Asset Management

Advanced Investments

Prof. Dr. Thorsten Hens
University of Zurich

14th September 2020

ZZ VERMÖGENSBERATUNG (SCHWEIZ) AG

Portfolio Management Program

A unique Masters Programm

sponsored by the PoK-foundation

September 14, 2020

Background

- The **Portfolio Management Program** is a Master seminar series at UZH supported by an industry partner (ZZ Vermögensberatung).

- It enables students to participate in a unique seminar where they can deepen their theoretical as well as their **practical financial knowledge** and gain valuable experience in the field of asset management.

- Seminar participants get to know various fields of **asset management,** from strategy analysis and strategy conception to trading, risk management, and controlling. They manage **three real-money portfolios of approx. 1.5 Mio EUR each.**

Course Structure

- The program is a two-year commitment
- Students are awarded 21 ECTS Credits

Year 1				Year 2	
Fall Term			Spring Term	Fall Term	Spring Term
Course: Asset Mgt: Advanced Investments	Seminar: Portfolio Management Theory I	Course: MATLAB for Portfolio Management	Seminar: Portfolio Management Theory II	Seminar: Portfolio Management Implementation I	Seminar: Portfolio Management Implementation II
3 ECTS Credits	3 ECTS Credits	3 ECTS Credits	3 ECTS Credits	3 ECTS Credits	6 ECTS Credits

Application

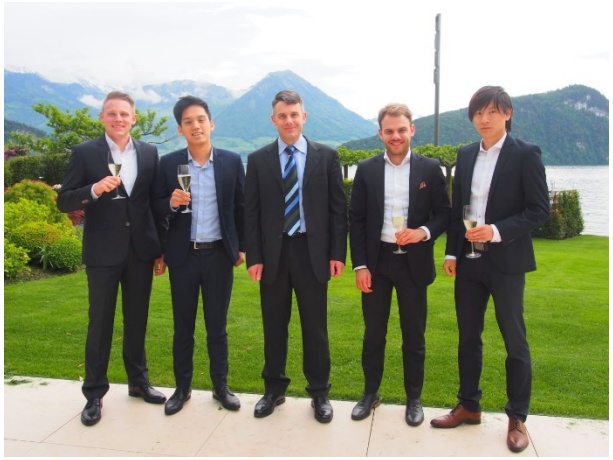
ZZ VERMÖGENSBERATUNG (SCHWEIZ) AG

- Interested students can send their complete applications for the Fall Semester 2020 in **a single PDF** file to **pmpadmin@bf.uzh.ch by Friday September 18.**

- There will be an **information session** on **Wednesday September 16** at 6 p.m. via Zoom: https://uzh.zoom.us/j/99238811793?pwd=ZjBUWkh4NU40UFc2VFl6cHpiamVWUT09; Meeting ID: 992 3881 1793, Passcode: 819294 (Link in Olat (Asset Management: Advanced Investments) or email me)

- Interviews to select this year‘s students will be held online on **Monday, September 21.**

Just do it!



Syllabus

Asset Management: Advanced Investments

Portfolio Management Theory I

Administrative Deadlines

Interviews / Exam

#	Day	Time	Place	Topic	Content	Instructor(s)
	Sat, 01/08			Official Start of the Semester		
	Mon, 14/09			Official Start of the Lectures		
1	Mon, 14/09	14.00-18.00	UZH	Introductory Lecture	Overview of the program; portfolio management strategies; asset allocation; portfolio optimization	Thorsten Hens Alexandre Ziegler
	Fri, 18/09			Final Application Deadline		
	Sat, 19/09			Invitations to Interviews		
	Mon, 21/09		UZH	Interviews Portfolio Management Program (all day)		
	Tue, 22/09			Announcement of Participants		
2	Mon, 28/09	14.00-18.00	UZH	Strategy Development	Portfolio Management Strategy Development	Alexandre Ziegler
	Fri, 09/10			Deadline Module Booking		

Syllabus

3	Mon, 05/10	14.00-18.00	UZH	Strategy Development	Portfolio Management Strategy Development	Alexandre Ziegler
4	Mon, 12/10	14.00-18.00	UZH	Portfolio Management Theory	Equities	Alexandre Ziegler
	Mon, 19/10	14.00-18.00	Online	Group Presentations & Expert Lecture		
5	Mon, 26/10	14.00-18.00	UZH	Portfolio Management Theory	Bonds/Interest rates	Alexandre Ziegler
6	Mon, 02/11	14.00-18.00	UZH	Portfolio Management Theory	Currencies	Alexandre Ziegler
7	Mon, 09/11	14.00-18.00	UZH	Portfolio Management Theory / Q&A Exam	Options/Volatility	Alexandre Ziegler
	Mon, 16/11	14.00-18.00	Online	Group Presentations & Expert Lecture		Thorsten Hens Matthias Uhl Alexandre Ziegler
	Mon, 23/11	16.15-20.00	Online	Guest Lecture		William T. Ziemba
	Mon, 30/11	14.00-18.00	UZH	Student Presentations	TBA	Thorsten Hens Matthias Uhl Alexandre Ziegler
	Mon, 07/12	14.00-18.00	Online	Group Presentations		Thorsten Hens Matthias Uhl Alexandre Ziegler
	Mon, 14/12	14.00-18.00	UZH	Student Presentations	TBA	Thorsten Hens Matthias Uhl Alexandre Ziegler
	Fri, 18/12			Official End of the Lectures		
	Mon, 11/01	14:00-16:00	UZH	Exam: Asset Management: Advanced Investments	Material from lectures 1-7 (Asset Allocation, Optimization, Strategy Development, Equities, Bonds, Currencies, and Options)	
	Sun, 31/01			Official End of the Semester		

Content

- **Definition Asset Management**
- Economic Foundations
- Practical Procedures
- Performance Measurement
- Summary
- References
- Bonus Material

Asset Management

Asset management:

"Investing into assets in order to achieve certain goals given some restrictions."

Example: achieve a high average return but make sure the volatility of your returns does not exceed a certain level.

Wealth management determines the goals and restrictions.

Risk management makes sure the restrictions are satisfied.

Example Pension Fund

- Board of directors:
  - Goal: achieve 4% on average over 5 years
  - Restrictions: coverage ratio above 90% at the end of each year
- Investment committee:
  - **Asset management**
    - Select asset classes
    - Define general rules
    - Select asset managers
    - Monitor returns and asset managers
  - Report results to board of directors
- Risk Management
  - Independent advisor checks risks and reports to board of directors.

Example “The Fisher Family”

- Relationship manager and family define:
  - Goal: achieve 7% on average over 10 years
  - Restrictions: make sure maximum drawdown below 20%
- Asset Management of the bank
  - Select asset classes
  - Invest consistent with goals and restrictions
  - Monitor returns
  - Report to relationship manager
- Regulator sets general rules (FIDLEG)
  - Asset Managers need to be qualified
  - Investment strategy shall be **suitable**
- Bankenombudsmann can be called

Content

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Asset Pricing Theories

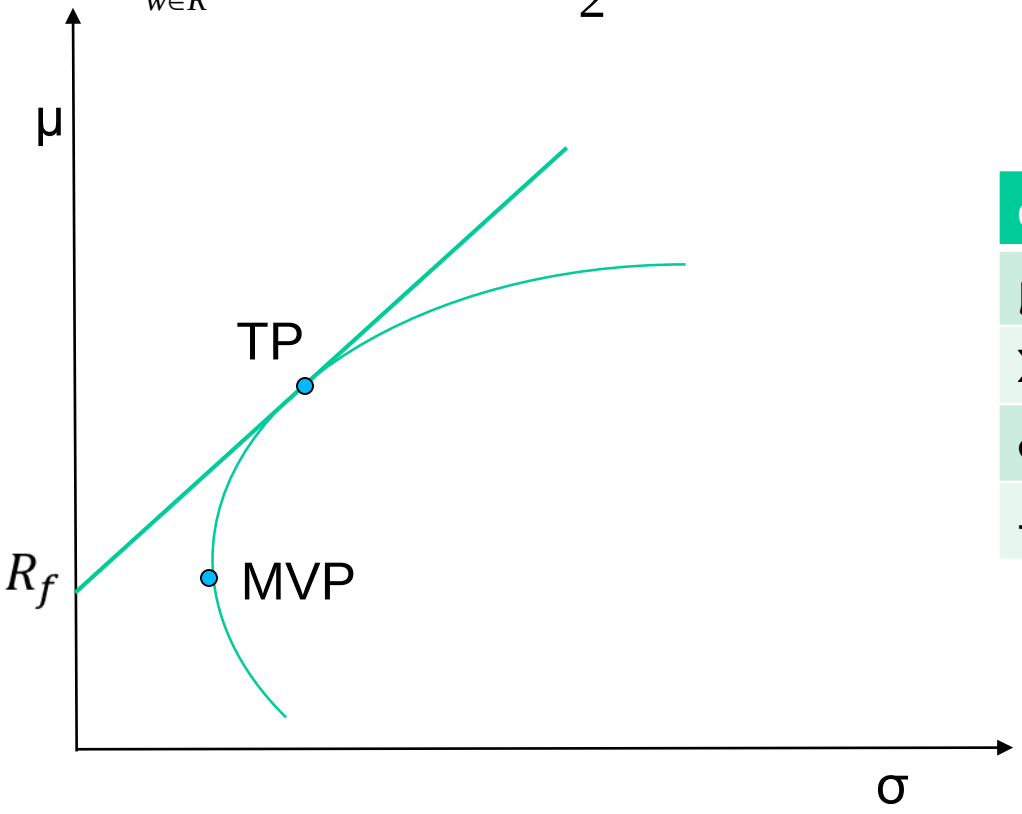
Theory	**Practice**
•Financial Analysis	•Value/Growth Investing
•Mean-Variance-Analysis	•Active Portfolio Management
•CAPM	•Indexing
•EPT	•Factor investing
•…	•…

Financial Analysis

Input	Firm 1	Firm 2
(1) price	70.00	40.00
(2) stocks	62'900'000	19'599'999
(3) profit	244'500'000	3'067'000
(4) book value	1'109'000'000	72'594'507
(5) cash flow	352'000'000	19'694'496
(6) earnings growth	5%	20%
Ratios		
P/E= ((1)*(2))/(3)	18.01	255.62
M/B = ((1)*(2))/(4)	3.97	10.80
PEG = PE / (6)	360.16	1'278.12
Weights		
P/E	0.40	0.40
M/B	0.40	0.40
PEG	0.20	0.20
Valuation	80.82	362.19
	Value stock	Growth stock

Mean-Variance Analysis

$$\max_{w \in R^K} \; w'(\mu - R_f 1) - \frac{a^i}{2} w' \Sigma w$$



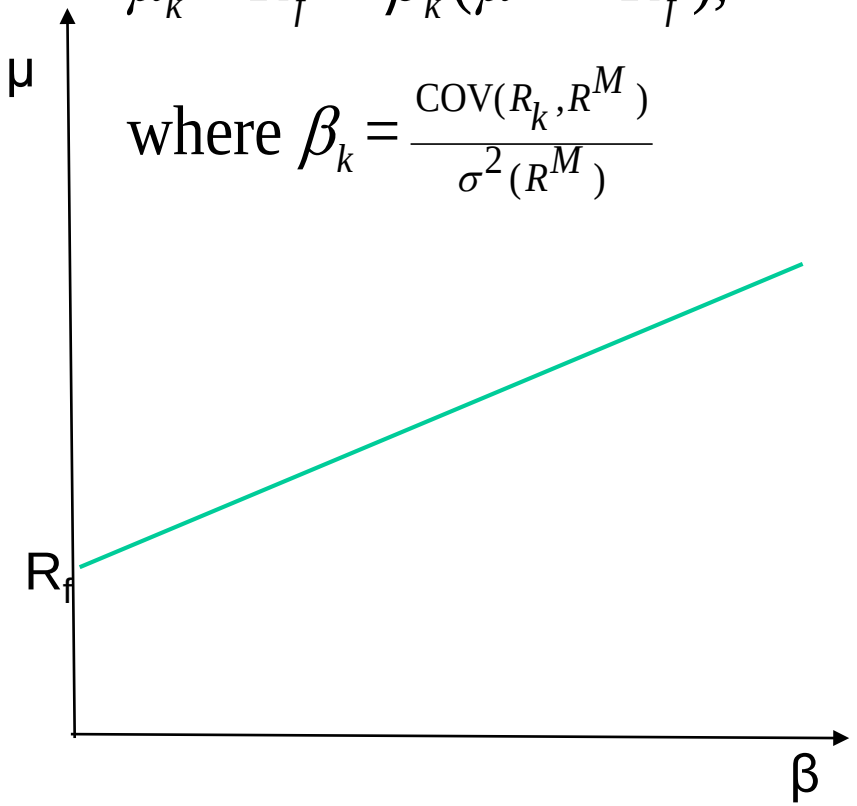
Estimation problems

estimate	portfolio
μ, Σ	TP
Σ	MVP
σ	ECR
-	1/K

CAPM

$$\mu_k - R_f = \beta_k (\mu^M - R_f),$$

where $\beta_k = \frac{\mathrm{COV}(R_k, R^M)}{\sigma^2(R^M)}$



Required Rate of Return

Only systematic risk is rewarded

Cross-section of asset returns

Empirical evidence

- weak for single assets
- better for asset classes
- anomalies
  - Size, Value, Momentum

Static

CAPM-Assumptions

- Standard Assumptions
  - Mean-Variance
  - Risk free asset
  - No background risk
  - Homogenous expectations

$$\mu_k - R_f = \frac{COV(R_k, R^M)}{\sigma^2(R^M)}(\mu^M - R_f)$$

- Generalizations
  - Heterogenous expectations

$$\bar{\mu}_k - R_f = \frac{COV(R_k, R^M)}{\sigma^2(R^M)}(\bar{\mu}^M - R_f)$$

  - Background risk

$$\mu_k - R_f = \frac{COV(R_k, R^M + R_y)}{COV(R^M, R^M + R_y)}(\mu^M - R_f)$$

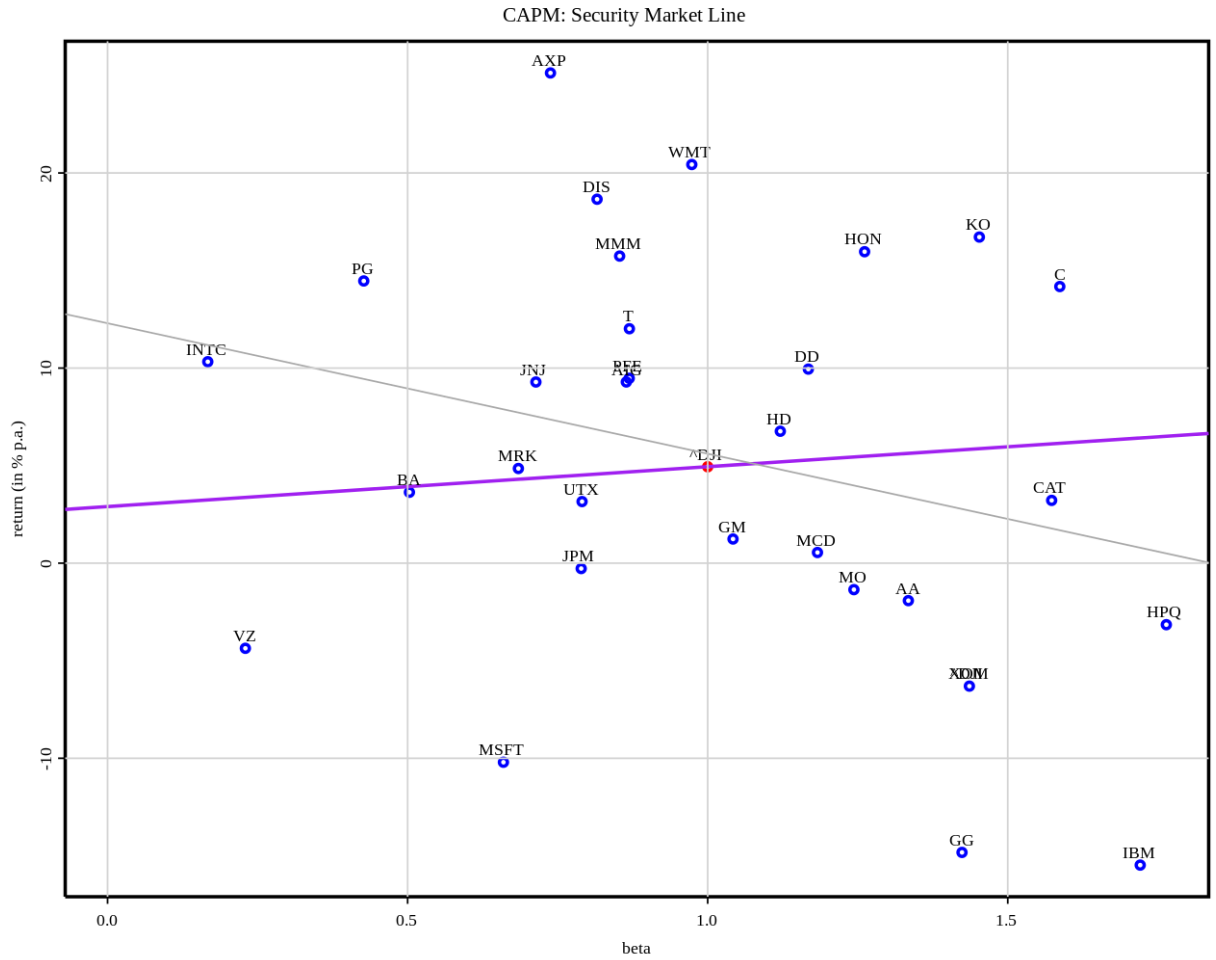
  - Heterogenous behavior

$$\mu_k - R_f = \frac{COV(R_k, R^M - r^I R^I)}{COV(R^M, R^M - r^I R^I)}(\mu^M - R_f)$$

  - No risk free asset

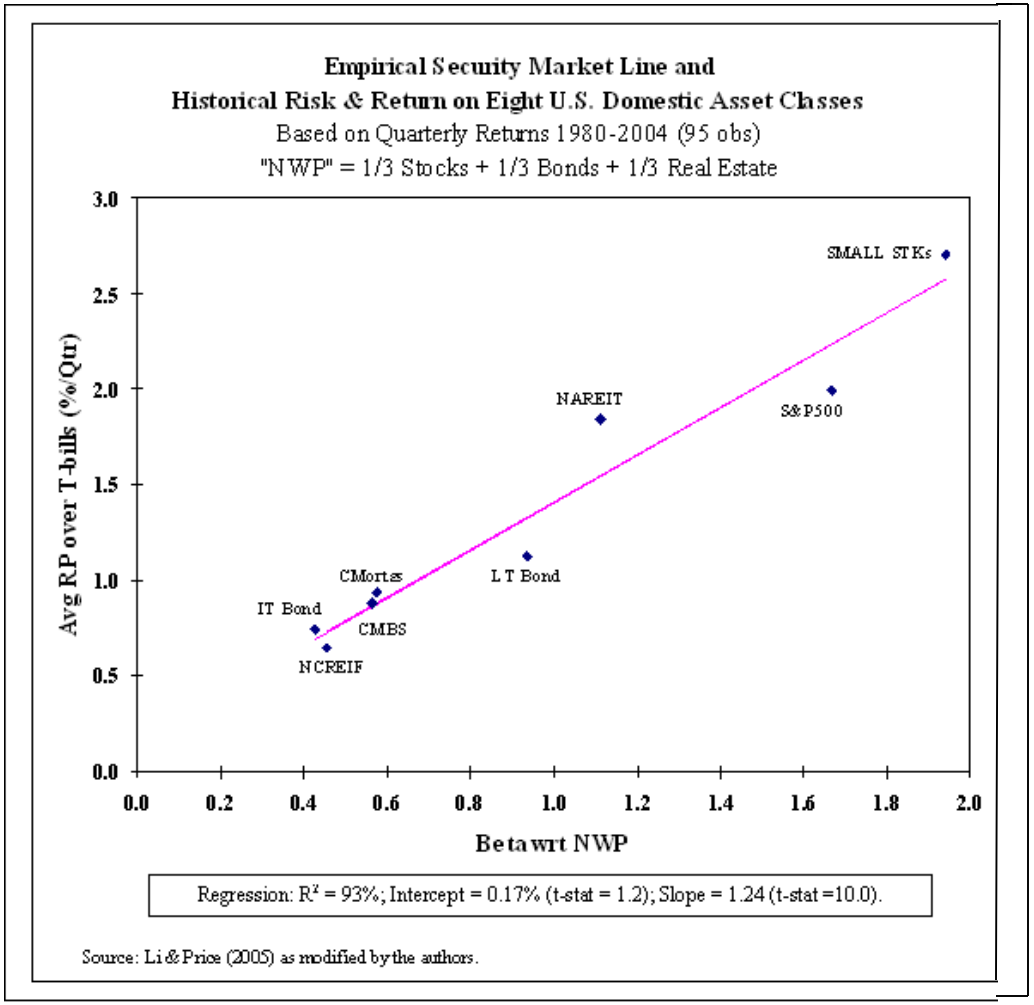
$$\mu_k - \mu_z = \frac{COV(R_k, R^M)}{\sigma^2(R^M)}(\mu^M - \mu_z), \text{ where } \frac{COV(R_z, R^M)}{\sigma^2(R^M)} = 0$$

CAPM on Single Stocks



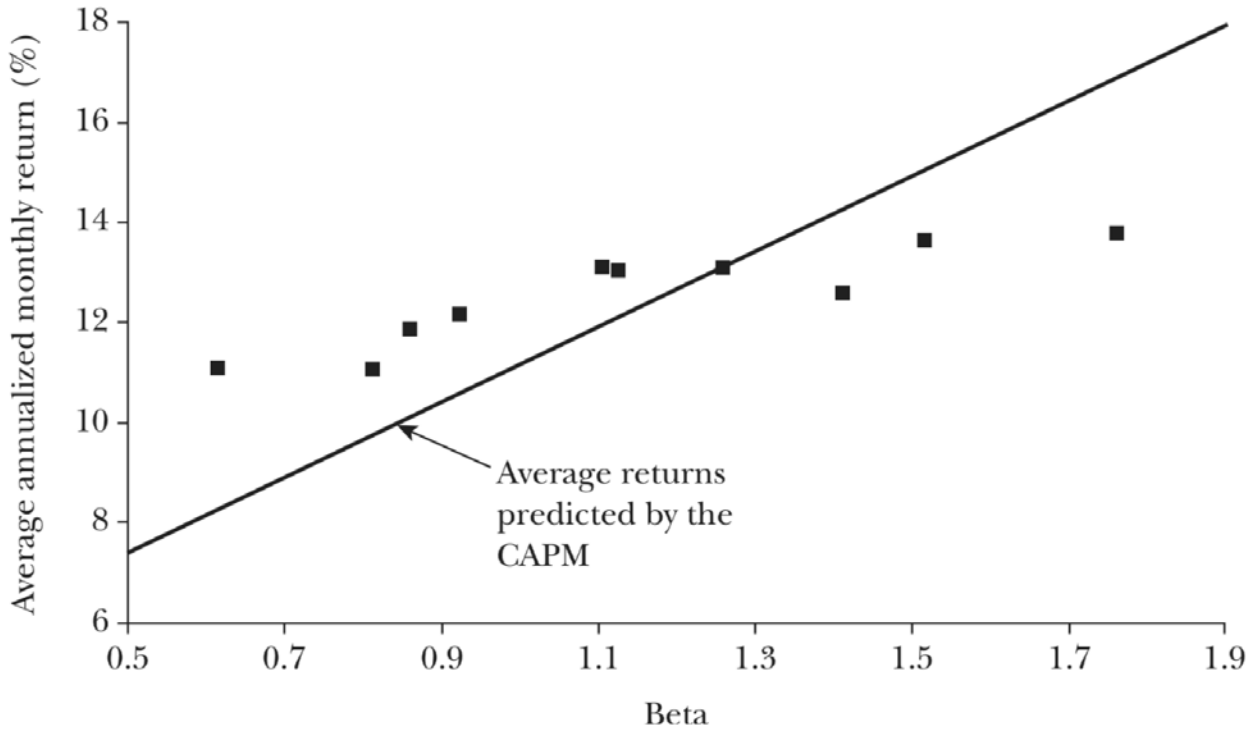
https://en.wikipedia.org/wiki/Capital_asset_pricing_model#/media/File:CAPM-SML.svg

CAPM on Asset Classes



CAPM Low Beta Anomaly

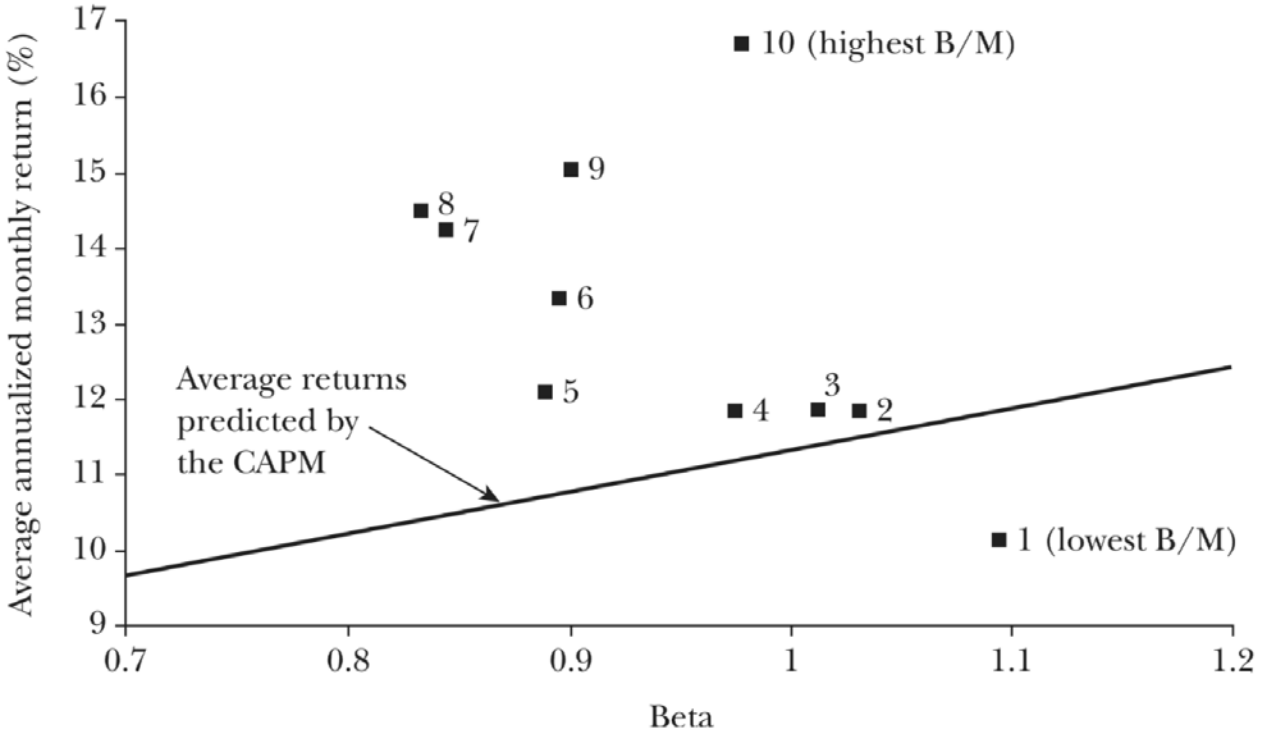
Abbildung 32: Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on Prior Beta, 1928–2003



Quelle: Fama & French (2004).

CAPM Value Anomaly

Abbildung 33: Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on B/M, 1963–2003



Quelle: Fama & French (2004).

EPT and Fama-French Factor Model

$$\mu(r_x) = r_f + \beta_{x,M}[r_M - r_f] + \beta_{x,SMB}SMB + \beta_{x,HML}HML + \beta_{x,UMD}UMD$$

SMB= Small Minus Big (Size Effect)

HML = High Minus Low (Value Effect)

UMD = Up Minus Down (Momentum)

…

Factor-Zoo: more than 200 factors have been suggested so far!

PCA shows: Different representation of same return space.

EPT (Evolutionary Portfolio Theory) models the dynamic interaction of factors.

EPT

Modelling of factor strategies i=1,...,I

$\lambda_t^{i,k}$ is percentage of wealth factor strategy i invests in asset k

Asset prices are given by average strategy: $q_t^k = \sum_{i=1}^{I} \lambda_t^{i,k} r_t^i, t = 1,...,T$

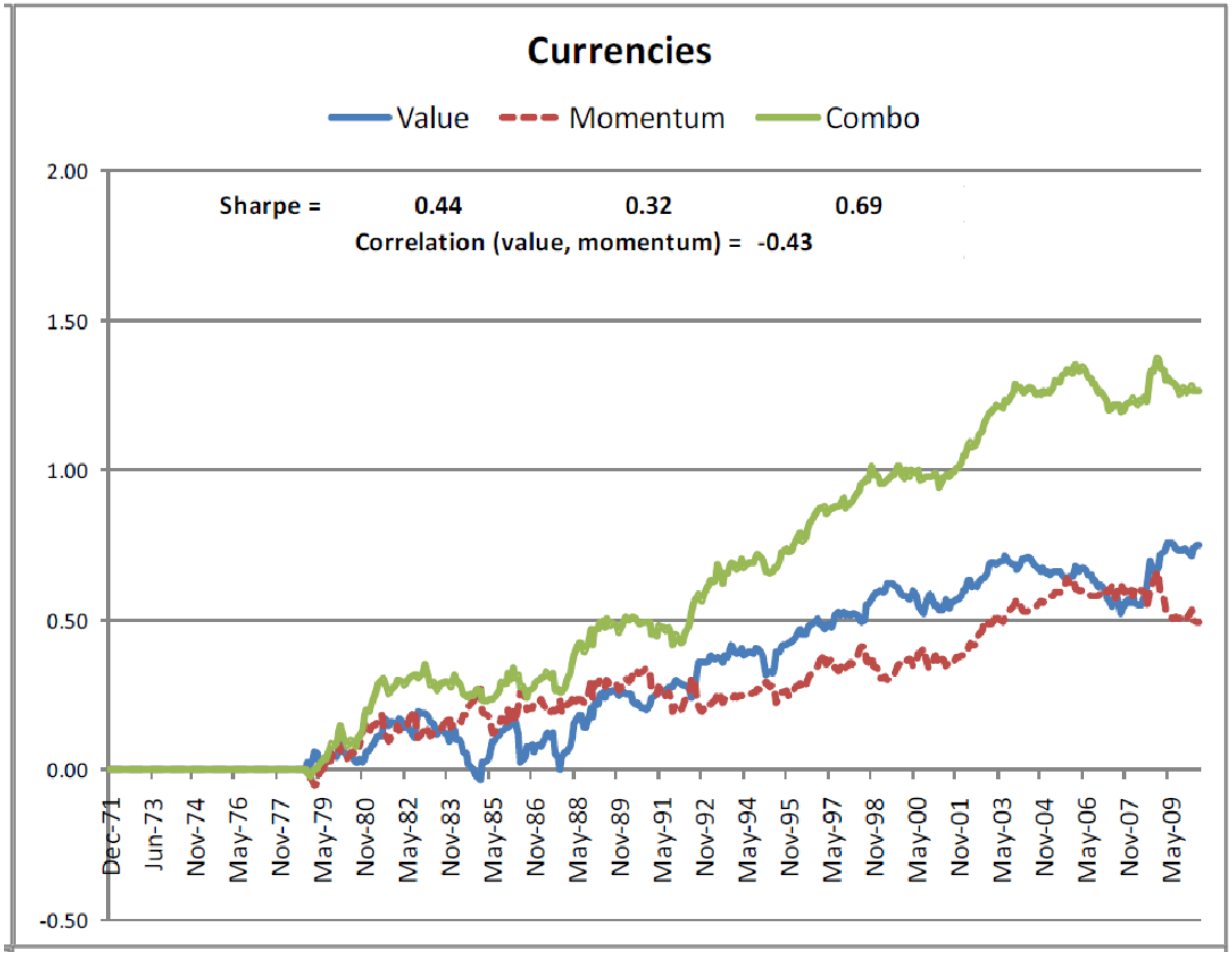
Return of asset k: $R_t^k = \frac{q_t^k + D_t^k}{q_{t-1}^k}, t = 1,...,T.$

Evolution of relative wealth: $r_{t+1}^i = \left\{ \sum_{k=1}^{K} \left[\frac{D_{t+1}^k + q_{t+1}^k}{q_t^k} \right] \lambda_t^{i,k} \right\} r_t^i$

Result: Random Dynamical System

$$r_{t+1} = \lambda_0 \left\{ Id - \left[\frac{\lambda_{t,k}^i r_t^i}{\sum_{i=1}^{I} \lambda_{t,k}^i r_t^i} \right]_i^k \Lambda_{t+1} \right\}^{-1} \left(\sum_{k=1}^{K} d_{t+1,k} \frac{\lambda_{t,k}^i r_t^i}{\sum_{i=1}^{I} \lambda_{t,k}^i r_t^i} \right)_i, \text{where } d_k = \frac{D_k}{\overline{D}}, \overline{D_t} = \sum_{k=1}^{K} D_k.$$

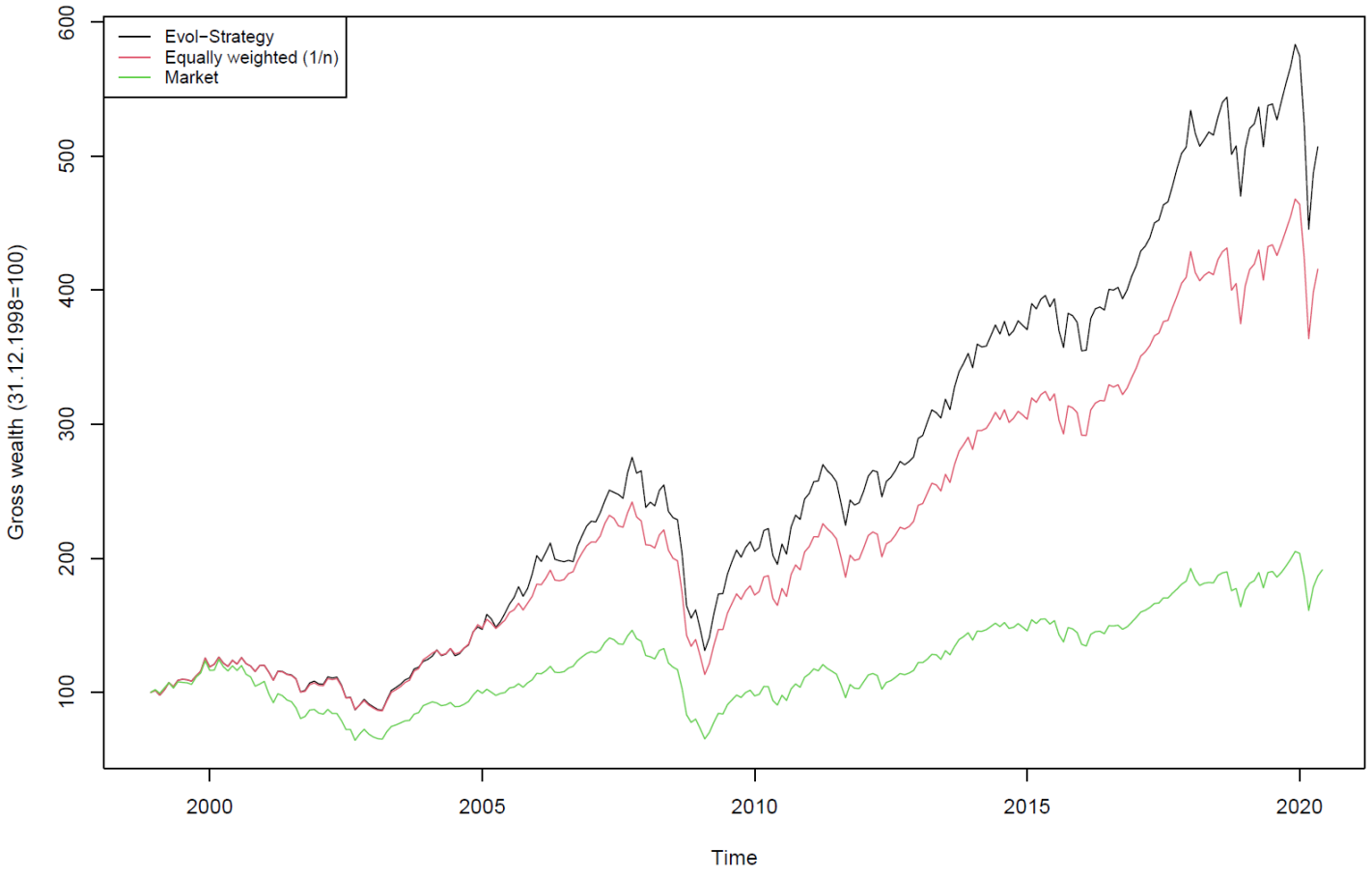
Combination of Factors



Asness et al. (2015)

*

Factor Rotation with EPT



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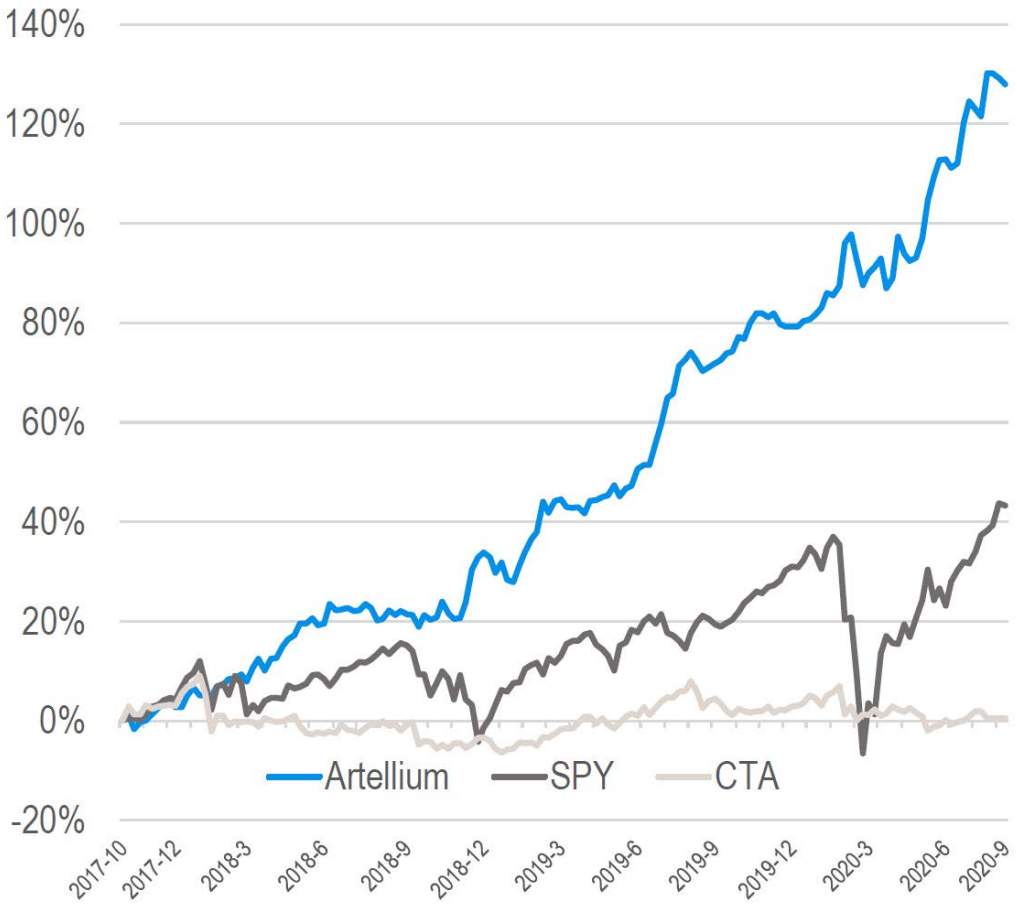
Big Data

Machine Learning

Artificial Intelligence

Does … work?



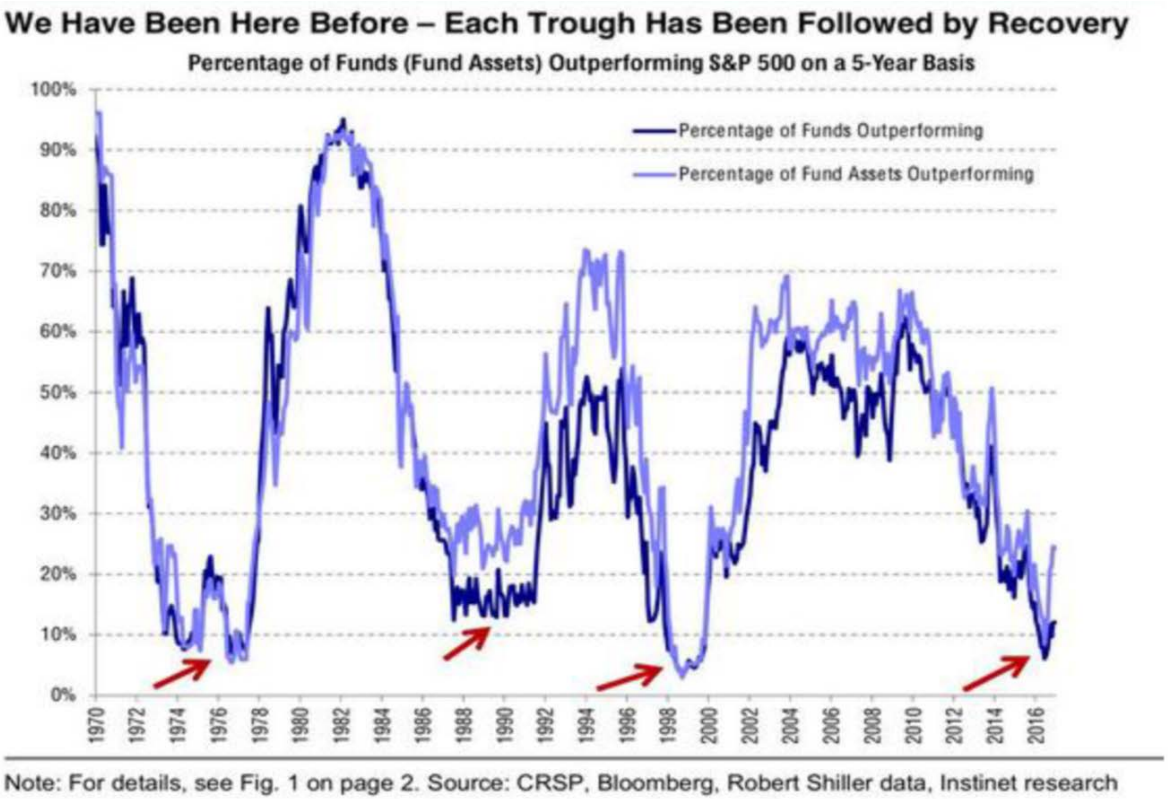
.. but why?

Active or Passive?

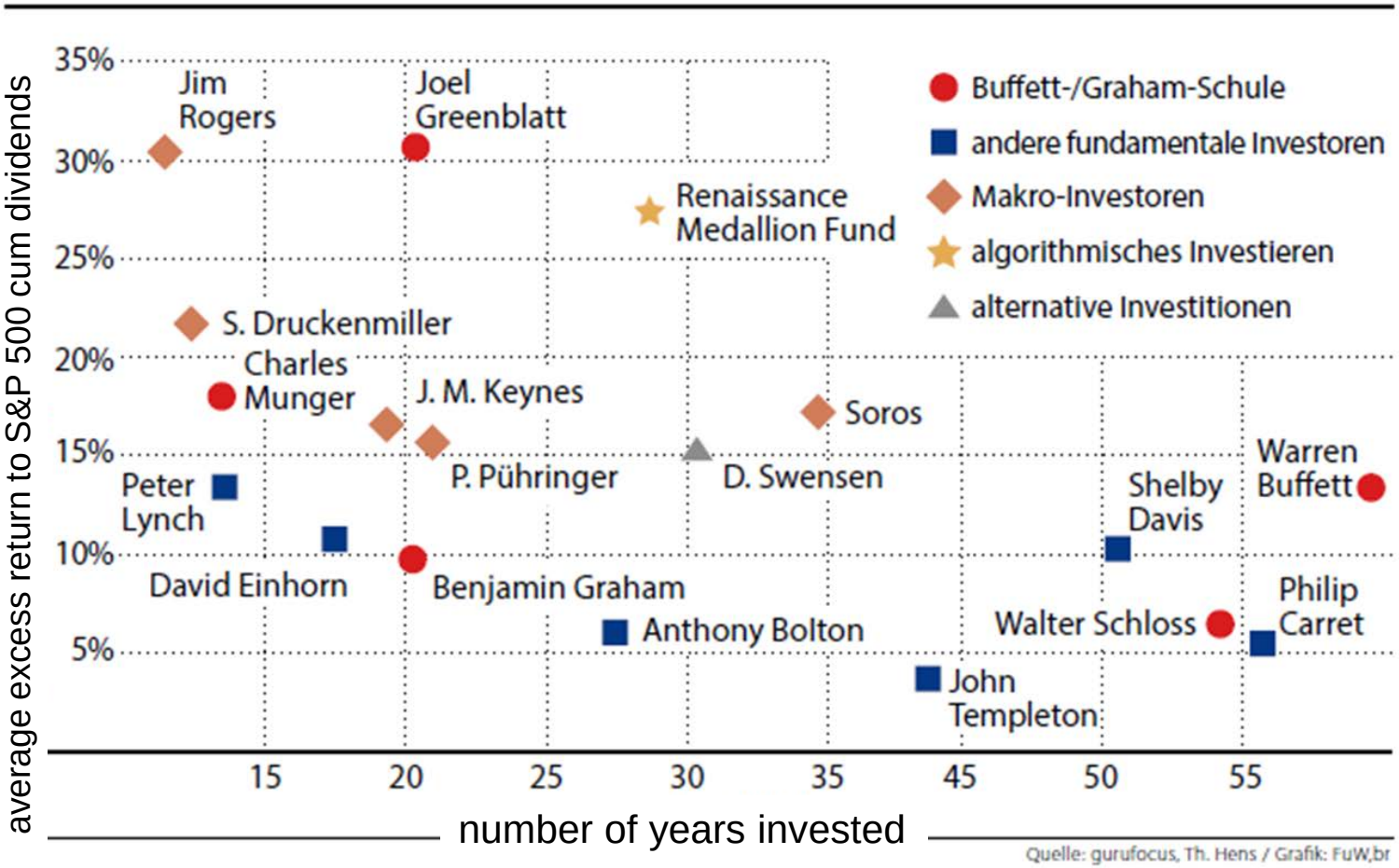
Passive = invest according to relative market capitalization

Grossman-Stiglitz-Theorem “Impossibility of Efficient Markets”

→ active-passive cycles



Great Investors: Luck, Skill or Personality?



Great Investors (Skill): Buffett's Alpha

$$r_t - r_t^f = \alpha + \beta_1 MKT_t + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \beta_5 BAB_t + \beta_6 QMJ_t + \varepsilon_t$$

6.3%	(1.58)	0.95	(10.98)	-0.15	(-1.15)	0.46	(3.28)	-0.05	(-0.71)	0.29	(2.67)	0.43	(2.34)

where

$r - r^f$ = Alpha,

MKT= **Market**, SMB = Size, HML = **value**, UMD = Momentum,

BAB = **low beta**, QMJ = **profitability**

Buffett's alpha cannot completely be replicated by known risk factors.

Reference: Frazzini, Kabiller, Pedersen (2014): Buffett`s Alpha.

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Practical Procedures

- SAA = Strategic Asset Allocation

  Allocation to asset classes that should be followed on long-term average

- TAA = Tactical Asset Allocation

  tactical deviation from SAA mostly on a monthly basis

- IAA = Is Asset Allocation

  implementation of TAA with investments

- Hedging
  - Overlay of SAA to satisfy restrictions (Downside risk, FX risk, …)

Approaches for SAA

- Mean-Variance Analysis (Standard)
- Mean-Downside Risk Analysis (Ortec)

How to determine the expected return (mean)

→ Standard: risk premia approach

→ Michael Schnetzer: yield approach

Yield (Carry Based) SAA

	Mean return	Standard deviation	Skew	Excess kurtosis	Sharpe ratio	MDD	MDD (from - to)
Annual returns							
US treasuries	5.97%	5.95%	0.13	-0.78	0.45	5.42%	31 Jan 94 - 30 Jun 94
US corporate bonds	7.06%	6.55%	0.24	0.07	0.58	15.42%	29 Feb 08 - 31 Oct 08
US high-yield bonds	9.67%	16.46%	0.95	2.13	0.39	33.31%	31 May 07 - 28 Nov 08
S&P 500	10.91%	17.64%	-0.75	0.45	0.43	50.95%	31 Oct 07 - 27 Feb 09

based on gordon growth model $\mu = \frac{CF}{P}(1+g)$

	Mean return	Standard deviation	Skew	Excess kurtosis	Sharpe ratio	MDD	MDD (from - to)
Annual returns							
$\text{Carry}_{\text{YELRDg}}$	9.45%	10.99%	0.14	1.21	0.56	23.89%	31 Oct 07 - 28 Nov 08
1/n	8.25%	8.86%	-0.01	0.84	0.56	20.11%	31 Oct 07 - 27 Feb 09
60/40	9.04%	11.23%	-0.58	0.82	0.51	33.21%	31 Oct 07 - 27 Feb 09
Market cap-weighted	8.57%	12.57%	-0.95	1.16	0.42	38.88%	31 Oct 07 - 27 Feb 09

Schnetzer (2019, JPM)

Approaches for TAA

- Passive Rebalancing (calendar time or event-driven)
- Qualitative Analysis (FMM market view)
  - FMM = fundamental monetary macro
- Quantitative Analysis
  - Vescore: Regressions on FMM-Indicators
  - Swissquant: Heat Map based on SR
- Rank-based:
  - Wang and Kochert
    - For each asset class compute the fundamental and momentum rank
  - Michael Schnetzer JPM 2
    - For each asset class compare how its FMM stand relative to their previous values

Score Card of Michael Schnetzer

Government bonds

	Valuation				Trend				Risk				Macro						Score
	rYTW		rYTW/D		Mom		Mom 1m		TED spread		Debt/GDP[1]		Bus. conf.		Unempl.[1]		Term spread		
US Treasuries	0.78	0.42	0.15	0.42	0.06	0.48	-0.02	0.07	0.16	0.22	85.10	0.01	57.30	0.87	9.80	0.07	2.73	0.61	**0.33**
UK Gilts	-0.26	0.08	-0.03	0.08	0.08	0.70	0.00	0.36	0.19	0.69	71.50	0.02	-2.40	0.75	7.80	0.06	2.68	0.85	**0.38**
Eurozone Gov't Bonds	1.29	0.39	0.21	0.37	0.01	0.15	-0.01	0.25	0.61	0.83	82.30	0.02	2.60	0.81	10.20	0.06	2.18	0.78	**0.39**
Japan Gov't Bonds	0.67	0.25	0.09	0.21	0.02	0.59	0.01	0.86	0.05	0.31	170.20	0.04	-4.00	0.49	5.10	0.33	0.96	0.21	**0.37**

Corporate bonds

	Valuation				Trend				Risk				Macro						
	rYTW		OAS		Mom		Mom 1m		TED spread[1]		HY OAS[1]		Bus. conf.		Unempl.[1]		Term spread		
US Corporate Bonds	2.92	0.61	1.56	0.52	0.09	0.68	-0.01	0.16	0.16	0.79	5.26	0.55	57.30	0.87	9.80	0.07	2.73	0.61	**0.54**
US High-Yield Bonds	6.41	0.54	5.26	0.46	0.15	0.78	0.02	0.72	0.16	0.79	5.26	0.55	57.30	0.87	9.80	0.07	2.73	0.61	**0.61**
UK Corporate Bonds	2.23	0.07	2.34	0.79	0.09	0.74	0.00	0.46	0.19	0.32	7.00	0.43	-2.40	0.75	7.80	0.06	2.68	0.85	**0.49**
Eurozone Corp. Bonds	1.99	0.39	2.12	0.87	0.05	0.44	0.00	0.25	0.61	0.18	5.96	0.49	2.60	0.81	10.20	0.06	2.18	0.78	**0.46**
Japan Corp. Bonds	0.54	0.16	0.27	0.59	0.02	0.75	0.00	0.63	0.05	0.70	0.61	0.41	-4.00	0.49	5.10	0.33	0.96	0.21	**0.49**

Equities

	Valuation				Trend				Risk				Macro						
	DY		P/E[1]		Mom		Mom 1m		Vol. index[1]		HY OAS[1]		Bus. conf.		Unempl.[1]		Term spread		
US Equities	1.88	0.67	15.41	0.90	0.08	0.52	0.07	0.93	17.75	0.60	5.26	0.55	57.30	0.87	9.80	0.07	2.73	0.61	**0.65**
UK Equities	3.17	0.28	14.12	0.71	0.05	0.43	0.07	0.94	18.84	0.57	7.00	0.43	-2.40	0.75	7.80	0.06	2.68	0.85	**0.56**
Eurozone Equities	4.09	0.82	11.22	0.91	-0.07	0.39	0.05	0.88	23.92	0.49	5.96	0.49	2.60	0.81	10.20	0.06	2.18	0.78	**0.63**
Japan Equities	1.96	0.86	15.15	0.97	-0.03	0.46	0.04	0.84	18.79	0.77	0.61	0.41	-4.00	0.49	5.10	0.33	0.96	0.21	**0.63**

Performance (Michael Schnetzer Paper 2)

	Mean return	Standard deviation	Sharpe ratio	Inf. ratio	Tracking error	Months outperf'ed	G/L ratio	relative MDD	relative MDD (from - to)
1/n	5.87%	7.82%	0.55						
$1/n_{TAA}$	6.12%**	7.87%	0.58	0.65	0.38%	0.62	1.02	0.81%	28 Feb 11 - 30 Sep 11
60/40	7.03%	9.44%	0.55						
$60/40_{TAA}$	7.37%**	9.54%	0.57	0.71	0.47%	0.61	1.13	1.02%	27 Feb 09 - 30 Sep 11
Market cap	6.20%	8.66%	0.49						
Market cap_{TAA}	6.55%***	8.74%	0.52	0.73	0.49%	0.60	1.17	1.06%	27 Feb 09 - 30 Sep 11
Carry	6.62%	8.81%	0.54						
$Carry_{TAA}$	6.81%*	8.95%	0.54	0.50	0.38%	0.61	0.96	1.02%	29 Jun 07 - 31 May 12

Approaches for IAA

- Make
  - Screening tool (value, size, quality, momentum,..)
  - Qualitative analysis
- Buy
  - Asset manager selection criteria
    - Returns, risk, alpha, …
    - Team (stability, single-person risk, ..)
    - Personality of key team members
  - Use Watch Lists!

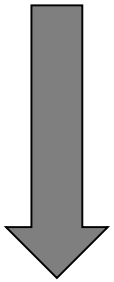
Hedging

- FX-Hedging
  - Standard rule:
    - Hedge nominal assets
    - Partially hedge real assets
  - Typically FX-hedging for CHF investor reduces vola by keeping mean
- Tail-Risk Hedging
  - When you have an asymmetric payoff function (e.g. coverage ratio restr.)
  - Offensive risk management
    - Hedge Tails but increase exposures to offset the hedge costs

Final Remarks

- Explanatory power of *AA for observed returns
  - SAA 75%
  - TAA 20%
  - IAA 5%

- Quantitative or qualitative approach
  - SAA
  - TAA
  - IAA
  - Trading



more qualitative

more quantitative

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Performance Attribution

Brinson decomposition

Sector	TAA Weight	SAA Weight	IAA Return	BeMa Return	Attrib. TAA	Attrib. IAA	Inter-action	Total Active
Equities	90%	70%	5.00%	3.00%	0.12%	1.40%	0.40%	1.92%
Cash	10%	30%	1.00%	1.00%	0.28%	0.00%	0.00%	0.28%
Total	100%	100%	4.60%	2.40%	0.40%	1.40%	0.40%	2.20%

$$\underset{2.2\%}{R^{active}} = \underbrace{\sum_k TAA_k R_k^{IAA}}_{\substack{R^{pofo} \\ 4.6\%}} - \underbrace{\sum_k SAA_k R_k^{BMA}}_{\substack{R^{BMA} \\ 2.4\%}} = \underbrace{\sum_k (TAA_k - SAA_k) \mathrm{R}_k^{BMA}}_{\substack{Attr.TAA \\ 0.4\%}} + \underbrace{\sum_k SAA_k (\mathrm{R}_k^{IAA} - \mathrm{R}_k^{BMA})}_{\substack{Attr.IAA \\ 1.4\%}} + \underset{\substack{Attr.Int \\ 0.4\%}}{\mathrm{INT}}$$

Performance Measures

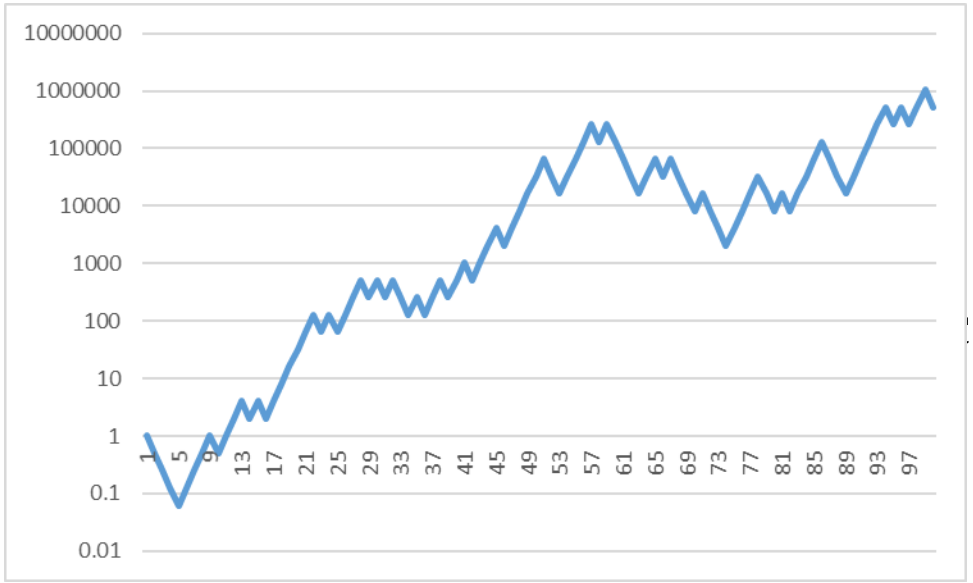
- Average return (arithmetic or geometric)
- TWR or MWR (see below)
- Risk (vola, VaR, MDD,…)
- Risk Adjusted Return (SR, DSR,TR,..)
- Benchmark Deviation (TE, …)

Performance Measures

- Which average?

	arithmetic			geometric		
	Asset 1	**Asset 2**	**50:50**	**Asset 1**	**Asset 2**	**50:50**
s = 1	0%	100%	50%	1	2	1.5
s = 2	0%	-50%	-25%	1	0.5	0.75
average	0%	25%	12.5%	0	0	6%

linear non-linear



Performance Measures

- TWR (time weighted return)
  - A manager has invested a fixed amount X over t = 1,…,T years.
  - His TWR measures the average return he was able to achieve:

$$TWR = \left(\prod_{t=1}^{T} R_t \right)^{1/T}$$

- MWR (money weighted return)
  - A manager has invested variable amounts X_t over t = 1,…, T years
  - His MWR is the IRR (internal rate of return) he was able to achieve:

$$\sum_{t=1}^{T} \frac{CF_{in}}{(MWR)^t} = \sum_{t=1}^{T} \frac{CF_{out}}{(MWR)^t}$$

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- Economic Foundations
- Practical Procedures
- Performance Measurement
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Summary

- Asset Management …
  - is an important service for institutional and for private investors
  - takes goals and restrictions as given
  - can be based on various asset pricing theories
- So far in practice management procedures are more important than theories/maths
- **This course shall encourage you to develop better support for practice!**

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References

- **Value Investing:** Greenwald (2004):”Value Investing: From Graham to Buffett and Beyond”,Wiley Finance.
- **Mean-Variance Investing**: Grinold and Kahn (1995):”Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Selecting Superior Returns and Controlling Risk”, MacGrawhill.
- **CAPM Investing:** Litterman (2003):”Modern Investment Management: An Equilibrium Approach”, John Wiley & Co.
- **Factor Investing:** Ang (2014):”Asset Management: A Systematic Approach to Factor Investing”, Oxford University Press.

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Bonus Material: Value Investing

→ See other slide set