe financial assets	Total financial assets	Total assets
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Business equity	Other non-financial assets	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Money lent to family/friends	Other non-financial assets	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Assets not mentioned in other categories	Other non-financial assets	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Primary housing	Primary housing	Total real estate	Total non-financial assets	Total assets
Secondary housing	Total secondary real estate	Total real estate	Total non-financial assets	Total assets
Other real estate	Total secondary real estate	Total real estate	Total non-financial assets	Total assets
Credit-card debt	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
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Hire purchase contracts	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
Checking account with negative balance	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
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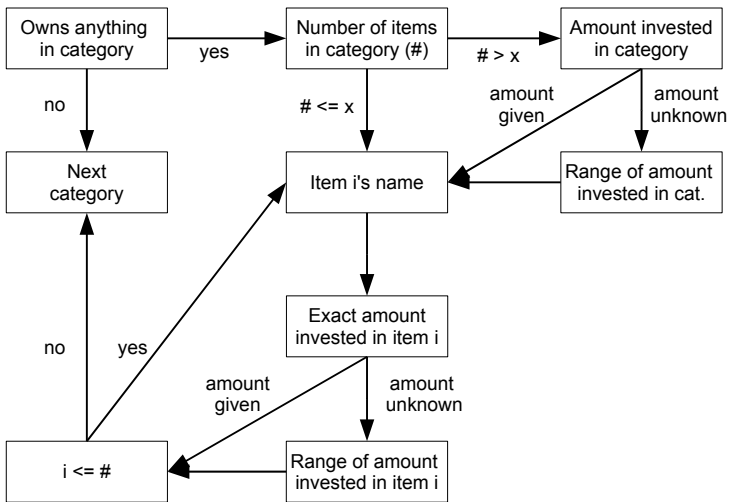
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Saving or endowment insurance policy	Cash value of insurances	Safe financial assets	Total financial assets	Total assets
Mortgage-related life insurance	Cash value of insurances	Safe financial assets	Total financial assets	Total assets
Life-cycle savings plan	Cash value of insurances	Safe financial assets	Total financial assets	Total assets
Single premium annuity insurance policy	Cash value of insurances	Safe financial assets	Total financial assets	Total assets
Boat	Durables	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Car	Durables	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Caravan	Durables	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Motorbike	Durables	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Business equity	Other non-financial assets	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Money lent to family/friends	Other non-financial assets	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Assets not mentioned in other categories	Other non-financial assets	Non-financial assets (excl. real estate)	Total non-financial assets	Total assets
Primary housing	Primary housing	Total real estate	Total non-financial assets	Total assets
Secondary housing	Total secondary real estate	Total real estate	Total non-financial assets	Total assets
Other real estate	Total secondary real estate	Total real estate	Total non-financial assets	Total assets
Credit-card debt	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
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Other consumer credit	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
Private loan	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
Hire purchase contracts	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
Checking account with negative balance	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
Student loan	Total consumer credit	Total non-mortgage debt	Total debt	Total debt
Borrowed from friends/family	Other debt	Total non-mortgage debt	Total debt	Total debt
Debts not mentioned in other categories	Other debt	Total non-mortgage debt	Total debt	Total debt
Mortgage on primary housing	Mortgage on primary housing	Total mortgage debt	Total debt	Total debt
Mortgage on secondary housing	Total mortgages on secondary real estate	Total mortgage debt	Total debt	Total debt
Mortgage on other real estate	Total mortgages on secondary real estate	Total mortgage debt	Total debt	Total debt



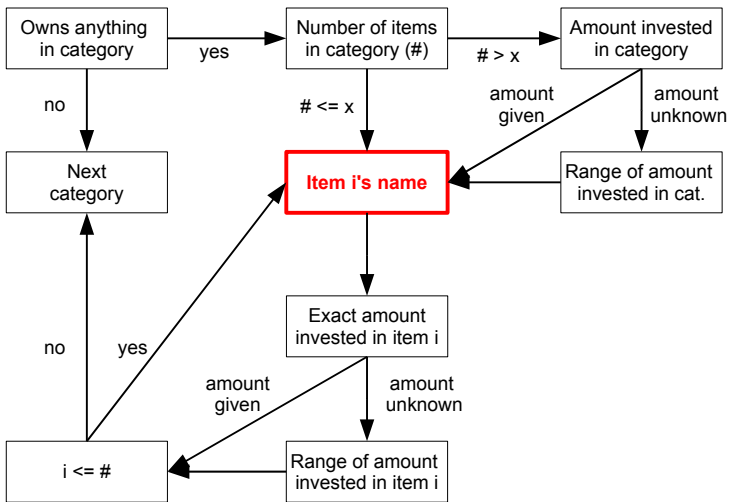
# Portfolio variables in the DHS

Level 0	Level 1	Level 2	Level 3	Level 4
Mutual funds	Mutual and growth funds	Risky financial assets	Total financial assets	Total assets
Growth funds	Mutual and growth funds	Risky financial assets	Total financial assets	Total assets
Shares	Shares	Risky financial assets	Total financial assets	Total assets
Bonds (sovereign, corporate, mortgage)	Bonds and options	Risky financial assets	Total financial assets	Total assets
Options	Bonds and options	Risky financial assets	Total financial assets	Total assets
Checking account with positive balance	Checking and savings accounts	Safe financial assets	Total financial assets	Total assets
Savings and deposit accounts	Checking and savings accounts	Safe financial assets	Total financial assets	Total assets
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# Questionnaire structure stocks and funds



# Questionnaire structure stocks and funds



## Coverage of the risky portfolio

Variable	obs	avg	5p	med95p
Total number of households	1604			
Owners of risky financial assets	527			
Owners of shares/funds	499			
Raw report of individual items	497	3.34	1	210
Raw report (hh. in final sample)	408	3.69	1	211
Matched report of individual items	408	2.96	1	29
Fraction of shares/funds covered	408	0.90	0.28	0.991.00
Fraction of risky fin. assets covered	408	0.84	0.18	0.991.00
Fraction of quantities imputed	408	0.08	0.00	0.000.75
Length of time series of returns	269	137.72	57	128235
Total expense ratio, mutual funds	170	1.30	0.33	1.271.87

*Source:* DHS 2005/2006, Datastream, own calculations. Numbers in column “raw” refer to all observations, those in column “obs” are adjusted for clustering at the household level, as are the remaining statistics.

## Financial literacy measures from van Rooij, Lusardi, & Alessie (JFE 2011)

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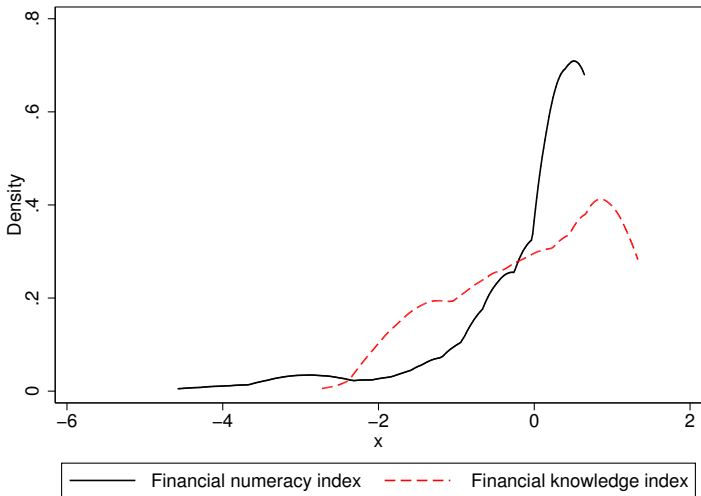
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- ▶ Use factor analysis to construct indices
- ▶ Standardise to mean zero, variance 1



## The distribution of financial literacy



## Primary source of financial advice

Original variable in 9 categories, break down into 2 categories.

Seeking advice	Parents, friends, or acquaintances	27%
Seeking advice	Professional financial advisors	26%
Own judgement	Newspapers; financial magazines, guides, books; brochures from bank or mortgage advisor; advertisements; financial computer programs; Internet; other.	47%

# Decomposition of portfolio risk

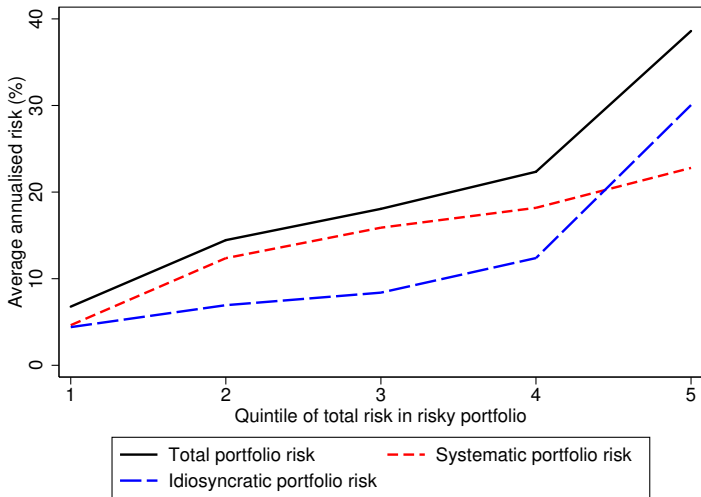
- ▶ Expected returns for household  $h$ :

$$r_{h,t}^e = \alpha_h + \beta_h \cdot r_{b,t}^e + \varepsilon_{h,t}$$

- ▶ Decompose variance of  $r_{h,t}^e$

$$\sigma_h^2 = \beta_h^2 \cdot \sigma_b^2 + \sigma_{h,\text{idios.}}^2$$

## Inefficient risk-taking with less assumptions



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