Down or Out:
Assessing the Welfare Costs of Household Investment Mistakes

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Down or Out

Welfare cost of

- underdiversification — Down
- nonparticipation — Out

New dataset containing detailed information on the finances of all the households in Sweden

Comprehensiveness main difference with earlier work

Guiso, Haliassos, Jappelli (2002)

Vissing-Jorgensen (2002)

Goetzmann and Kumar (2004)

Outline

1. The measurement challenge and our data
2. Diversification
   - Risk exposure
   - Risk premium
3. Who diversifies and how?
4. Cost of Nonparticipation
5. Conclusions

The Measurement Challenge

Existing Datasets

- Surveys (SCF)
  households do not like to share financial information
  cannot be detailed, high refusal rate, answers often implausible.

- Account providers (brokerage house, 401(k))
  detailed but multiple accounts, non-representative sample

- Registers of ownership (Sweden, Finland)
  detailed and representative sample but capture one asset class

- Tax records (US)
  estate tax returns

Our Data

Panel covering four years (1999-2002) and all resident households (4.8 million). For each household we have:

Demographic variables	Age, gender, marital status, education, birthplace, residence
Assets at security level	Holdings at yearend of stocks and mutual funds, bank accounts
Income flows	Labor income, welfare payments, capital income by assets, private pension savings

Main Limitations

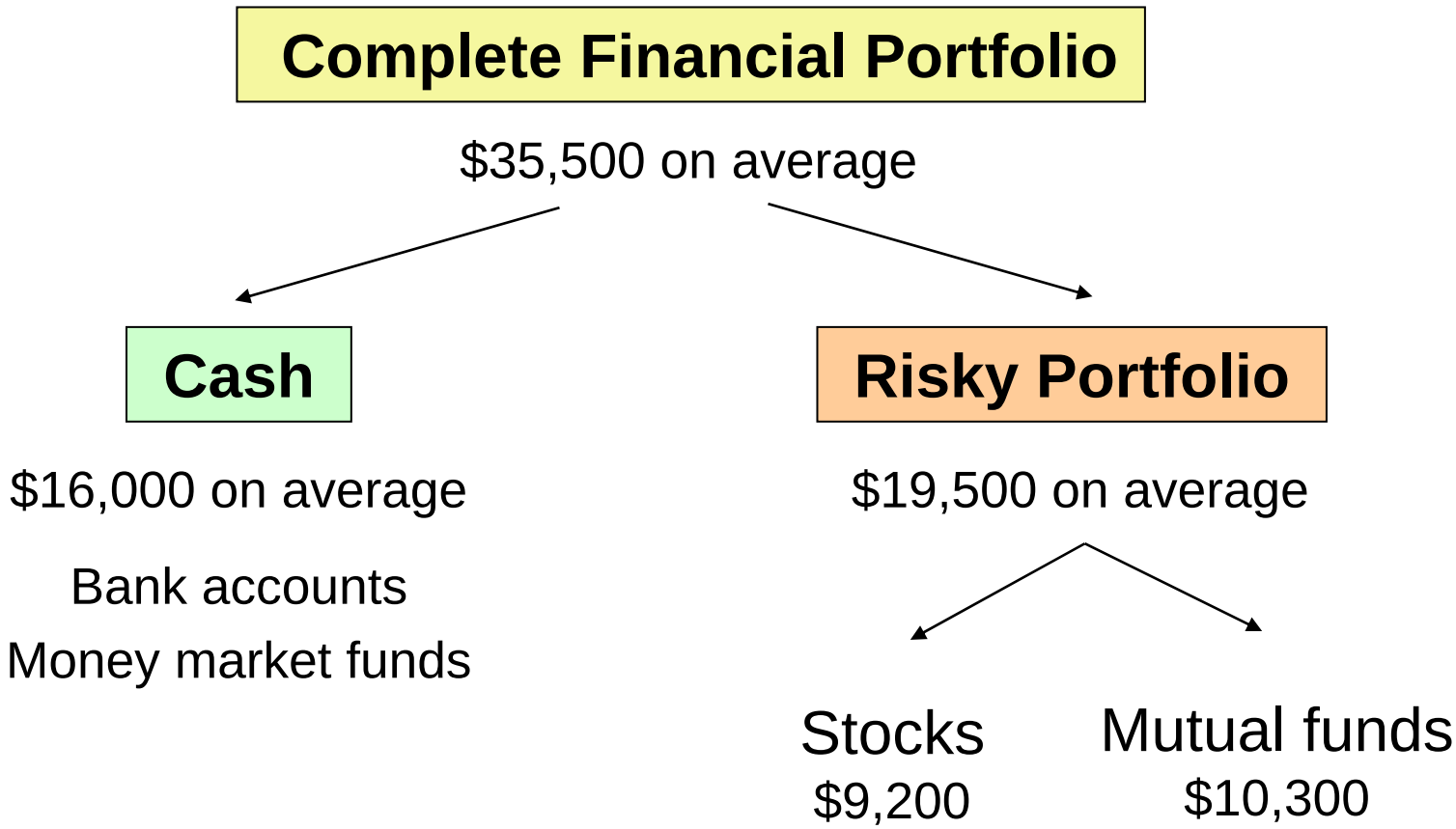
Value of DC pension assets (but we see contributions to private pension)

Asset allocation of capital insurance products (but we see total value)

Diversification

Participants

- 62% Swedish households held risky assets in 2002



Methodology

Compare household portfolios with diversified indexes

Benchmarks (83-04)

- MSCI All Country World Index
  - hedged for currency risk: S_B = 45.2%
  - unhedged: S_B = 34.5%
- Swedish Stock Index: S_B = 27.4%
- Pooled Index: S_B = 35.5%

Two approaches

Idiosyncratic risk exposure

model free statistical decomposition

Risk premium loss

CAPM and Fama French factor models

Risk exposure

Statistical Decomposition (risky portfolio)

Excess Return

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

Variance

$$\sigma_h^2 = \beta_h^2 \sigma_B^2 + \sigma_{i,h}^2$$

Total risk

Systematic risk

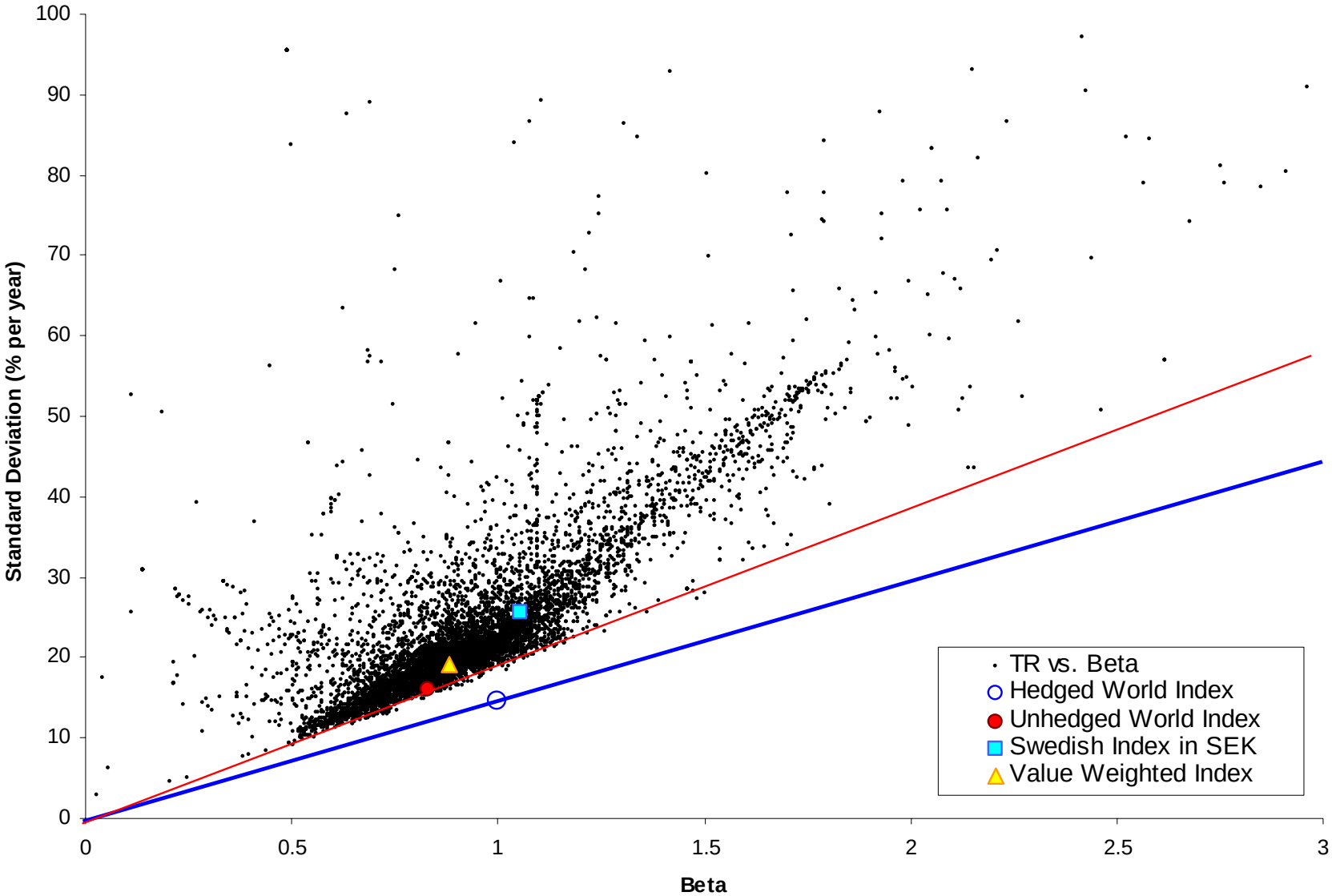
Idiosyncratic risk

$$\sigma_h \geq \beta_h \sigma_B \quad \Rightarrow \quad \sigma_h = \beta_h \sigma_B$$

Full Diversification

Plot σ_h on β_h

Volatility and Beta Of Risky Porfolios



Measuring Mean Returns

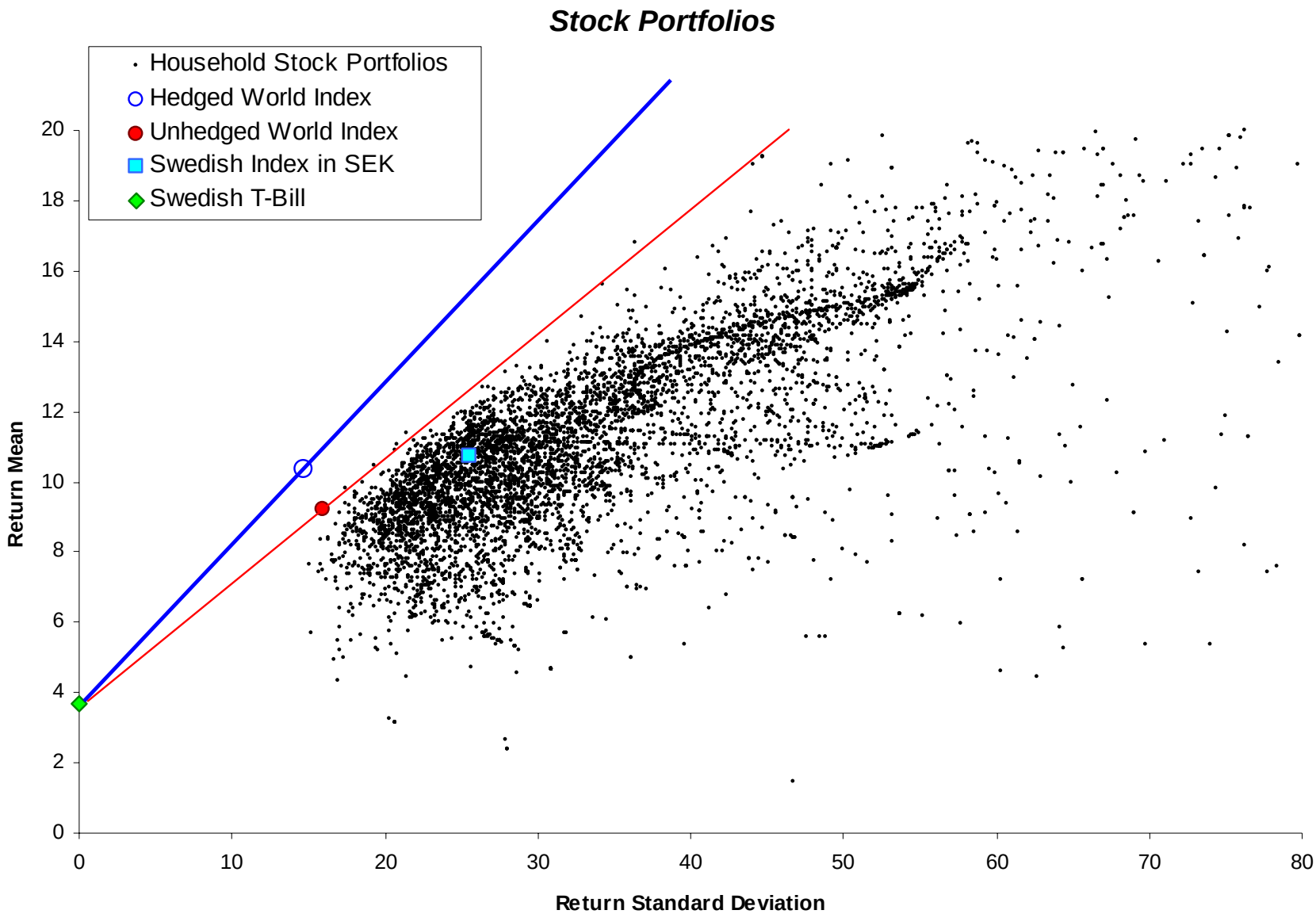
- Historical average returns are noisy estimates
- Diversification value of household portfolios

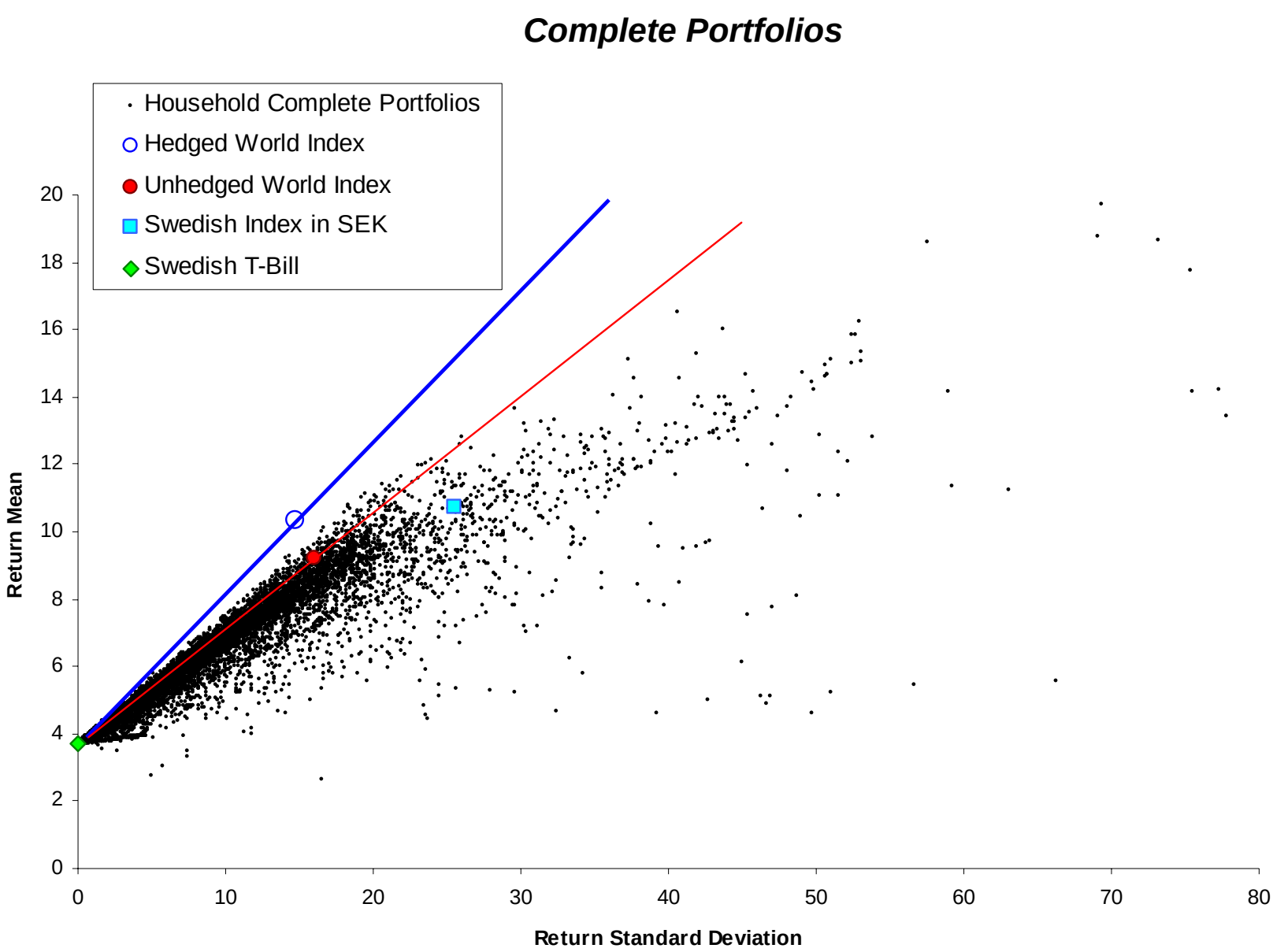
Use asset pricing models to infer mean returns

- International **CAPM**
  - Hedged world index is mean-variance efficient

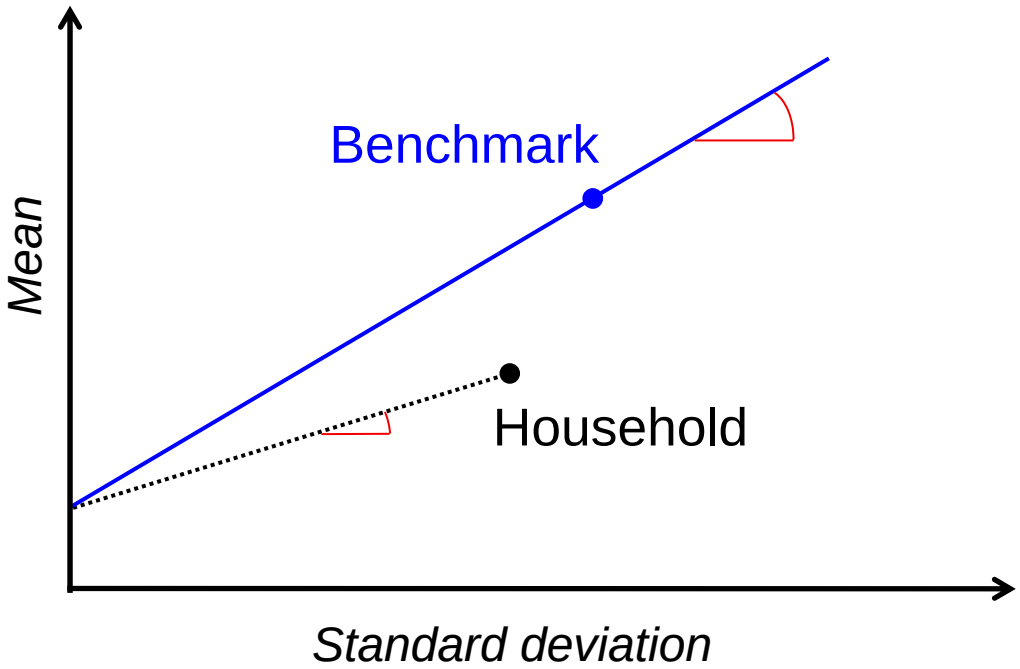
- **Fama-French** three-factor model
  - Market, size, and value factors

Scatter Plots of Household Portfolios




Complete Portfolios
Household Complete Portfolios
Hedged World Index
Unhedged World Index
Swedish Index in SEK
Swedish T-Bill
Return Mean
Return Standard Deviation
0
2
4
6
8
10
12
14
16
18
20
0
10
20
30
40
50
60
70
80

Relative Sharpe Ratio Loss



Sharpe ratios

slopes of capital allocation lines

Household h **relative Sharpe ratio loss** wrt benchmark S_B

$$RSRL_h = 1 - \frac{S_h}{S_B}, \qquad S_h = \frac{\mu_h}{\sigma_h}$$

Relative Sharpe Ratio Loss

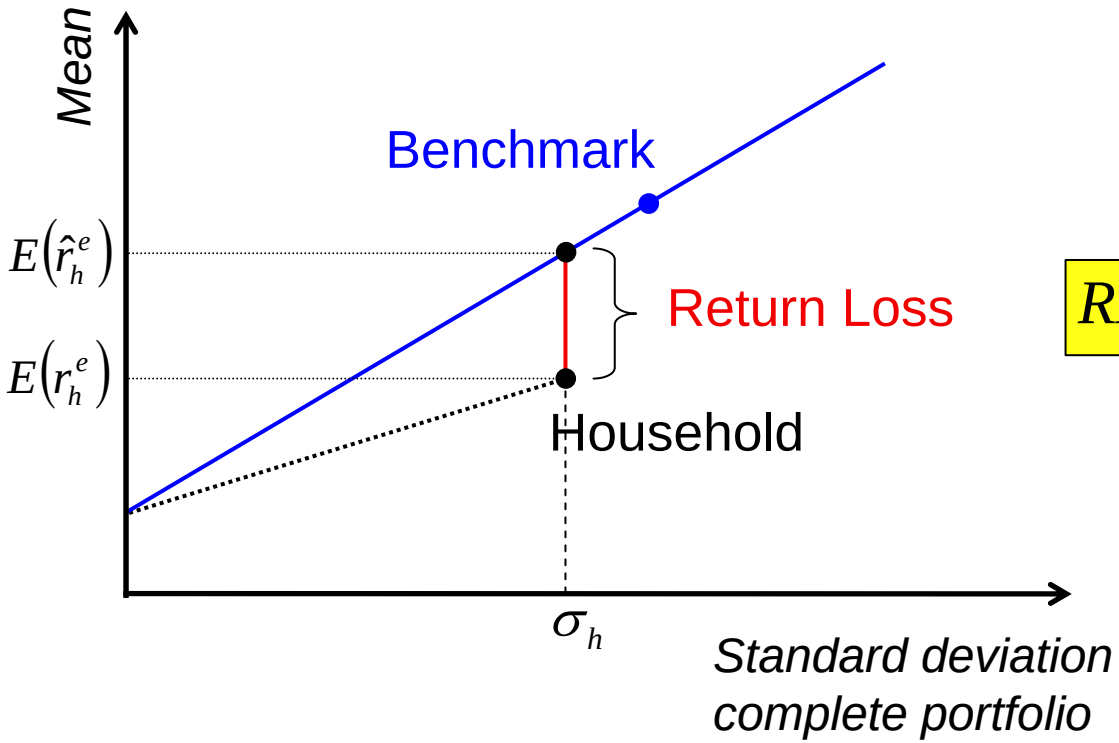
Benchmark	Hedged World Index		Unhedged World Index		Swedish Index in SEK		Maximal Sharpe Ratio	
Specification	CAPM	FF	CAPM	FF	CAPM	FF	CAPM	FF
Sharpe Ratio (%)	45.23	45.23	34.56	35.97	27.44	31.00	40.56	45.45
Complete Portfolios								
Mean	0.38	0.35	0.19	0.18	-0.02	0.05	0.31	0.35
Std Dev	0.15	0.15	0.19	0.19	0.24	0.22	0.16	0.15
25th Percentile	0.29	0.25	0.07	0.06	-0.16	-0.09	0.21	0.26
50th Percentile	0.35	0.32	0.14	0.14	-0.08	0.00	0.27	0.32
75th Percentile	0.42	0.40	0.24	0.25	0.04	0.13	0.35	0.41
90th Percentile	0.55	0.53	0.41	0.41	0.26	0.31	0.50	0.53
95th Percentile	0.69	0.68	0.60	0.60	0.49	0.54	0.66	0.69
99th Percentile	0.89	0.89	0.85	0.86	0.82	0.84	0.88	0.89
Stock Portfolios								
Mean	0.52	0.48	0.37	0.34	0.21	0.24	0.47	0.48
Std Dev	0.13	0.16	0.17	0.20	0.21	0.24	0.15	0.16
25th Percentile	0.42	0.40	0.25	0.24	0.05	0.12	0.36	0.40
50th Percentile	0.51	0.47	0.35	0.34	0.19	0.23	0.45	0.48
75th Percentile	0.58	0.54	0.45	0.42	0.31	0.33	0.53	0.54
90th Percentile	0.69	0.69	0.60	0.61	0.49	0.55	0.66	0.69
95th Percentile	0.77	0.77	0.70	0.71	0.62	0.66	0.74	0.77
99th Percentile	0.93	0.93	0.91	0.91	0.89	0.90	0.93	0.93

Sharpe Ratio Losses

- Reasonable level of diversification especially with respect to the unhedged world index and Swedish index
- Most popular mutual funds are well diversified internationally and do not offer currency risk exposure
- Non trivial fraction of population quite undiversified

Return Loss

- Relative Sharpe ratio loss does not consider the amount of risk a household is taking
- Average return the investor is giving up by choosing a suboptimal portfolio compared to a benchmark



$$RL_h = S_B\sigma_h - S_h\sigma_h$$

$E\left(\hat{r}_h^e\right)$ $E\left(r_h^e\right)$

Return Loss

As a Fraction of Financial Wealth

Benchmark	Hedged World Index		Unhedged World Index		Swedish Index in SEK		Maximal Sharpe Ratio	
Specification	CAPM	FF	CAPM	FF	CAPM	FF	CAPM	FF
Sharpe Ratio (%)	45.23	45.23	34.56	35.97	27.44	31.00	40.56	45.45
Complete Portfolio Return Loss (%)								
Mean	1.68	1.54	0.66	0.66	-0.01	0.20	1.23	1.56
Std Dev	2.10	2.05	1.32	1.39	0.94	1.11	1.74	2.06
25th Percentile	0.54	0.48	0.09	0.07	-0.36	-0.17	0.36	0.49
50th Percentile	1.17	1.04	0.30	0.29	-0.11	0.00	0.79	1.06
75th Percentile	2.06	1.83	0.71	0.72	0.05	0.22	1.45	1.86
90th Percentile	3.40	3.12	1.58	1.57	0.61	0.89	2.58	3.16
95th Percentile	5.04	4.71	2.65	2.69	1.17	1.68	3.97	4.76
99th Percentile	9.86	9.58	5.84	6.10	3.28	4.28	8.06	9.67
Risky Portfolio Return Loss (%)								
Mean	4.14	3.83	1.75	1.78	0.16	0.67	3.09	3.88
Std Dev	4.91	4.97	3.53	3.79	2.70	3.20	4.29	5.00
25th Percentile	2.01	1.81	0.40	0.34	-0.82	-0.49	1.31	1.84
50th Percentile	2.92	2.55	0.87	0.86	-0.39	0.02	1.97	2.59
75th Percentile	4.21	3.84	1.73	1.72	0.22	0.81	3.13	3.89
90th Percentile	8.51	7.75	4.61	4.50	1.93	2.87	6.82	7.83
95th Percentile	12.16	11.86	7.07	6.91	3.20	4.65	9.92	11.97
99th Percentile	17.91	17.86	11.25	12.08	7.52	8.98	14.81	18.00

Return Loss

Rescaled Measures

Benchmark	Hedged World Index		Unhedged World Index		Swedish Index in SEK		Maximal Sharpe Ratio	
Specification	CAPM	FF	CAPM	FF	CAPM	FF	CAPM	FF
Return Loss in USD								
Mean	740	638	321	278	43	85	557	646
Std Dev	2,243	1,954	1,127	1,342	768	1,648	1,756	1,978
25th Percentile	36	33	6	5	-55	-21	24	33
50th Percentile	131	118	33	30	-8	0	91	120
75th Percentile	433	383	133	121	4	24	302	389
90th Percentile	1,190	1,039	426	388	78	138	847	1,056
95th Percentile	2,204	1,922	851	762	218	324	1,609	1,952
99th Percentile	7,565	6,341	3,244	2,892	1,129	1,521	5,640	6,429
Return Loss as a Fraction of Disposable Income (%)								
Mean	2.13	1.88	0.86	0.79	0.02	0.20	1.58	1.91
Std Dev	9.64	9.07	5.34	5.48	3.19	3.95	7.70	9.16
25th Percentile	0.14	0.13	0.02	0.02	-0.20	-0.08	0.10	0.13
50th Percentile	0.51	0.46	0.13	0.12	-0.03	0.00	0.35	0.46
75th Percentile	1.64	1.45	0.52	0.48	0.02	0.10	1.16	1.47
90th Percentile	4.48	3.94	1.62	1.53	0.32	0.57	3.21	4.00
95th Percentile	7.84	6.85	3.13	2.92	0.89	1.33	5.72	6.95
99th Percentile	23.99	20.82	11.40	10.18	4.48	5.60	18.48	21.14

Return Losses

- Modest return losses in complete portfolios especially wrt unhedged world index and Swedish index
- Risky portfolios have return losses three times as large as complete portfolios
- 5% population loosing more than 5% per year wrt hedged world index
- Results robust to rescaling

Who is undiversified and why?

Return Loss Decomposition

- Decompose the complete portfolio return loss

$$RL_{complete,h} = E(r_m^e)\ w_h\ \beta_{risky,h}\ \frac{RSRL_h}{1 - RSRL_h}$$

Risky asset share

(aggressiveness)

Systematic exposure of risky portfolio

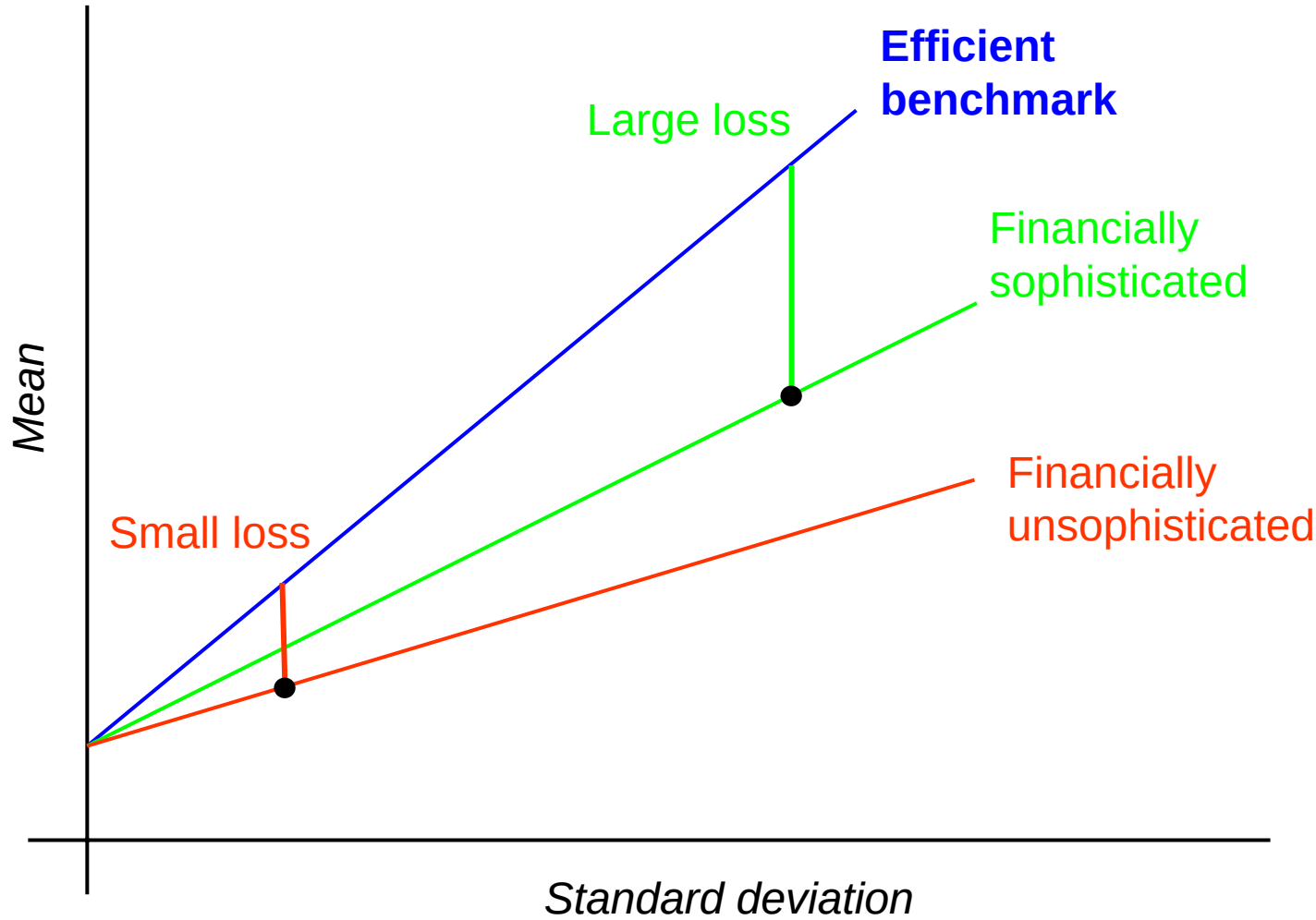
Diversification loss

Portfolio Inefficiency

Contributors to Complete Return Loss

	Return Loss $\ln(RL_{complete,h})$			Risky Share $\ln(w_h)$			Risky Portfolio Beta $\ln\lvert\beta_h\rvert$			Diversification Loss $\ln\lvert RSRL_h/(1\text{-}RSRL_h)\rvert$		
	Estimate	Std Err	Change	Estimate	Std Err	Change	Estimate	Std Err	Change	Estimate	Std Err	Change
Intercept	-1.093	0.055	–	-2.752	0.053	–	-0.108	0.027	–	-0.127	0.030	–
Disposable Income	0.007	0.002	2.1%	-0.007	0.002	-2.1%	0.009	0.001	2.7%	0.005	0.001	1.5%
Log of Financial Wealth	0.090	0.004	14.1%	0.137	0.004	22.3%	-0.016	0.002	-2.2%	-0.032	0.002	-4.5%
Log of Real-Estate Wealth	0.008	0.001	5.1%	0.005	0.001	3.2%	0.003	0.001	2.1%	0.000	0.001	-0.3%
Age	-0.001	0.001	-1.9%	-0.001	0.001	-1.9%	-0.002	0.000	-3.7%	0.002	0.000	3.8%
High-School Dummy	0.111	0.016	10.5%	0.107	0.016	10.2%	0.057	0.008	5.6%	-0.053	0.009	-5.5%
Post High-School Dummy	0.173	0.013	18.9%	0.124	0.013	13.2%	0.042	0.007	4.3%	0.006	0.007	0.6%
Missing Education	0.112	0.024	11.9%	0.087	0.024	9.1%	-0.037	0.012	-3.7%	0.063	0.013	6.5%
Immigration Dummy	0.043	0.017	4.4%	-0.112	0.017	-10.6%	0.045	0.009	4.6%	0.110	0.009	11.6%
Household Size	-0.143	0.005	-16.9%	-0.086	0.005	-10.5%	-0.010	0.002	-1.3%	-0.047	0.003	-5.9%
Retired Dummy	-0.043	0.022	-4.2%	-0.023	0.021	-2.3%	-0.050	0.011	-4.9%	0.031	0.012	3.1%
Unemployment Dummy	-0.086	0.021	-8.2%	-0.105	0.021	-9.9%	-0.001	0.011	-0.1%	0.020	0.012	2.0%
Entrepreneur Dummy	-0.115	0.029	-10.8%	-0.261	0.028	-22.9%	0.097	0.014	10.2%	0.049	0.016	5.0%
Student Dummy	0.020	0.031	2.0%	0.069	0.030	7.1%	-0.053	0.015	-5.2%	0.004	0.017	0.4%
Private Pension Premia/Incom	0.248	0.074	1.8%	0.352	0.071	2.6%	-0.016	0.037	-0.1%	-0.087	0.040	-0.6%
Log of Total Liabilities	0.012	0.001	7.0%	0.004	0.001	2.3%	0.010	0.001	5.6%	-0.002	0.001	-0.9%
Adjusted R^2	0.034			0.039			0.050			0.030		

Intuition


Efficient
benchmark
Large loss
Financially
sophisticated
Financially
unsophisticated
Small loss
Mean
Standard deviation

Who Incurs Return Losses?

- Financially sophisticated households (rich, educated, …) invest efficiently but take more risk
- Retired and unemployed households invest inefficiently and take less risk
- Entrepreneurs and larger households invest conservatively
- Overall, financially sophisticated non-entrepreneurial households have the greatest return losses

Consistent with the idea that people know their limitations

Nonparticipation

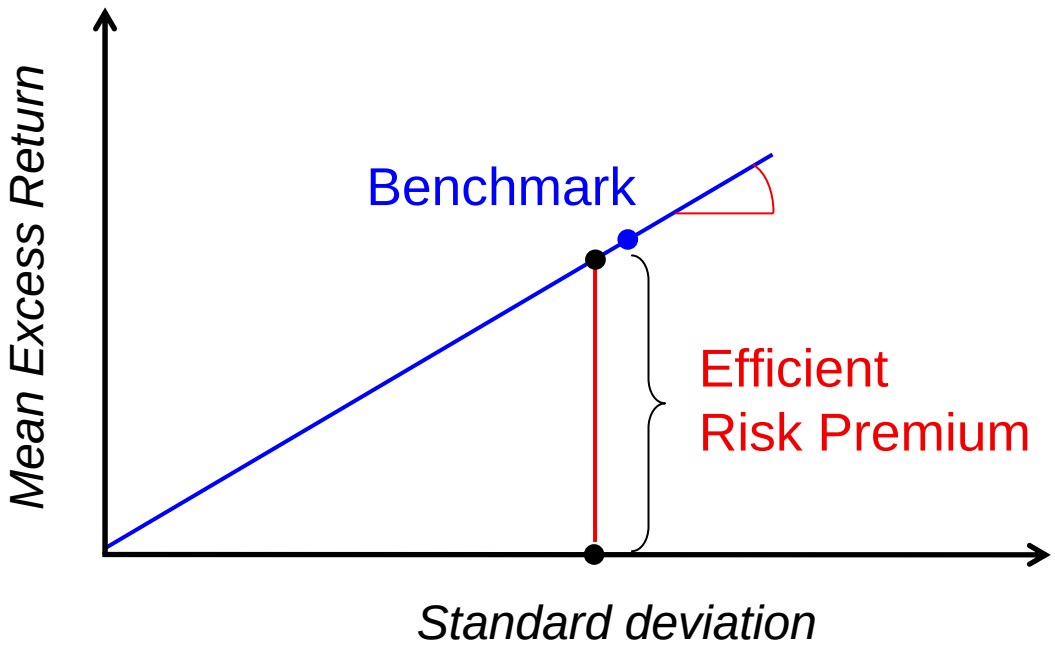
Who Participates?

- 62% of Swedish households participate (in 2002)
- We look at demographic determinants of participation
  - Non participants are financially unsophisticated households (poorer, less educated households unfamiliar with financial mrk)
  - Consistent with participation learning and setup costs
  - What are the benefits of participation? Risk premium

Down or Out?

- Welfare cost of nonparticipation

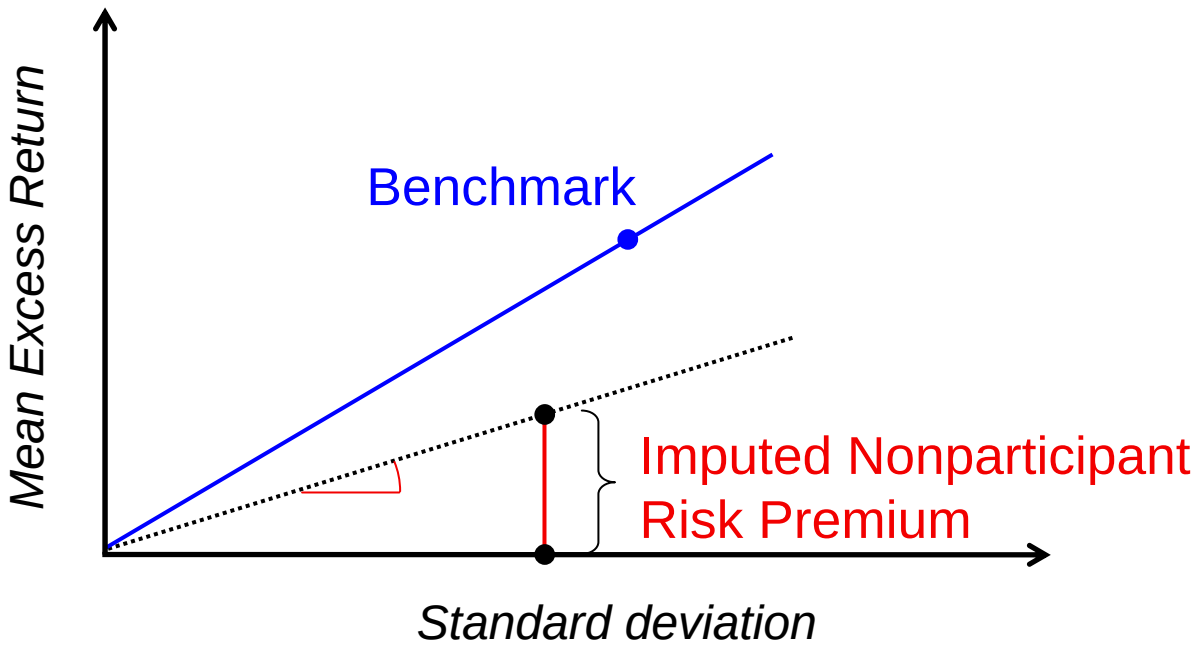
$$S_B \quad \sigma_{complete,p}$$



Down or Out?

- Welfare cost of nonparticipation

$S_h \quad \sigma_{complete,h}$



- Impute S_h and $\sigma_{complete,h}$ from non-participant characteristics
- If a household will invest poorly (“down”) it may not be such a bad mistake to stay “out”

Down or Out?

Scenarios				
Sharpe Ratio: S_h		**Portfolio Risk**: $\sigma_{complete,h}$		***Non Participation Cost***
Hedged World Index	45.2%	Average Participant	9.50%	4.3%
Unhedged World Index	34.6%	Average Participant	9.50%	3.3%
Inputed on Average Non-Participant	26.9%	Inputed on Average Non-Participant	8.40%	2.3%
Inputed on Non-Participant with dummies = 0	27.0%	Inputed on Non-Participant with dummies = 0	7.60%	2.1%
Inputed on Immigrant Non-Participant	25.9%	Inputed on Immigrant Non-Participant	8.50%	2.2%
Inputed on Unemployed Non-Participant	26.8%	Inputed on Unemployed Non-Participant	7.60%	2.0%

Conclusions

- Many Swedish households are quite well diversified
  - mutual funds play a vital role in diversification
- A minority of households are undiversified
- Financial sophistication improves portfolio efficiency but also increases risk-taking resulting in higher return losses
- You might want to be ”out” if you are going to be ”down”

Only in Sweden?

- Are households smart or is diversification the result of the Swedish specific institutional framework?
- “Fight or Flight? Portfolio Rebalancing by Individual Investors”
  - Active rebalancing which offsets about ½ of idiosyncratic passive variations in the risky asset share
  - Sophisticated households tend to rebalance more aggressively
- Results seem to hold in the US (SCF data with imputed portfolio risk and expected return)