Investment management

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Toulouse Business School

Course summary

- The course provides foundations that underpin popular passive, active, and smart-beta portfolio management techniques and provides a guide to their implementation.

- Students will get exposure to several passive (equity indexing), active, and smart-beta investment strategies; investment styles; and widely used portfolio performance evaluation techniques.

- On completing the course, students will be able to:
  - understand the key steps of investment management process
  - implement passive investment strategies & construct portfolios that systematically capture commonly used asset pricing factors
  - evaluate portfolio performance and analyse its sources
  - use Python to programme simple financial applications that are commonly used in quantitative equity investment management

Course organisational structure

1. Lectures & lab sessions
   15 hours of face-to-face instruction (4 lectures and 1 lab)
2. Office hours
   Agreed via email/Zoom
3. Contact details
   Email: m.zagonov@tbs-education.fr
4. Supporting materials
   see course page on C@mpus and GitHub

Course assessment

The course grade is made up of the following:

40% 2 practical assignments (partially completed during lab sessions in class)

60% class group presentation (lecture 5 of the course)

Class group presentation

Reference articles for presentations, as well as a presentation template document, will be provided

- class presentations during last lecture
- after first lecture, submit the names of your group members HERE (max. 2 members per group)
- academic articles to be presented by each group & a detailed presentation template will be provided in class
- 2 days before last lecture, upload your completed presentation HERE
- last lecture – be ready to present. You will have 10-15 minutes to present without interruptions, followed by audience questions. Your presentation should address all points listed in the template document.

Reading list

Core textbook:

[1] Bodie, Z., A. Kane, and A. J. Marcus. Investments, any available edition, McGraw Hill/Irwin.

Optional textbooks:

[1] Fabozzi, F.J. et al., 2003. The handbook of equity style management, 3rd edition, John Wiley & Sons, Inc.

[2] Klein, R.A. and J. Lederman, 1995. Equity style management: evaluating and selecting investment styles, Irwin Professional publishing

[3] Fabozzi, F.J. and T.D. Fabozzi, 1990. Current topics in investment management. Harper & Row, New York.

[4] Lofthouse, S., 1994. Equity investment management. John Wiley & Sons, Inc.

[5] Arnott, R.D. and Fabozzi, F.J., 1992. Active asset allocation. McGraw-Hill Publishing Co.

COURSE OUTLINE

1. PORTFOLIO MANAGEMENT PROCESS & PERFORMANCE EVALUATION*
2. ACTIVE EQUITY INVESTMENT STRATEGIES, INVESTMENT STYLES & FACTOR INVESTING*
3. PASSIVE EQUITY INVESTING (self-study)

* supported by practical assignments

PART 1

PORTFOLIO MANAGEMENT PROCESS & PERFORMANCE EVALUATION

What is portfolio management

Process of "selecting and overseeing a group of investments that meet the long-term financial objectives and risk tolerance of a client" (Investopedia)

- not about assessing the merits of individual investments (**security analysis**), but rather evaluating assets in relation to their contribution to the investment characteristics of the whole portfolio (**portfolio approach**)
- professional portfolio managers work on behalf of a client & understanding clients' needs is the first key step

Portfolio management process

1. Planning step

- Understanding clients' needs, goals and constraints
- Preparation of an Investment Policy Statement (IPS)

2. Execution step

- Asset allocation
- Security analysis
- Portfolio construction

3. Feedback step

- Portfolio monitoring and rebalancing
- Performance measurement and reporting

Understanding clients' needs

Key questions to ask:

- What is the goal for the total portfolio?
- What is the time frame for achieving that goal?
- What is the tolerance for loss and uncertainty within a shorter term period?
- Which kinds of risk are acceptable/unacceptable?
- What is the investor willing to pay for active risk management, e.g. currency hedges?
- What is the best way to monitor/evaluate risk?

Answer to these questions dictate the content of Investment Policy Statement

Step 1: Investment policy statement

Vanguard

Sample Investment Policy Statement

I. Introduction

The XYZ Institution Nonprofit Fund (hereinafter referred to as the "Fund") was created to provide perpetual financial support to XYZ Institution (the "Institution"). The purpose of this Investment Policy Statement is to establish guidelines for the Fund's investment portfolio (the "Portfolio").

II. Role of the Investment Committee

The Investment Committee (the "Committee") is acting in a fiduciary capacity with respect to the Portfolio, and is accountable to the Board of XYZ and to the Executive Committee, for overseeing the investment of all assets owned by, or held in trust for, the Portfolio.

III. Investment objective and spending policy

A. The Fund is to be invested with the objective of preserving the long-term, real purchasing power of assets while providing a relatively predictable and growing stream of annual distributions in support of the Institution.

1: Investment policy statement (2)

IV. Portfolio investment policies

A. Asset allocation policy

1. The Committee recognizes that the strategic allocation of Portfolio assets across broadly defined financial asset and subasset categories with varying degrees of risk, return, and return correlation will be the most significant determinant of long-term investment returns and Portfolio asset value stability.

5. Outlined below are the long-term strategic asset allocation guidelines determined by the Committee to be the most appropriate, given the Fund's long-term objectives and short-term constraints. Portfolio assets will, under normal circumstances, be allocated across broad asset and subasset classes in accordance with the following guidelines:

Asset class	Subasset class	Target allocation
Equity		70%
	U.S.	60%
	Non-U.S.	10%
Fixed income		30%
	Investment grade	25%
	Below-investment grade	5%

1: Investment policy statement (3)

IV. Portfolio investment policies

B. Diversification policy

1. Diversification across and within asset classes is the primary means by which the Committee expects the Portfolio to avoid undue risk of large losses over long time periods. To protect the Portfolio against unfavorable outcomes within an asset class due to the assumption of large risks, the Committee will take reasonable precautions to avoid excessive investment concentrations. Specifically, the following guidelines will be in place:

   a) With the exception of fixed income investments explicitly guaranteed by the U.S. government, no single investment security shall represent more than 5% of total Portfolio assets.
   b) With the exception of passively managed investment vehicles seeking to match the returns on a broadly diversified market index, no single investment pool or investment company (mutual fund) shall comprise more than 20% of total Portfolio assets.
   c) With respect to fixed income investments, the Portfolio may not allocate more than 10% to investments that are below investment grade (Standard & Poor's BBB or Moody's Baa or higher).

C. Rebalancing

It is expected that the Portfolio's actual asset allocation will vary from its target asset allocation as a result of the varying periodic returns earned on its investments in different asset and sub-asset classes. The Portfolio will be rebalanced to its target normal asset allocation under the following procedures:

1: Investment policy statement (4)

V. Monitoring portfolio investments and performance

The Committee will monitor the Portfolio's investment performance against the Portfolio's stated investment objectives. At a frequency to be decided by the Committee, it will formally assess the Portfolio and the performance of its underlying investments as follows:

A. The Portfolio's composite investment performance (net of fees) will be judged against the following standards:

   1. The Portfolio's absolute long-term real return objective.

   2. A composite benchmark consisting of the following unmanaged market indexes weighted according to the expected target asset allocations stipulated by the Portfolio's investment guidelines:

B. The performance of professional investment managers hired on behalf of the Portfolio will be judged against the following standards:

   1. A market-based index appropriately selected or tailored to the manager's agreed-upon investment objective and the normal investment characteristics of the manager's portfolio.

   2. The performance of other investment managers having similar investment objectives.

SAMPLE

Key components of IPS

Introduction: describes the client and states the purpose of the IPS.

Statement of duties and responsibilities: details the duties and responsibilities of the client, the custodian of the client's assets, and the investment managers.

Statement of investment goals & objectives: outlines the client's objectives in investing.

Statement of investment guidelines & constraints: explains how policy should be executed (e.g., use of leverage and derivatives), specifies asset allocation & diversification requirements, presents constraints faced by clients in seeking to achieve the investment objectives.

Evaluation and review: provides guidance on obtaining feedback on investment results & explains steps to take to keep the IPS current and to respond to various contingencies.

Step 2: Portfolio execution

Asset allocation

- manager assesses available investments and market & economic trends to form allocation of asset classes suitable for the client

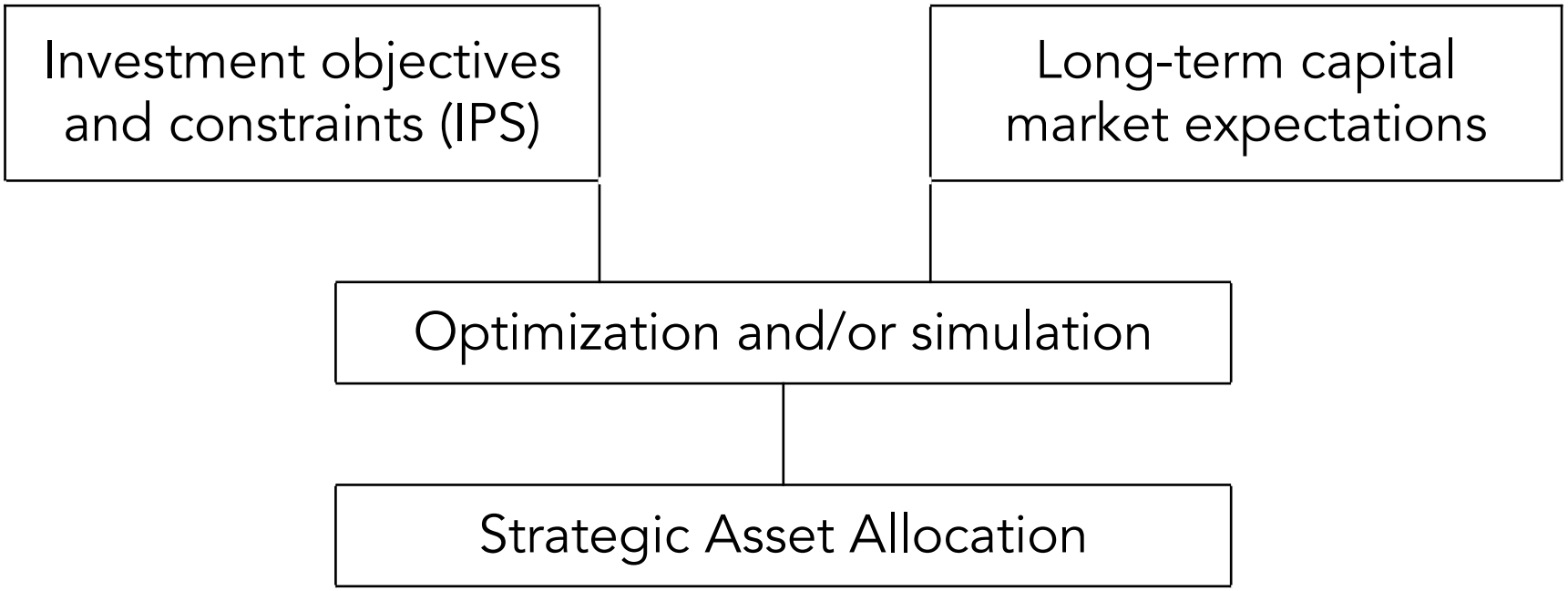
Security analysis

- bottom-up analysis of individual securities to identify attractive investments in particular market sectors

Portfolio construction

- decide on asset class- | sector- | individual securities– weightings while adhering to investment policies and guidelines outlined in the IPS

Strategic asset allocation



Theoretically, the combination of investment objectives and constraints and capital market expectations occurs using optimisation techniques – e.g., mean-variance optimisation

Strategic asset allocation (example)

Consider an extract from IPS for an individual high net worth investor, working for a housebuilding company:

Portfolio return objective:	5% per annum
Portfolio volatility objective:	10%
Portfolio constraints:	(a) exclude any stocks of tobacco product manufacturers or retailers; (b) no further exposure to real estate; (c) consider European & Emerging market assets only

Bank's asset management division provides the investor and his adviser with market expectations data on: European equities, emerging market equities, and European government bonds.

Strategic asset allocation (example 2)

Excluding the tobacco industry is believed to affect expected return of European equities by –0.2% & annual standard deviation by +0.1%.

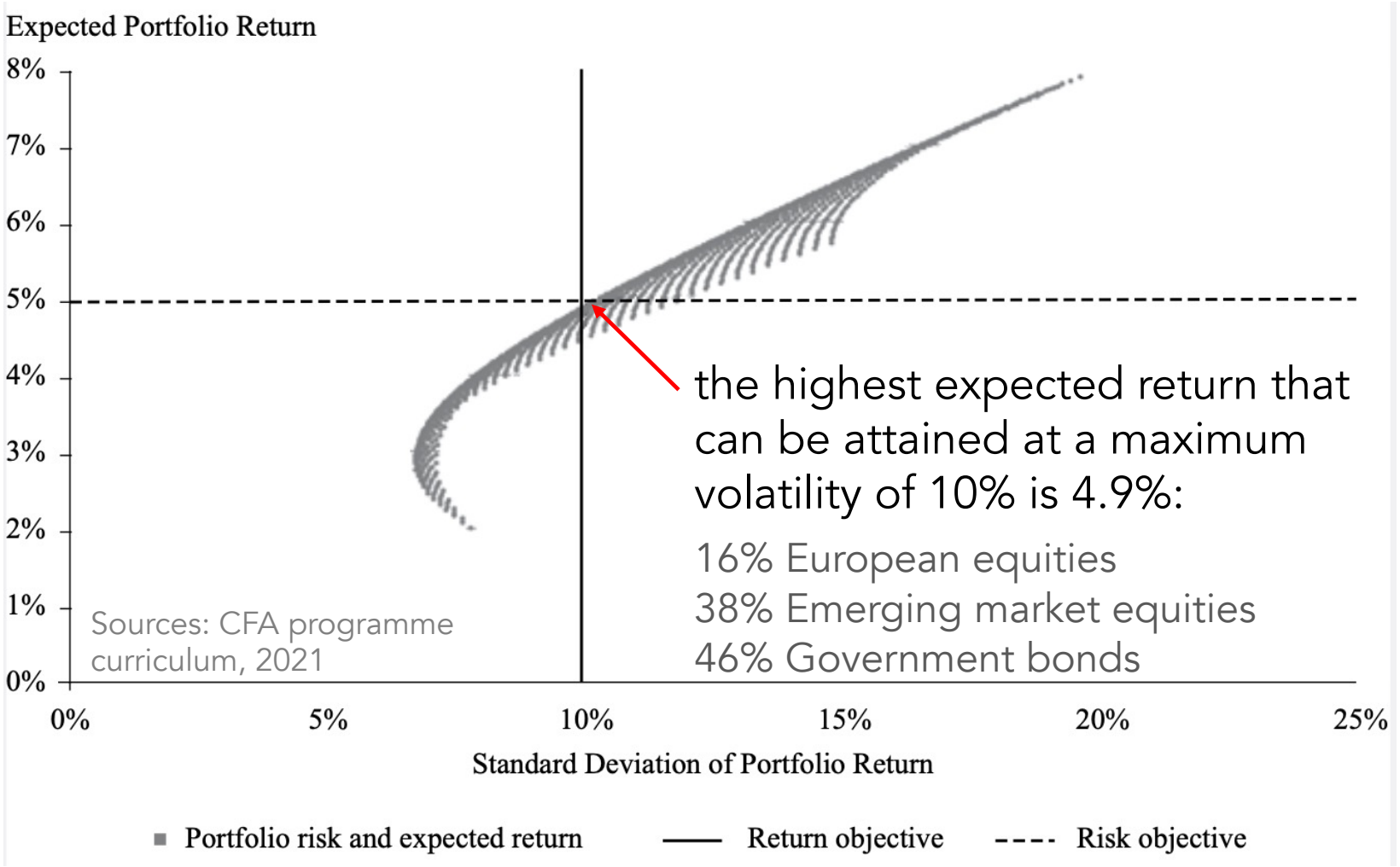
			Correlation Matrix		
	Expected Return	**Standard Deviation**	**European Equities**	**Emerging Mkt Equities**	**European Govt Bonds**
Panel 1					
European equities	6.0%	15.0%	1.00	0.78	–0.08
Emerging market equities	8.0%	20.1%	0.78	1.00	–0.07
European government bonds	2.0%	7.8%	–0.08	–0.07	1.00
Panel 2					
European equities	5.8%	15.1%	1.00	0.78	–0.08
Emerging market equities	8.0%	20.1%	0.78	1.00	–0.07
European government bonds	2.00%	7.8%	–0.08	–0.07	1.00

There is no impact on emerging market equities.

Sources: CFA programme curriculum, 2021

Strategic asset allocation (example 3)

No portfolio satisfies the two portfolio objectives exactly:



Asset allocation endowment

Harvard Endowment portfolio weights

Asset Class	2020	2019	2018
Public equity	19%	26%	31%
Private equity	23%	20%	16%
Hedge funds	36%	33%	21%
Real estate	7%	8%	13%
Natural resources	3%	4%	6%
Bonds/TIPS	5%	6%	8%
Other real assets	1%	2%	2%
Cash & other	6%	2%	3%

Portfolio value	$41.9bn	$40.9bn	$39.2nb
Return	7.3%	6.5%	10.0%

Sources: Harvard Endowment Annual Reports (2018, 2019, 2020)

Asset allocation insurer

Massachusetts Mutual Life Insurance Co portfolio weights

Asset Class	2020	2019	2018
Bonds	56.2%	58.0%	60.7%
Preferred & common shares	8.7%	9.4%	6.6%
Mortgages	15.0%	15.5%	13.4%
Real estate	0.2%	0.2%	0.3%
Policy loans	7.8%	8.2%	7.7%
Partnerships	4.8%	5.0%	4.8%
Other assets	0.6%	1.3%	0.6%
Cash	6.7%	2.4%	2.6%

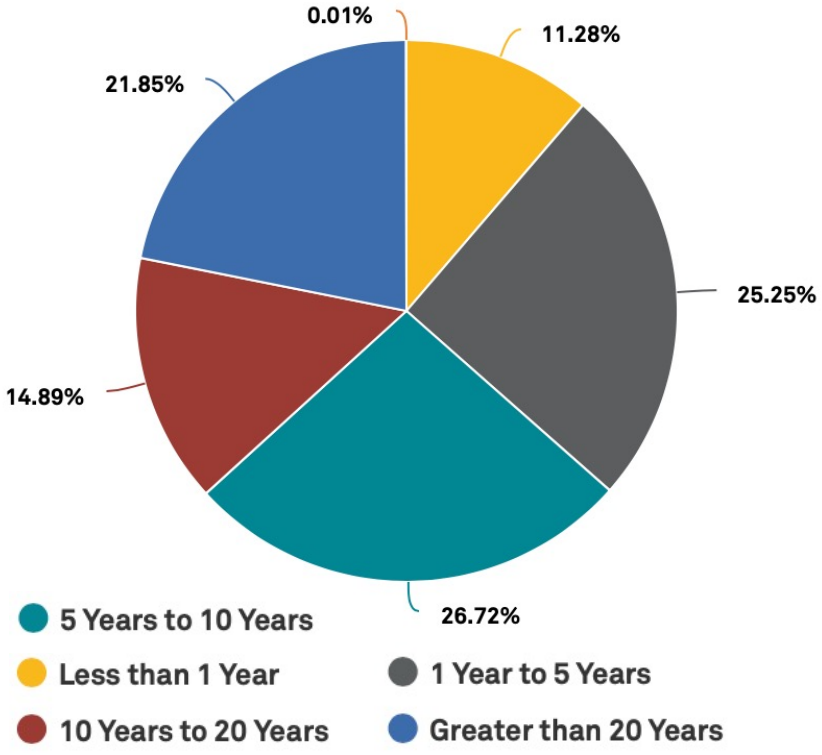
Portfolio value	$299bn	$279bn	$255bn

Sources: MassMutual Financial Group Annual Reports (2018, 2019, 2020)

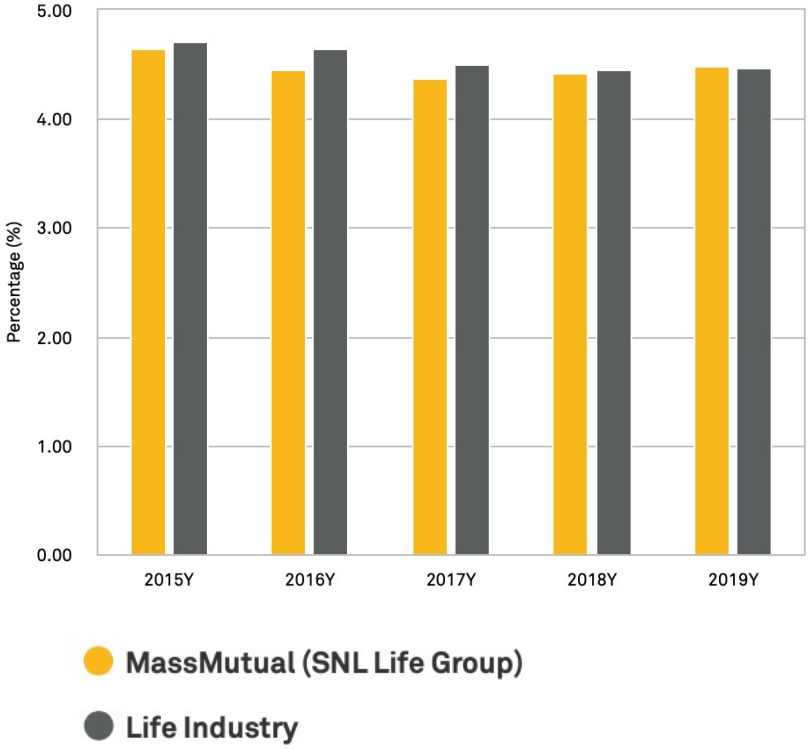
Asset allocation insurer (2)

Massachusetts Mutual Life Insurance Co bond portfolio

Bond maturity distribution



Gross yield on bonds



Source: S&P Global (2020)

Global AUM in regulated funds

Global AUM in regulated open-end funds, by region (in $trillion)

Region/Asset Class	2019	2018	2010
United States	25.7 (46.8%)	21.1 (45.2%)	12.8 (44.0%)
Europe	18.8 (34.2%)	16.5 (35.3%)	10.9 (37.5%)
Asia-Pacific	7.3 (13.3%)	6.4 (13.7%)	3.5 (12.0%)
Rest of the world	3.1 (5.6%)	2.7 (5.8%)	1.9 (6.5%)
Equity	**24.5 (44.7%)**	**19.9 (42.6%)**	**11.9 (40.9%)**
Bond	11.8 (21.5%)	10.1 (21.6%)	6.1 (21.0%)
Mixed strategies	11.6 (21.2%)	10.6 (22.7%)	6 (20.6%)
Money market	6.9 (12.6%)	6.1 (13.1%)	5.1 (17.5%)

Global AUM	$54.9tn	$46.7tn	$29.1tn
Number of funds	122,528	118,279	86,301

Sources: Investment Company Fact Book (2020)

Performance rank of asset classes

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
REIT 28.0%	REIT 8.3%	REIT 19.7%	Sm Cap 38.8%	REIT 28.0%	REIT 2.8%	Sm Cap 21.3%	EM 37.8%	Cash 1.8%	Lg Cap 31.5%	Sm Cap 20.0%	REIT 41.3%
Sm Cap 26.9%	HG Bnd 7.8%	EM 18.6%	Lg Cap 32.4%	Lg Cap 13.7%	Lg Cap 1.4%	HY Bnd 17.5%	Int'l 25.6%	HG Bnd 0.0%	REIT 28.7%	EM 18.7%	Lg Cap 28.7%
EM 19.2%	HY Bnd 4.4%	Int'l Stk 17.9%	Int'l Stk 23.3%	AA 6.9%	HG Bnd 0.6%	Lg Cap 12.0%	Lg Cap 21.8%	HY Bnd -2.3%	Sm Cap 25.5%	Lg Cap 18.4%	Sm Cap 14.8%
HY Bnd 15.2%	Lg Cap 2.1%	Sm Cap 16.4%	AA 11.5%	HG Bnd 6.0%	Cash 0.0%	EM 11.6%	Sm Cap 14.7%	REIT -4.0%	Int'l Stk 22.7%	AA 9.8%	Int'l Stk 11.8%
Lg Cap 15.1%	AA 0.3%	Lg Cap 16.0%	HY Bnd 7.4%	Sm Cap 4.9%	Int'l Stk -0.4%	REIT 8.6%	AA 14.6%	Lg Cap -4.4%	AA 18.9%	Int'l Stk 8.3%	AA 10.9%
AA 13.5%	Cash 0.1%	HY Bnd 15.6%	REIT 2.9%	HY Bnd 2.5%	AA -1.3%	AA 7.2%	REIT 8.7%	AA -5.6%	EM 18.9%	HY Bnd 7.5%	HY Bnd 5.4%
Int'l Stk 8.2%	Sm Cap -4.2%	AA 12.2%	Cash 0.1%	Cash 0.0%	Sm Cap -4.4%	HG Bnd 2.7%	HY Bnd 7.5%	Sm Cap -11.0%	HY Bnd 14.4%	HG Bnd 6.1%	Cash 0.0%
HG Bnd 6.5%	Int'l Stk -11.7%	HG Bnd 4.2%	HG Bnd -2.0%	EM -1.8%	HY Bnd -4.6%	Int'l Stk 1.5%	HG Bnd 3.5%	Int'l Stk -13.4%	HG Bnd 8.7%	Cash 0.6%	HG Bnd -1.5%
Cash 0.1%	EM -18.2%	Cash 0.1%	EM -2.3%	Int'l Stk -4.5%	EM -14.6%	Cash 0.3%	Cash 0.8%	EM -14.3%	Cash 2.2%	REIT -5.1%	EM -2.2%

AA: Asset Allocation Portfolio is 15% large cap stocks, 15% international stocks, 10% small cap stocks, 10% emerging market stocks, 10% REITs, 40% high-grade bonds, and annual rebalancing.

Active vs passive management

Passive approach describes a portfolio decision which does not engage in direct or indirect security analysis

- managers assume that markets are efficient and focus on beta drivers of return (CAPM)
- "buy-and-hold" a diversified portfolio of assets with managers judged by how well they track such a benchmark
- designed to match market performance (market index)

Active approach

through fundamental and quantitative research, managers attempt to outperform predetermined performance benchmarks on a risk-adjusted basis

Passive investment approach

Is it possible to beat the market and do so consistently?

Not in an **efficient market**, with prices fully & instantaneously reflecting all available information (Fama, 1970)

- in an efficient market competition between informed traders ensures that the price reaction is instantaneous and unbiased
- trading strategies based upon past/current information cannot consistently beat the market
- investor using same information as the rest of the market can only achieve an average return proportionate to the risk taken
- progressively more popular from the 1990s and, on average, outperform actively managed funds

Active investment approach

Managers assume there are mispriced securities or groups of securities and have different forecasts than consensus

- do not believe in market efficiency (or CAPM)
- irrationality of the herd pushes prices away from fundamentals and allows mispricing to endure
- active portfolio: differences between proportions in the actual portfolio and benchmark portfolio (bets are placed on certain securities expected to outperform)
- the aim is to outperform the predetermined benchmark, with success judged by how large is the difference between fund return and index return

Active investment approach (2)

3 fundamental building blocks

Asset allocation – allocating the funds within one asset class or between asset classes

- strategic AA: based on investors' objectives, constraints & long-term economic forecasts to determine positions in asset classes
- tactical AA: based on short-term forecasts to inform short-term deviations from strategic AA

Stock (sector) selection or stock screening – based on fundamental and quantitative techniques

- regression analysis, momentum investing, earning surprises, style investing, use of relative valuation techniques, optimisation, etc...

Market timing

- determining when to switch from one asset class to another
- can be done at individual security-, asset- or market-level

Passive vs active approaches

COST

Lower turnover | transaction | management costs of passive funds

- active manager must, on average, generate at least 1 – 1.25% of gross additional return to break even with passive funds

RISK

Passive funds enjoy greater diversification; active managers should rebalance portfolios frequently in search for "winners"

- hence, active portfolios are, on average, riskier than passive ones due to idiosyncratic risk

GOAL

The aim of the passive is to achieve returns close to the market return, while active funds attempt to outperform the market

Building blocks of most active strategies are **asset allocation**, **security selection** and **market timing**

Global AUM by management type

Global AUM by management type and asset class (% / $trillions)

	2019	2018	2008
Actively managed	79% / $70	82% / $63	90% / $34
Alternatives**	16% / $15	17% / $13	15% / $6
Active specialists‴	16% / $14	17% / $13	18% / $7
Multi-asset strategies	14% / $12	14% / $11	9% / $3
Core strategies*	33% / $29	34% / $26	48% / $18
Passively managed	21% / $18	19% / $14	10% / $4

Global AUM	$89tn	$77tn	$39tn

Sources: Boston Consulting Group (2020)

* Includes actively managed domestic large-cap equity, domestic government and corporate debt, money market, and structured products. ‴ Includes equity and fixed-income specialities.

** See next slide.

Alternative assets by product

Global AUM in alternative assets, by product

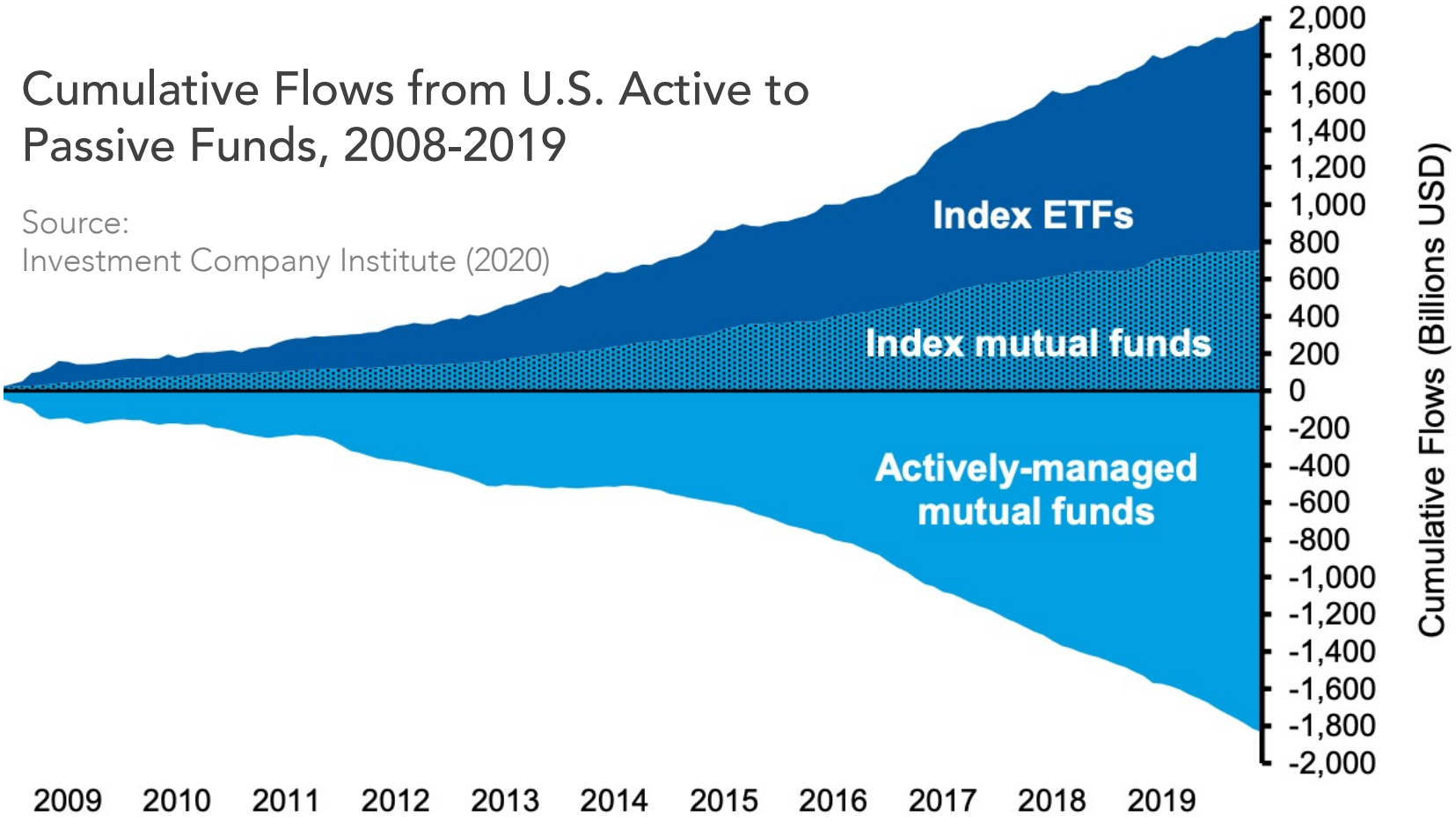
Asset Class	2019	2018	2008
Private equity	31%	28%	25%
Real estate	24%	25%	35%
Hedge funds	23%	24%	25%
Private debt	6%	6%	4%
Commodities	8%	8%	6%
Infrastructure	5%	5%	3%
Liquid alternatives	3%	4%	3%

Global AUM	$15tn	$13tn	$6tn

Sources: Boston Consulting Group (2020)

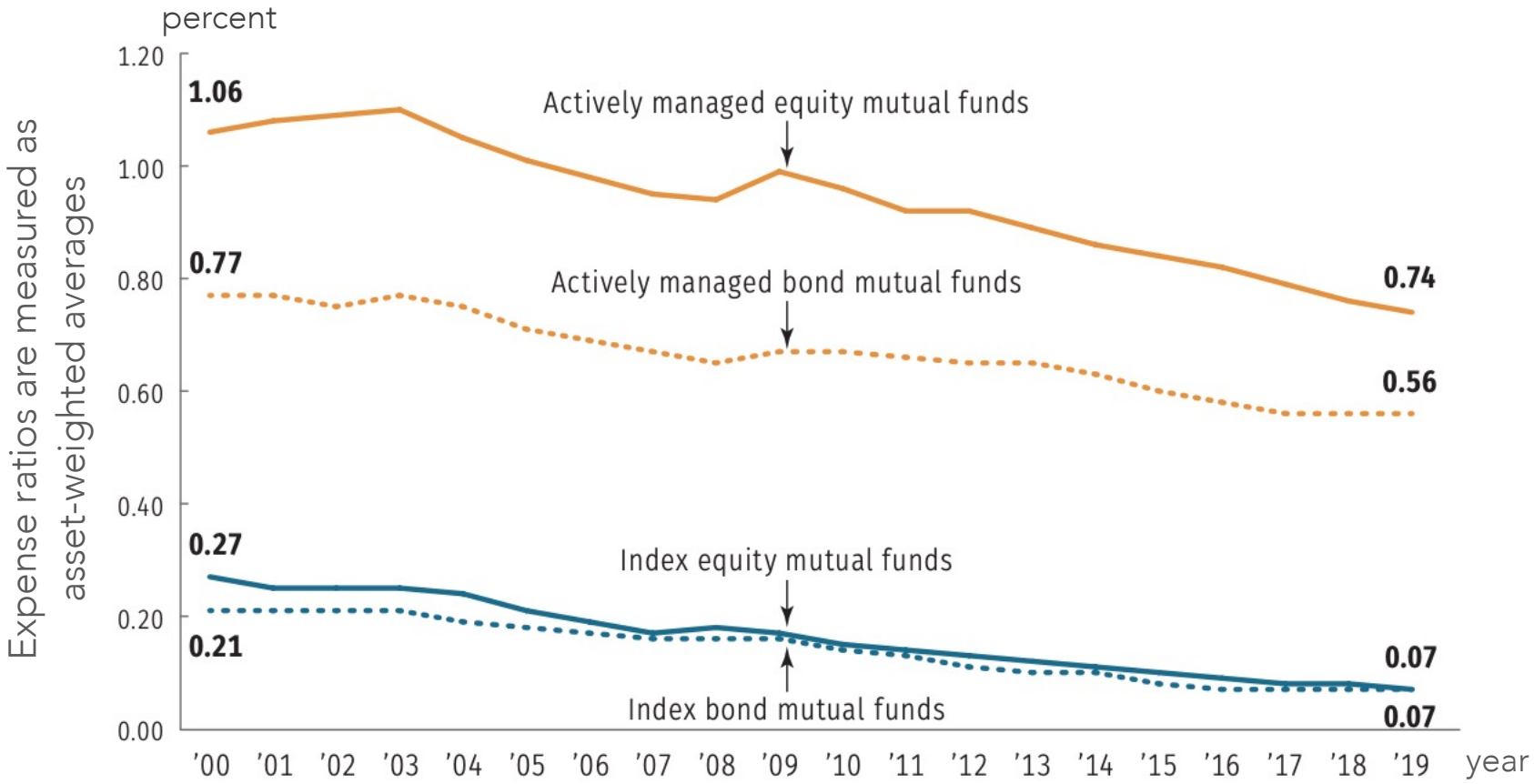
Active to passive flows

Significant shift from active funds to indexed, or rules-based, funds in recent years, across markets



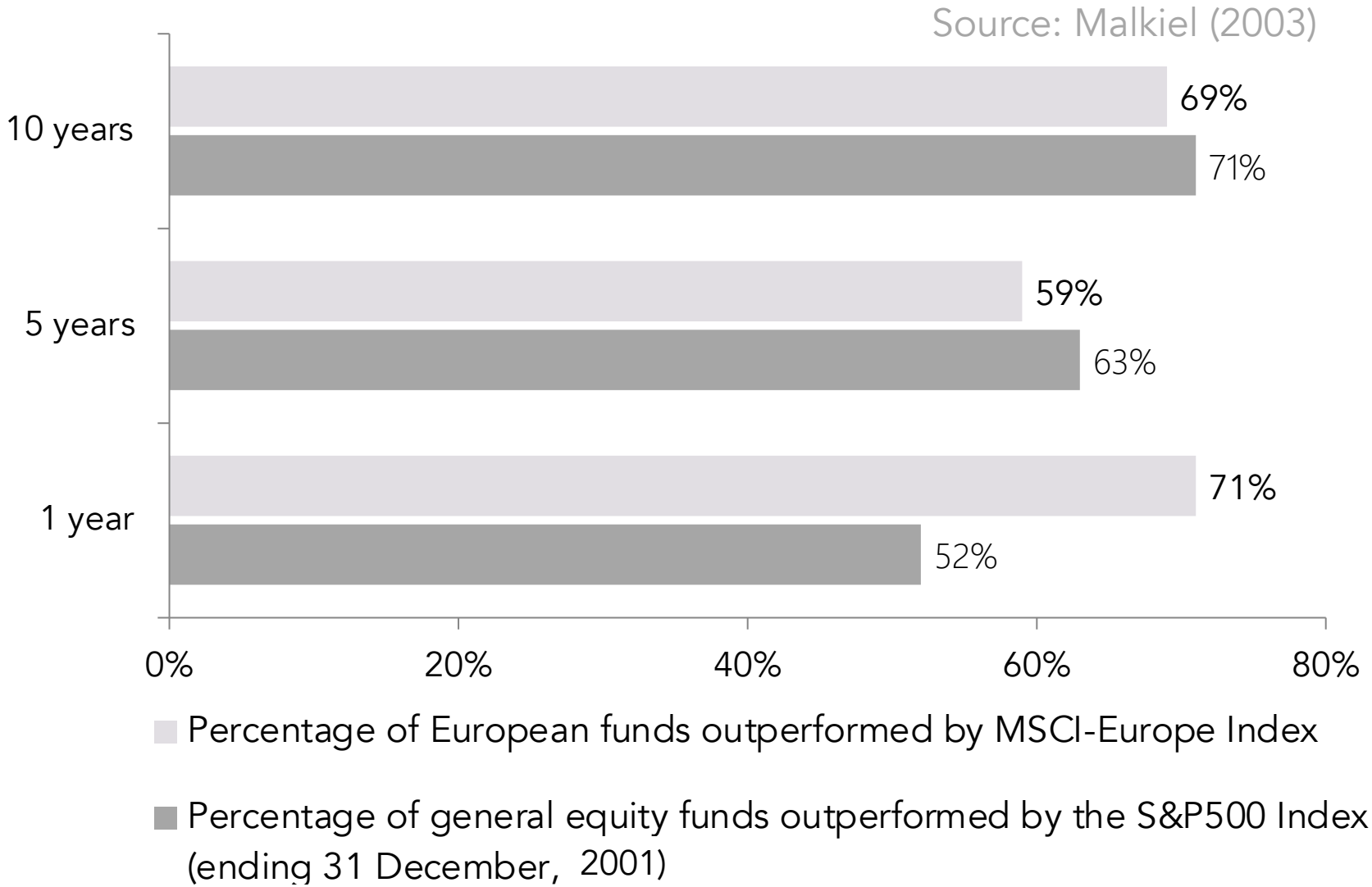
Fund expense ratios

Average expense ratio of actively managed and index funds decreased over the years



Source: Investment Company Institute (2020)

Passive vs active performance



Passive vs active performance (2)

Percentage of US actively managed equity funds outperformed by their prospectus benchmarks, by Morningstar Equity Style Box (1979-2018)

Style Box	1979-1983	1984-1988	1989-1993	1994-1998	1999-2003	2004-2008	2009-2013	2014-2018
Large-Blend	35%	73%	67%	90%	40%	49%	63%	85%
Large-Growth	24%	80%	42%	87%	25%	41%	56%	79%
Large-Value	39%	91%	74%	93%	39%	58%	53%	**77%**
Mid-Blend	NA	NA	80%	75%	29%	60%	62%	80%
Mid-Growth	33%	75%	39%	45%	30%	38%	68%	59%
Mid-Value	NA	NA	56%	69%	31%	63%	56%	**83%**
Small-Blend	NA	NA	58%	37%	29%	55%	32%	68%
Small-Growth	NA	NA	40%	30%	18%	56%	53%	51%
Small-Value	NA	NA	NA	58%	34%	62%	21%	**84%**

NA indicates there are less than 5 funds available per category. Data are from Morningstar

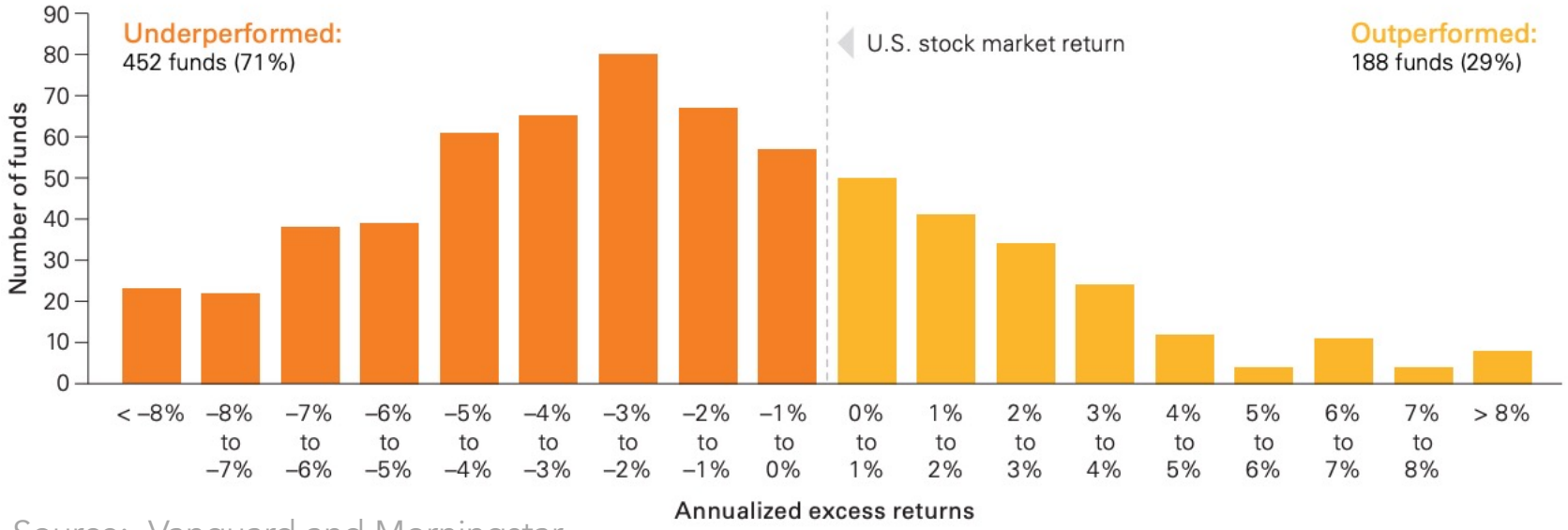
Source: Zagonov et al. (2020)

Passive vs active performance (3)

Some evidence to suggest cyclicality in passive versus active fund managers' performance

- often driven by periods of pronounced performance deviation between opposing market segments (e.g. large vs small cap)

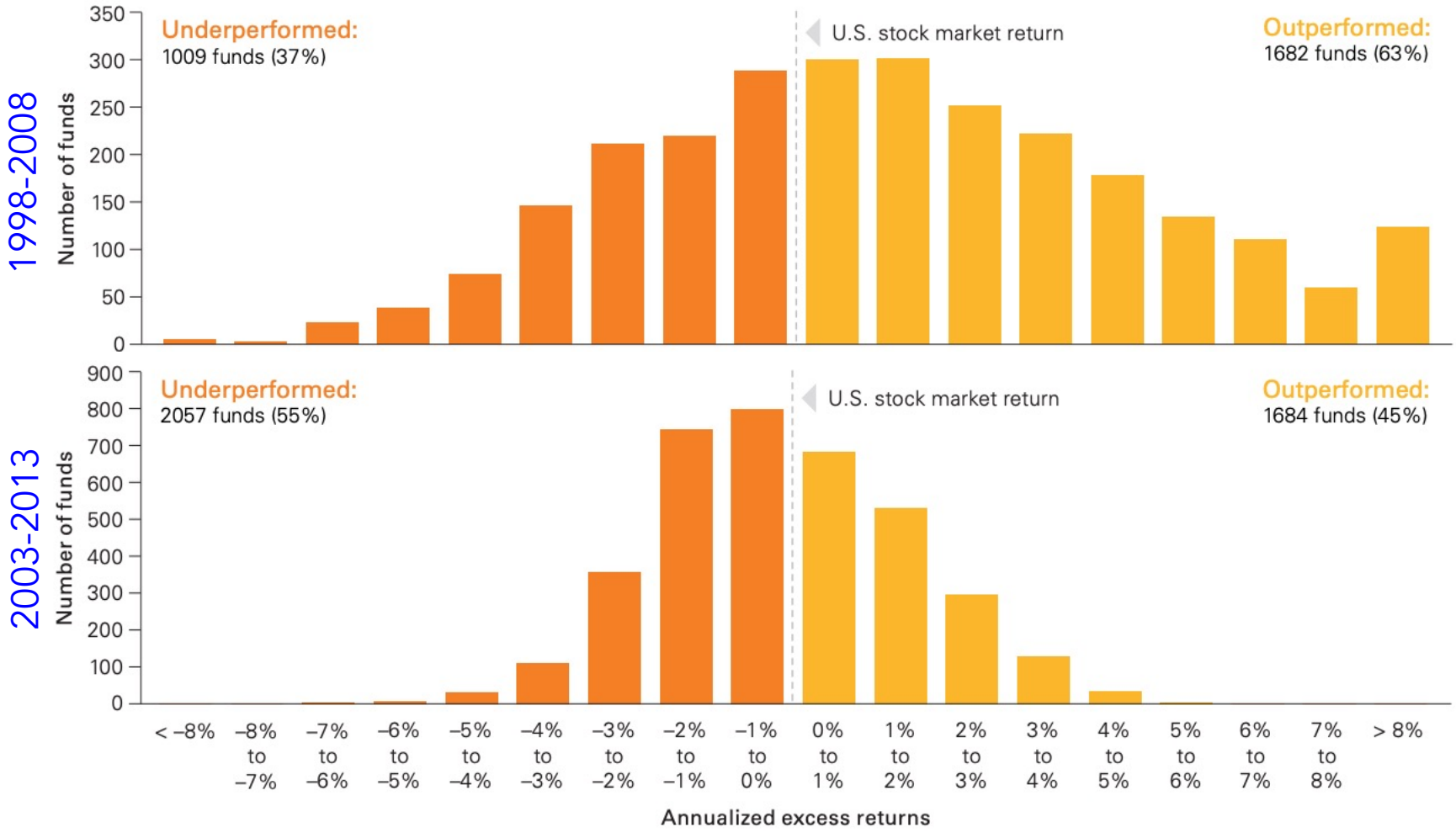
Distribution of active manager net excess returns versus benchmark (1990-1999)



Source: Vanguard and Morningstar

Passive vs active performance (4)

Distribution of active manager net excess returns versus benchmark (CONT'D)



Persistence in performance

	Relative rank of top-20 performers in the preceding 5-year period						
	1984-88	1989-93	1994-98	1999-03	2004-08	2009-13	2014-18
1 (best performing US mutual fund in prior 5-year period)	8	224	220	237	153	1117	1534
2	61	199	344	235	2	1580	1430
3	45	3	445	771	1167	1523	1484
4	67	101	56	575	896	1528	1091
5	102	263	62	141	1108	1190	1366
6	58	207	281	719	1227	1338	1056
7	56	230	357	514	1	1581	1399
8	124	39	234	258	733	1254	1329
9	122	108	442	826	1037	1029	1163
10	34	173	163	121	1197	818	1087
11	1	94	346	265	699	1141	1371
12	29	151	196	27	198	1266	40
13	85	33	53	626	1234	1073	1458
14	76	211	117	153	1172	708	1516
15	130	256	51	619	1220	226	1164
16	99	225	156	275	973	1521	1459
17	123	104	304	304	154	1535	547
18	21	41	269	230	1092	1522	373
19	73	184	262	833	44	1351	1035
20	44	195	8	848	22	323	1380
Number of funds in sample	130	268	449	855	1250	1589	1575

Source: Zagonov et al. (2020)

Persistence in performance (2)

The table presents the performance transition matrix for US actively managed equity funds over 1979-2018 period, by Morningstar equity style.

Performance quintile		LOW (t+1)	2	3	4	HIGH
LOW (t)	Large-cap	24.05%	16.83%	16.63%	19.24%	23.25%
	Mid-cap	21.62%	10.81%	17.84%	23.24%	26.49%
	Small-cap	21.57%	16.99%	14.38%	16.34%	30.72%
2	Large-cap	15.87%	17.78%	23.71%	23.14%	19.50%
	Mid-cap	17.13%	24.86%	21.55%	19.34%	17.13%
	Small-cap	18.01%	16.77%	19.25%	24.22%	21.74%
3	Large-cap	16.14%	25.30%	22.91%	20.12%	15.54%
	Mid-cap	14.21%	21.58%	25.26%	21.58%	17.37%
	Small-cap	12.73%	24.24%	27.27%	18.18%	17.58%
4	Large-cap	16.73%	22.43%	20.15%	22.24%	18.44%
	Mid-cap	24.34%	23.28%	15.87%	16.93%	19.58%
	Small-cap	15.29%	20.59%	19.41%	28.82%	15.88%
HIGH	Large-cap	29.24%	17.88%	15.46%	16.76%	20.67%
	Mid-cap	25.25%	18.69%	17.17%	20.20%	18.69%
	Small-cap	31.46%	20.22%	15.73%	19.66%	12.92%

Each 5-year period, funds are assigned into quintiles by that period's benchmark-adjusted return from 1 (LOW) to 5 (HIGH) and compared to their quintile assignment in the following 5-year period

Source: Zagonov et al. (2020)

Persistence in performance (3)

The literature on fund manager performance is vast:

Blake & Timmerman (1998) – forming portfolios of high and low alpha funds and testing subsequent performance suggests that performance did persist

Quigley & Sinquefield (1999) – using a similar strategy found that inferior performance persists while good performance does not

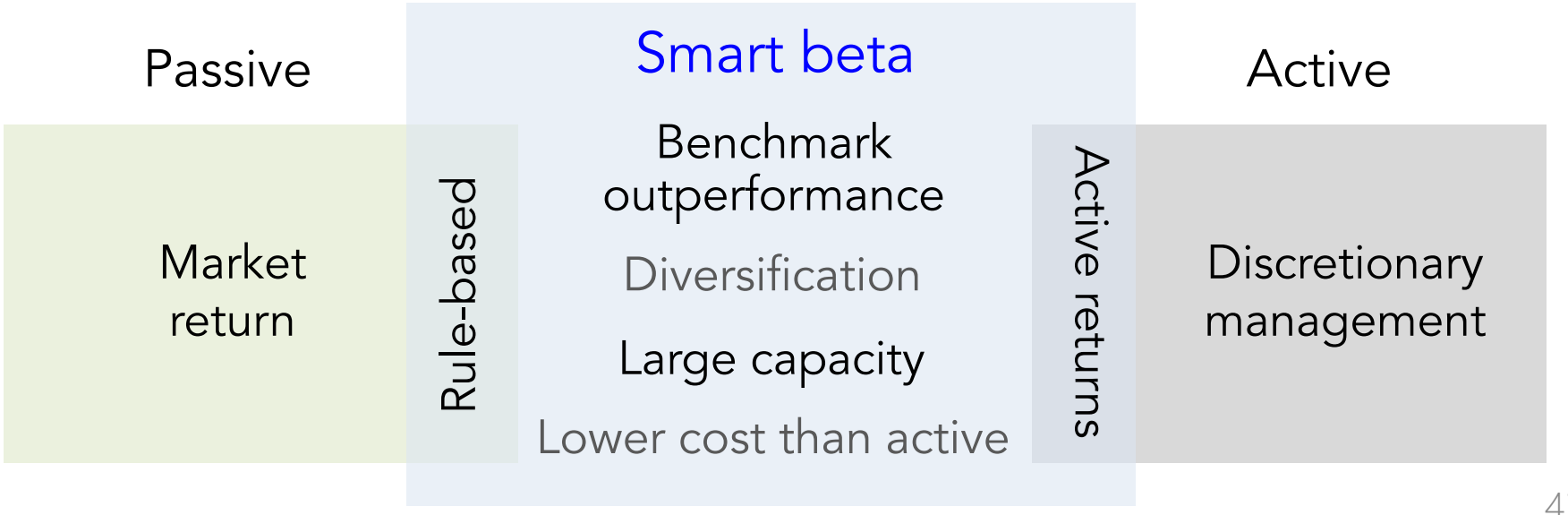
Cuthbertson, Nitzsche and O'Sullivan (2008) "Mutual fund performance" is a great survey of the literature in the area

Evidence is mixed – persistent outperformance is very hard to come by

Smart beta approach

Smart-beta involves following transparent, rule-based, and reproducible strategies as a basis for investment decisions

- focus on stocks with certain characteristics (factor exposures) that have historically been linked to superior performance
- typically associated with higher management fees and portfolio turnover compared to passive strategies



Popular smart-beta strategies

Factor performance varies considerably over time and difficult to predict

	2021	2020	2019	2018	2017
Momentum	15.75%	17.10%	29.90%	1.60%	15.90%
Quality	24.71%	5.20%	33.00%	-2.90%	8.20%
Small cap	17.52%	6.10%	28.80%	-9.80%	7.90%
Value	20.91%	-12.50%	22.00%	-9.80%	7.40%
Low volatility	13.94%	-6.10%	25.50%	2.50%	3.20%
Market	26.67%	6.10%	30.20%	-4.30%	7.60%

Momentum (higher) - MSCI World Momentum Index
Quality (higher) - MSCI World Quality Index
Size (lower) - MSCI World Small Cap Index
Value (higher) - MSCI World Enhanced Value Index
Volatility (lower) - MSCI World Minimum Volatility Index
Market portfolio: MSCI World Total Return

Step 3: Feedback step

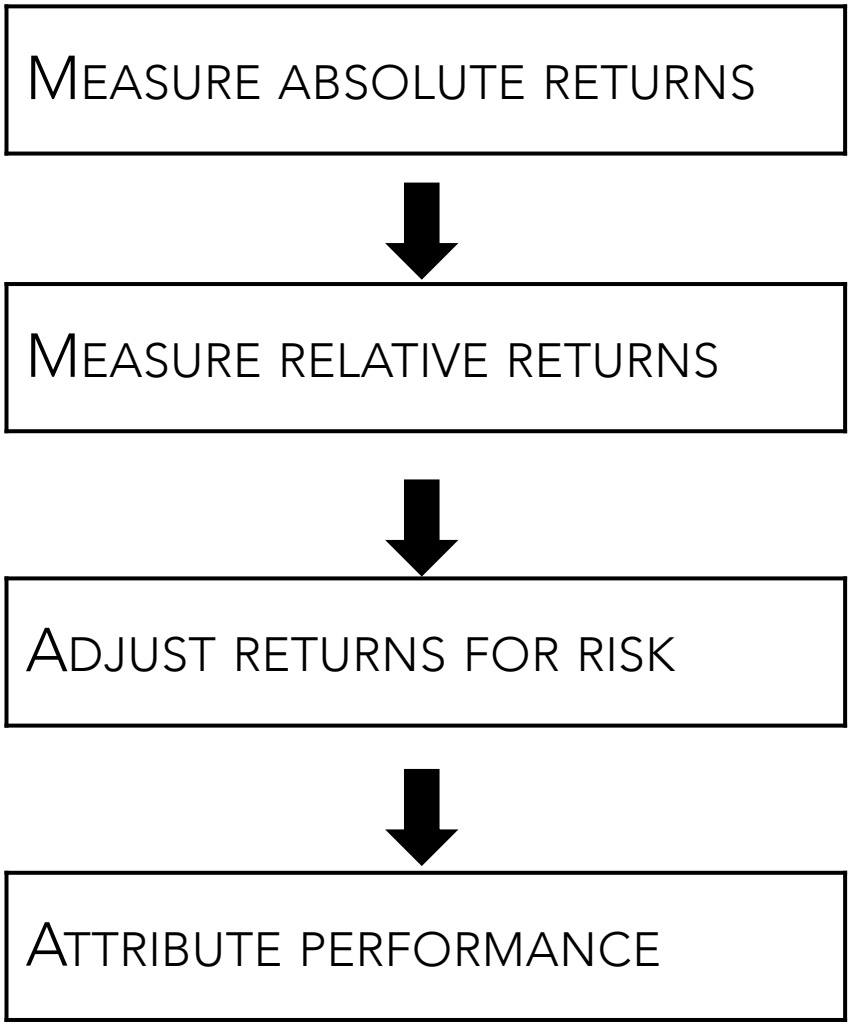
Portfolio monitoring & rebalancing

- ongoing changes in analysts' assessments of economic conditions, market trends and security prices may necessitate portfolio composition changes
- securities asset weightings may drift from the intended levels as a result of market movements

Portfolio performance evaluation

- periodic and standardised assessment of the portfolio's ability to meet the client's objectives, as outlined in IPS

Performance evaluation process



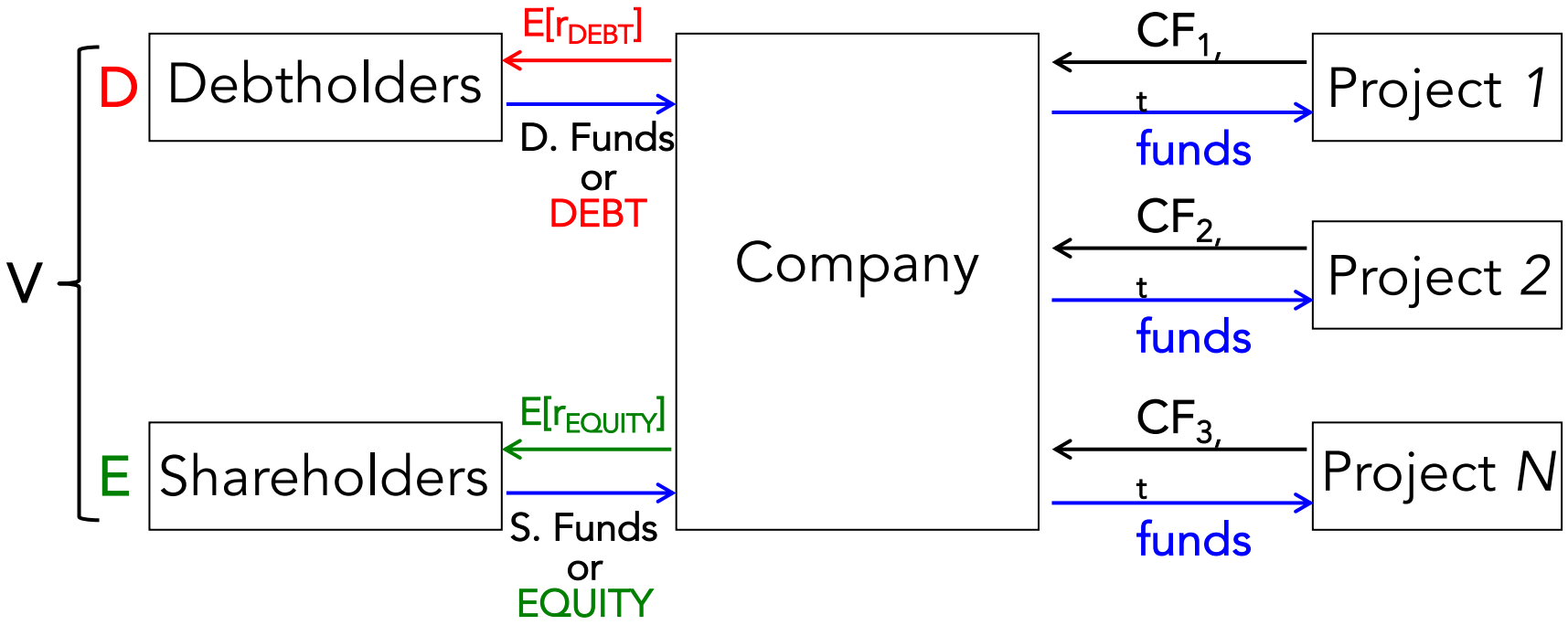
Capture absolute gain or loss an investment generates over a specific time period, irrespective of its risk.

Capture relative gain or loss an investment generates relative to a suitable benchmark, such as stock market index.

Measure absolute or relative gain an investment generates relative to the amount of risk the investment has taken over a specific time period.

Identifies and examines the sources of a portfolio's (out-)performance against a suitable benchmark.

Investments refresher



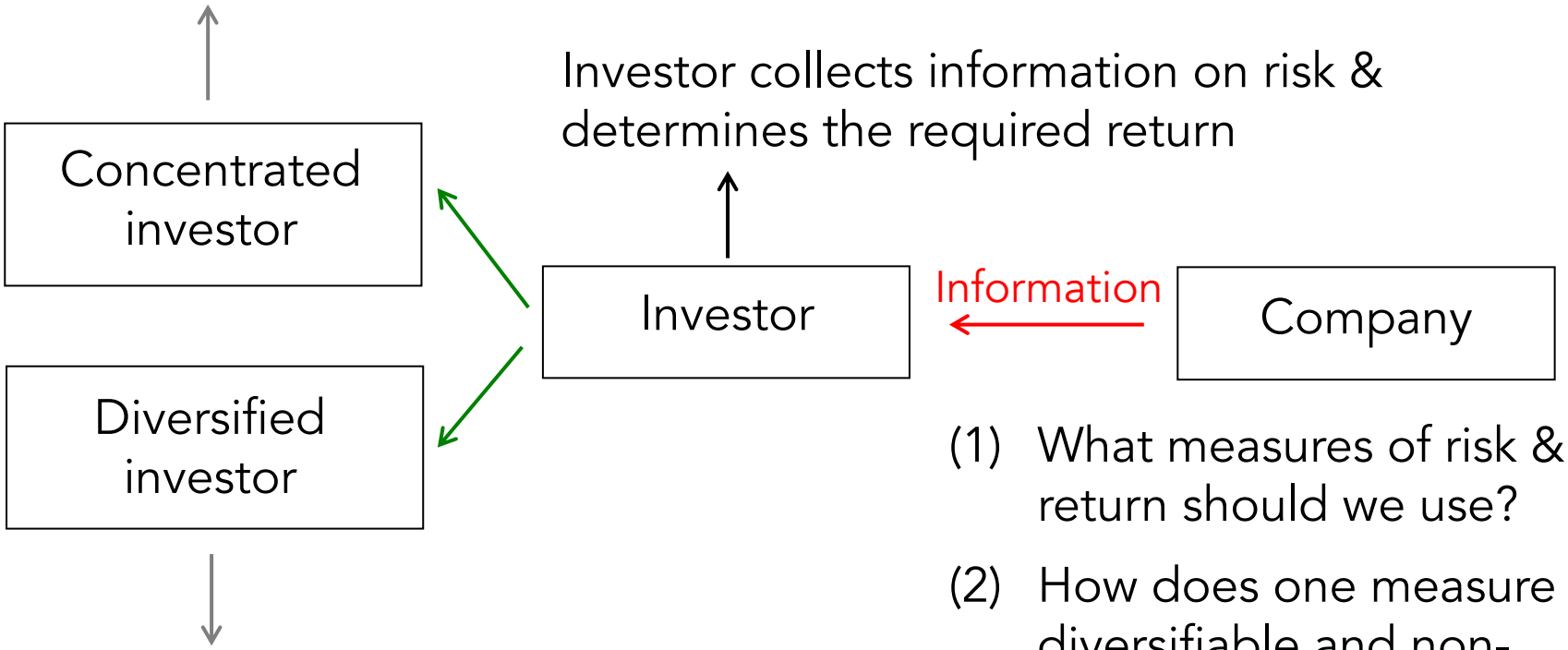
$E[r_{debt}]$ and $E[r_{equity}]$ are called "cost of debt" and "cost of equity" respectively

Company cost of capital (COC) is a <u>weighted average</u> of its cost of debt and cost of equity:

$$COC = \frac{D}{V} E\left[r_{debt}\right] + \frac{E}{V} E\left[r_{equity}\right]$$

Investments refresher (2)

Company risk cannot be diversified fully ➔ requires compensation for 100% of risk accepted



(1) What measures of risk & return should we use?

(2) How does one measure diversifiable and non-diversifiable risks?

(3) How do we isolate & price non-diversifiable risk?

Absolute return measures

Holding period return - a single period measure

$$HPR_t = r_t = \frac{P_t + D_t - P_{t-1}}{P_{t-1}} = \frac{P_t + D_t}{P_{t-1}} - 1 = \frac{P_t - P_{t-1}}{P_{t-1}} + \frac{D_t}{P_{t-1}}$$

Capital gain yield

Dividend yield

Arithmetic average - simple average of T single period returns

$$r_{A,i} = \frac{r_{i,1} + r_{i,2} + \cdots + r_{i,T}}{T} = \frac{1}{T}\sum_{t=1}^{T} r_{i,t}$$

It is an unbiased estimate of expected future portfolio returns

Geometric average - each period return has equal weight ($r_{G,i} \leq r_{A,i}$)

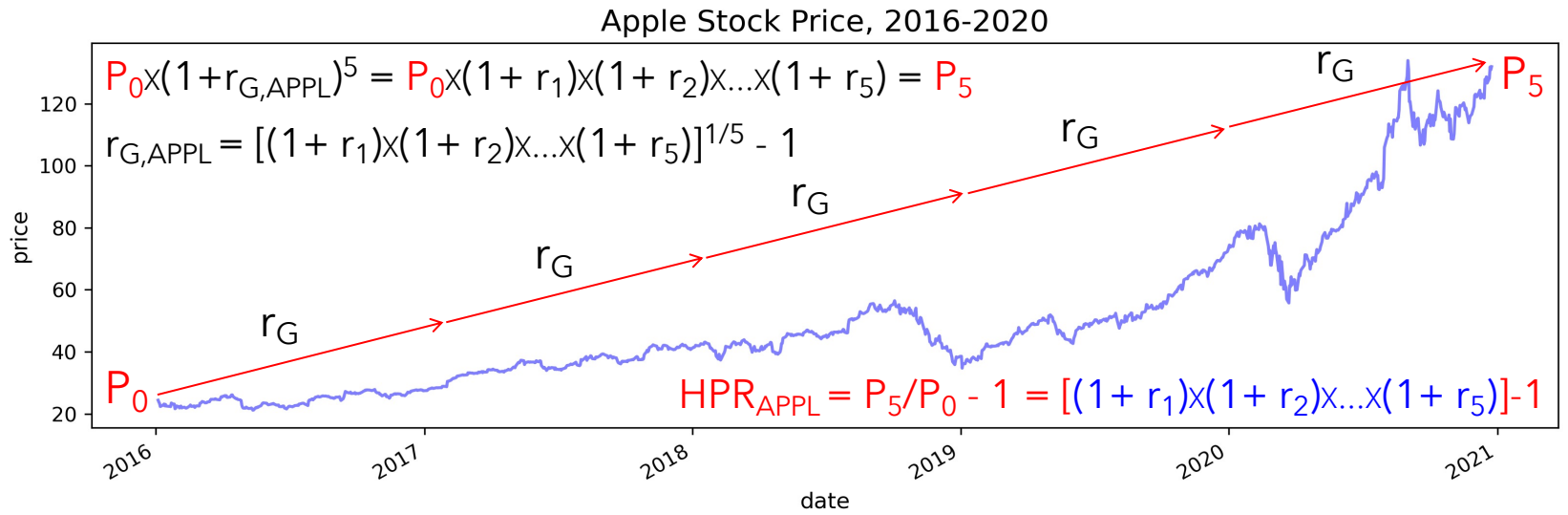
$$(1 + r_{G,i})^T = [(1 + r_{i,1}) \times \cdots \times (1 + r_{i,T})]$$

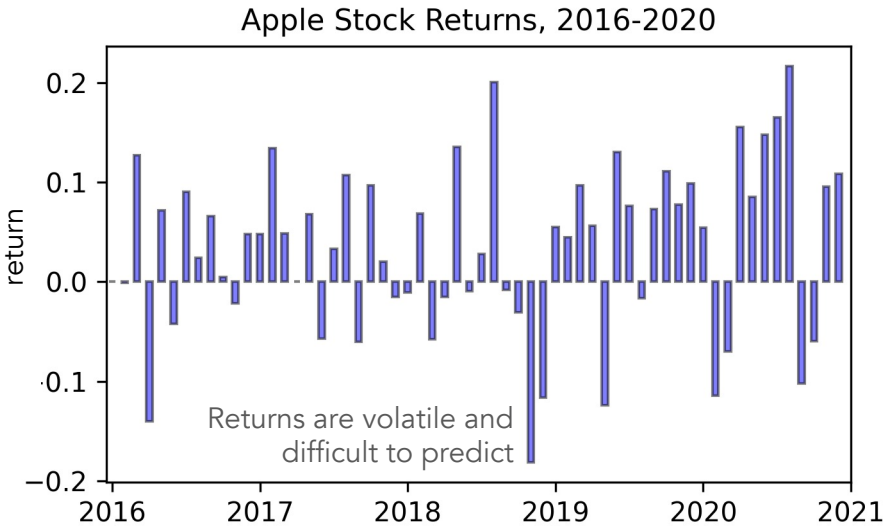
$$r_{G,i} = \left[\prod_{t=1}^{T}(1 + r_{i,t})\right]^{\frac{1}{T}} - 1$$

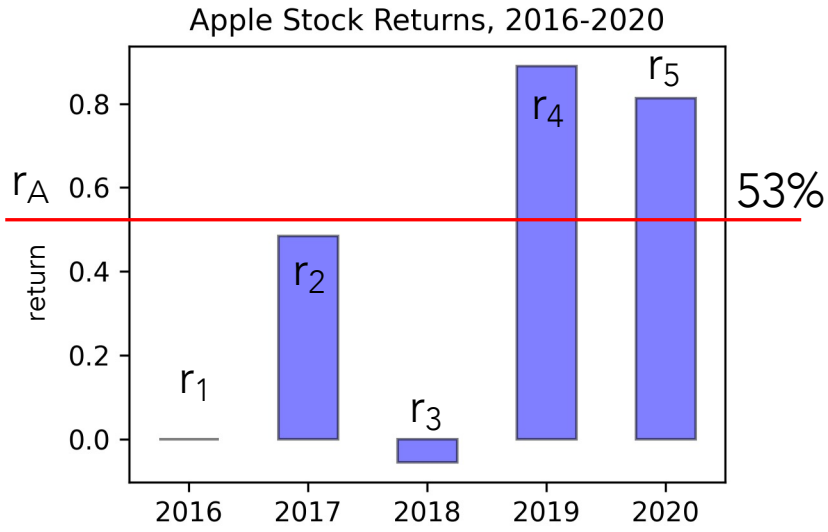
$r_{G,i}$ - fixed return the portfolio would need to have earned each year in order to match actual performance.

The geometric mean is a good measure of past performance.

Stock price and return measures







Source: Alpha Vantage

Absolute return measures (2)

Value-weighted return - (aka money-weighted & IRR) - rate of return which equates the present value of cash in-flows with the (initial) cash outflow

↓

No intermediate cash in- or out-flows during holding period

↓

$$HPR_t = IRR_t$$

↓

$$P_{t-1} = \frac{P_t + D_t}{1+IRR}$$

↓

Additional cash in- or out-flows period holding period

↓

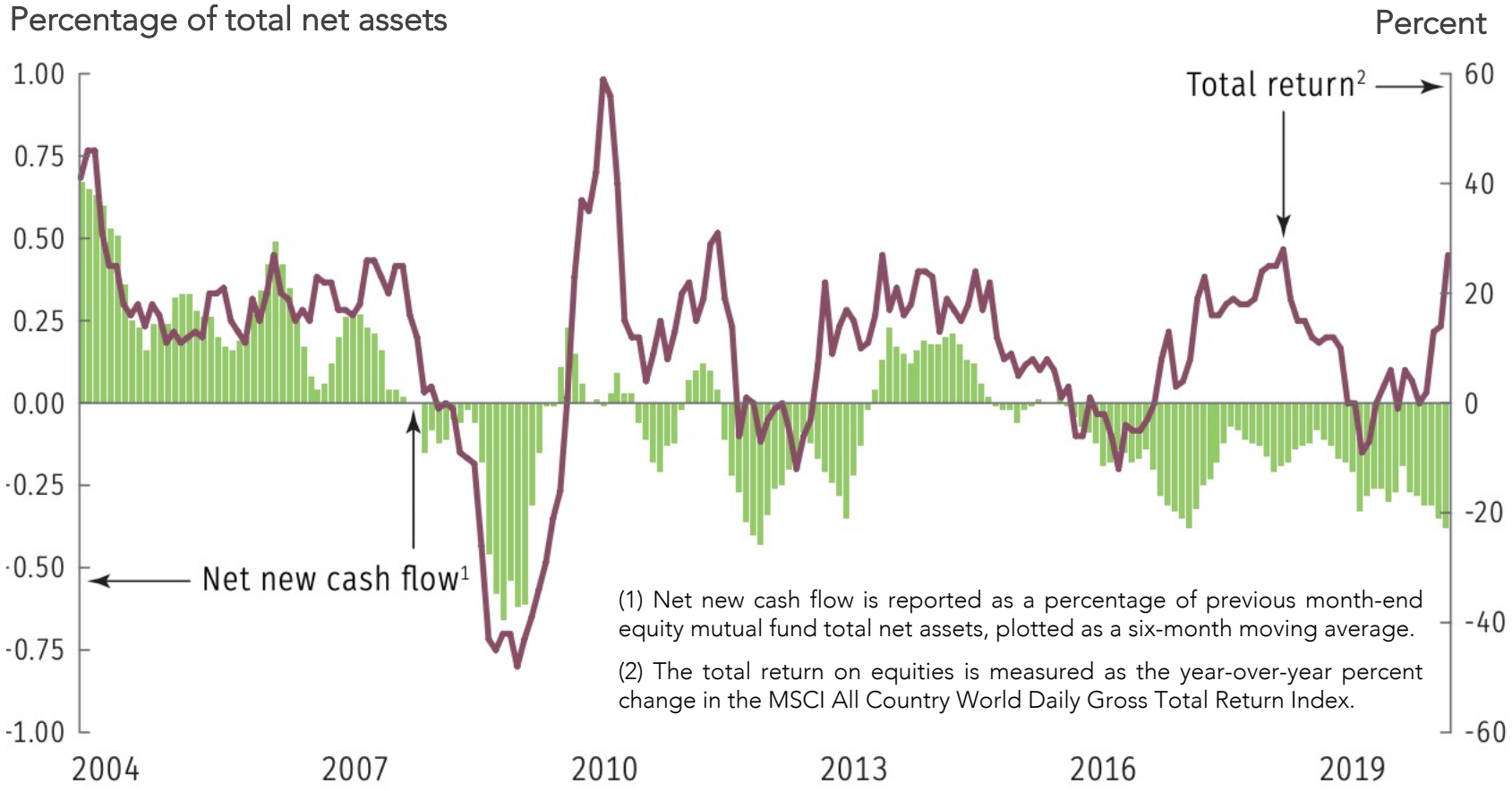
IRR depends on sub-period returns & investor timing

↓

$$\sum_{t=0}^{T} \frac{CF_t}{(1+IRR)^t} = 0$$

Data on mutual fund flows

Net new cash flow to US domestic equity mutual funds (2004-20)



Source: Investment Company Institute (2020), MSCI, and Bloomberg

Investor vs. investment returns

Consider **investment returns** and **cash flows** at t_1 and t_2:
$r_1 = 100\%$, $r_2 = -50\%$ and $C_0 = \$1000$, $C_1 = \$2000$

Terminal wealth

$V_2 = \$1000*(1+100\%)*(1-50\%)+\$2000*(1-50\%)=\$2000$

Time-weighted return

$TWR=[(1+100\%)*(1-50\%)]^{1/2}-1=0\%$

Money-weighted return

$1000*(1+IRR)^2+\$2000*(1+IRR)=\$2000$

$MWR = IRR = -26.8\%$

Performance gap $PG = TWR - MWR = 26.8\%$

Conclusion: investor lost money due to poor timing

Use of Wooclap app

1

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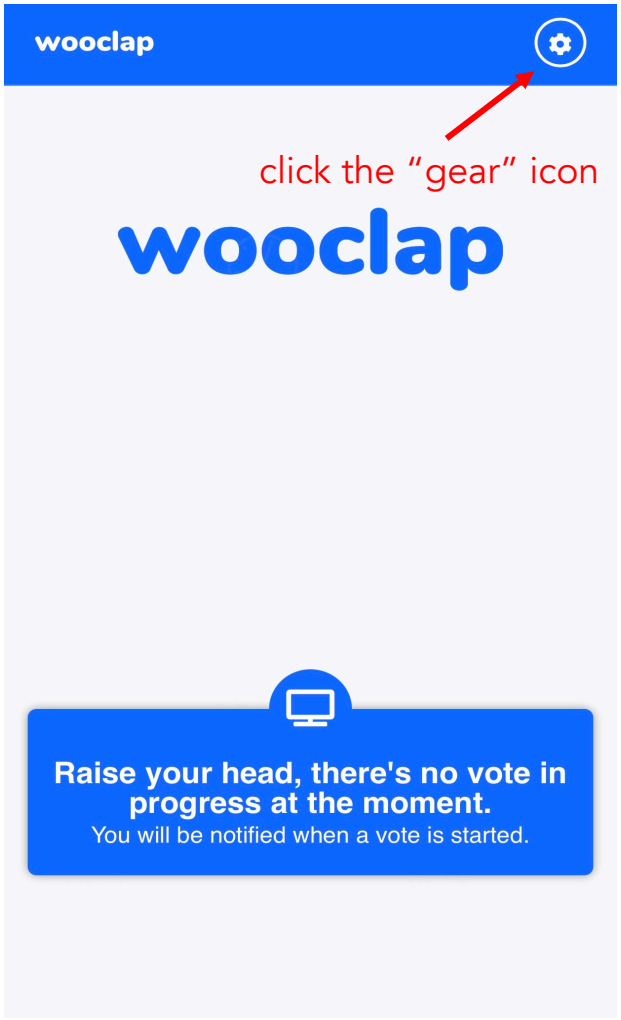

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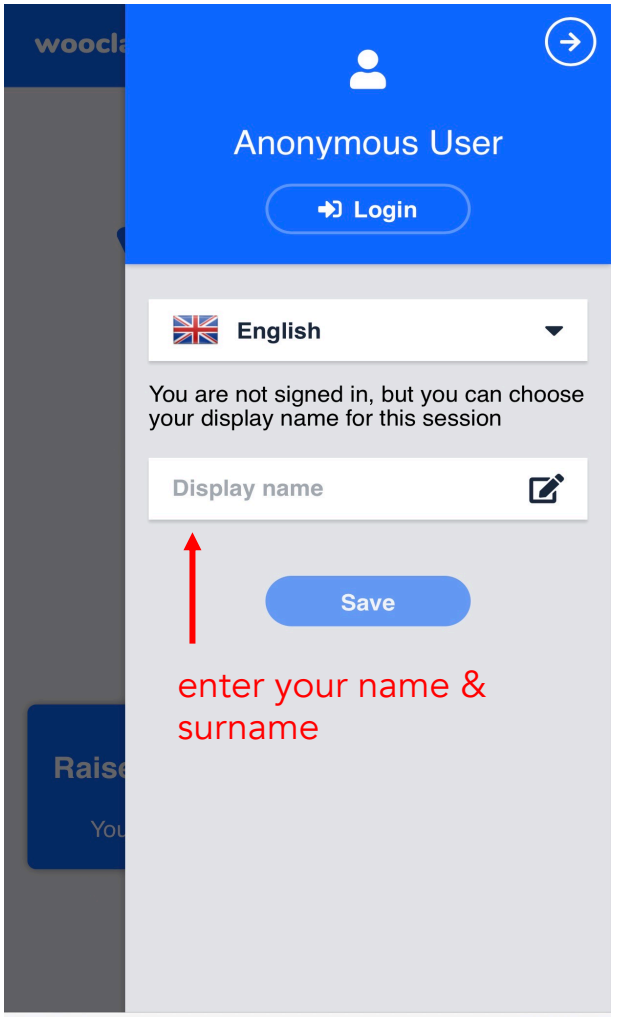

Sample exam question 1

Jeff Lee and his wife, Katherine Lee, are planning for retirement and want to compare the past performance of several mutual funds they are considering for investment. They believe that comparison over a five-year period would be appropriate. They are given the following information about Fund A.

Year	Assets under management (year start, €)	Net Return (%)
1	30mn	15
2	45mn	-5
3	20mn	10
4	25mn	15
5	35mn	3

(1) Compute the holding period return for the five-year period.

(2) Compute the arithmetic mean annual return.

(3) Compute the geometric mean annual return. How does it compare with the arithmetic mean annual return?

(4) The Lees want to earn a minimum annual return of 5 percent. Is the money-weighted annual return greater than 5 percent?

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Adjusting for risk

To meaningfully compare returns, they must be adjusted for risk - i.e. we need to consider **relative returns**

The simplest way to adjust returns for risk is to compare investments with similar risk characteristics or comparison universe - "benchmark"

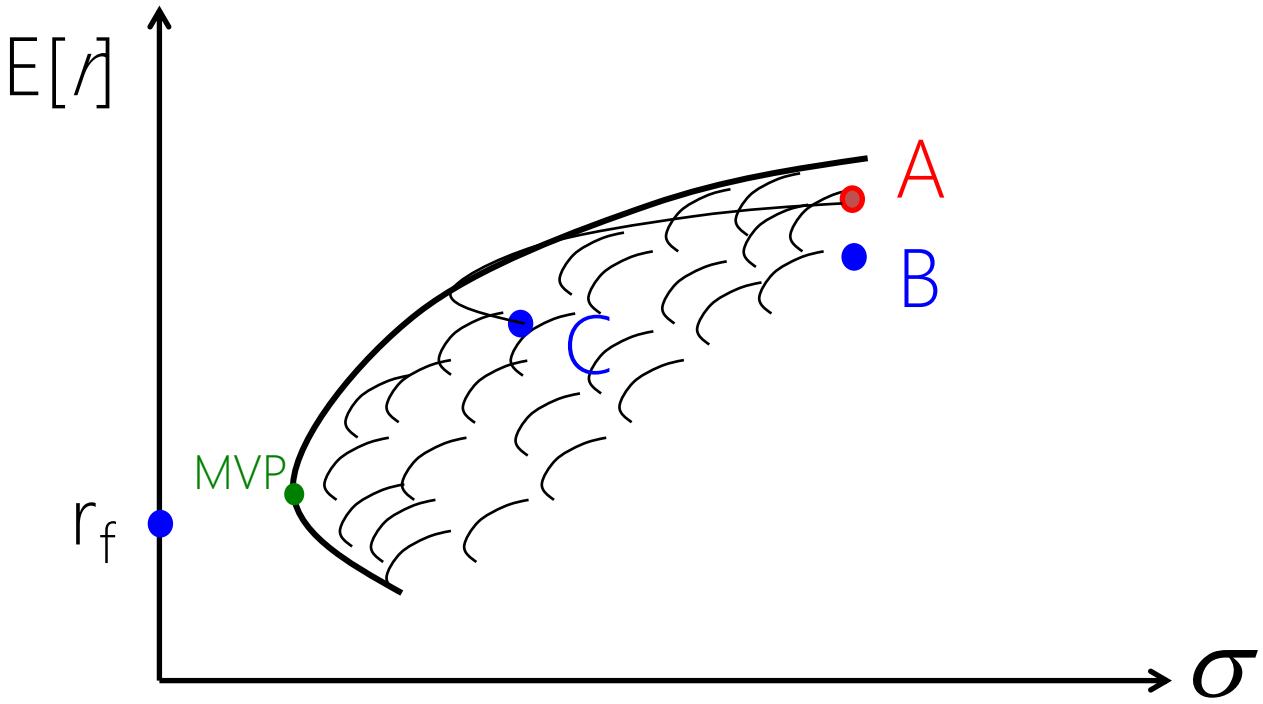
Several types of benchmarks are in use: manager universe, broad market index, style index, etc.

Issues with benchmarking:

- the assumption of same risk among portfolios within the same style/strategy universe may be restrictive
- it does not tell us if portfolio managers have accomplished individual objectives and satisfied investment constraints

Minimum-variance frontier

Each small curve represents the possible weighted combinations of some pair of stocks. The big outer curve is the boundary of the set of all feasible portfolios (minimum-variance frontier).

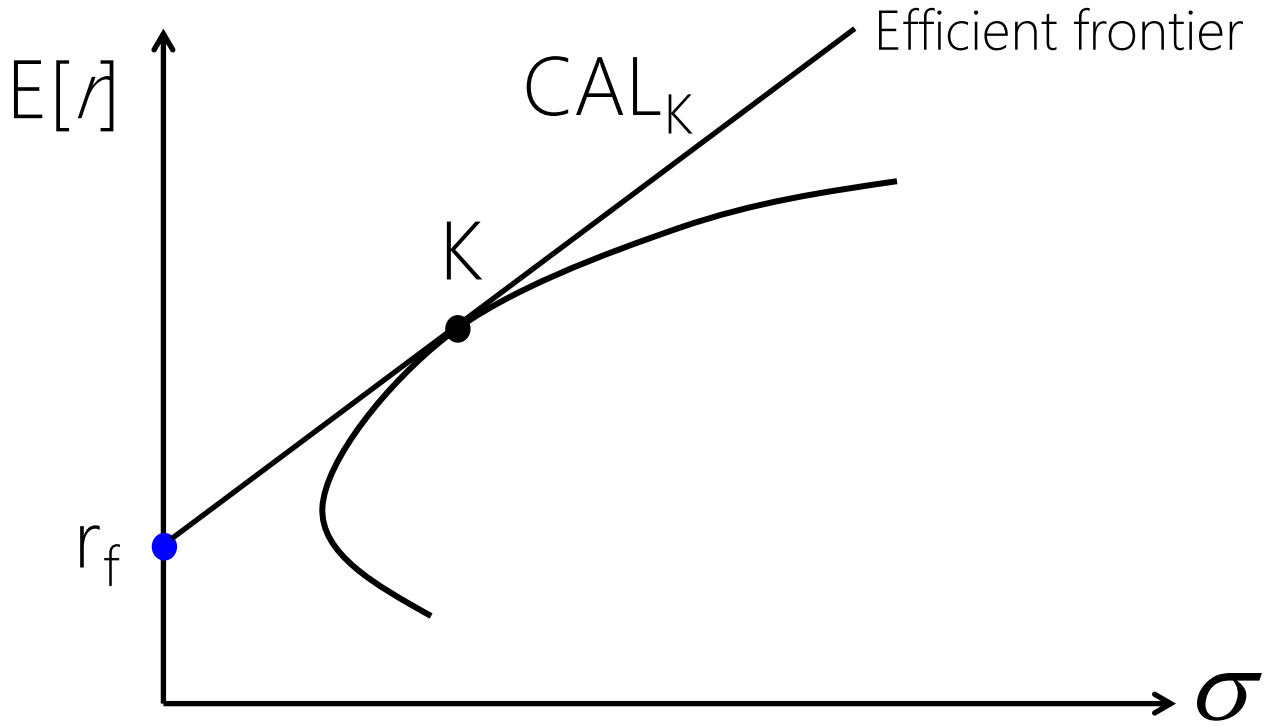


Portfolio theory makes a case for investing in the portfolio with the highest expected return per unit of risk ...

Efficient frontier

CAL – capital allocation line (efficient frontier) for investor K

r_f – rate of return on a risk-free asset

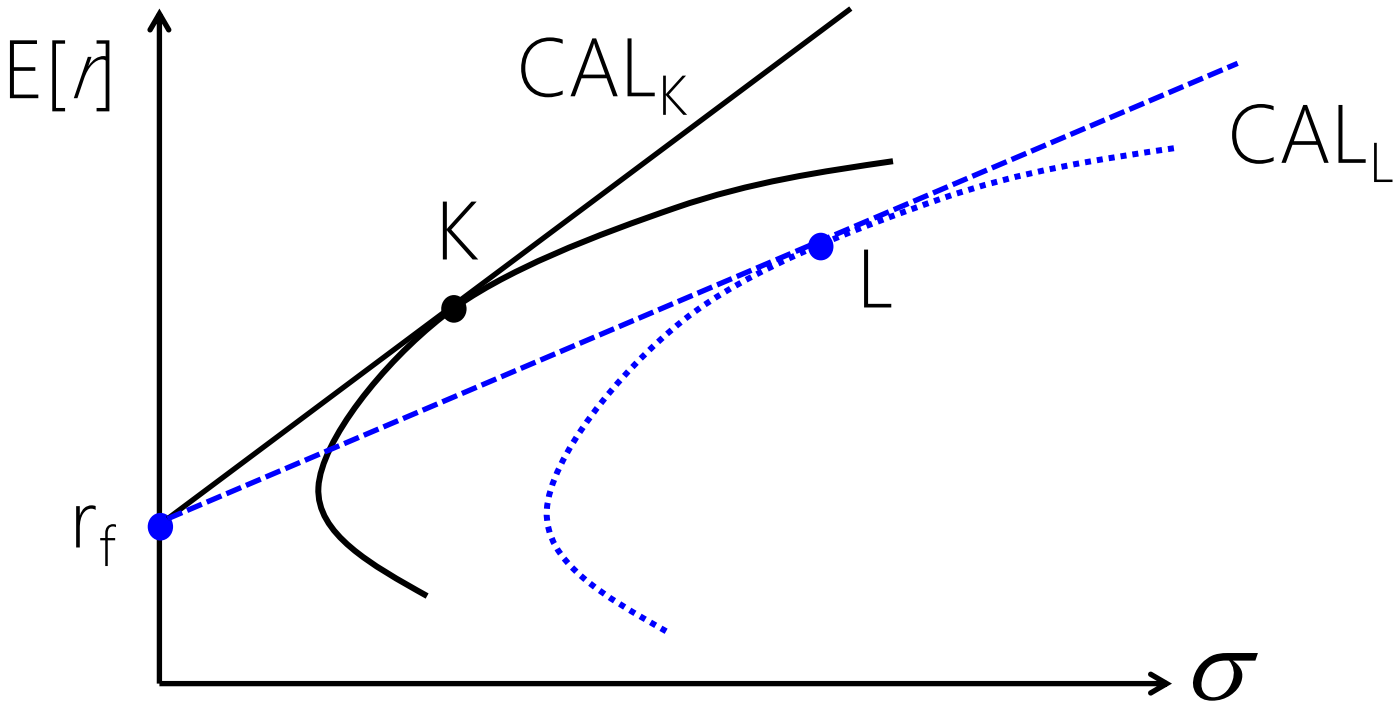


Portfolio theory makes a case for investing in the portfolio with the highest expected return per unit of risk ...

Efficient frontier (2)

CAL – capital allocation line (efficient frontier) for investors K & L

r_f – rate of return on a risk-free asset

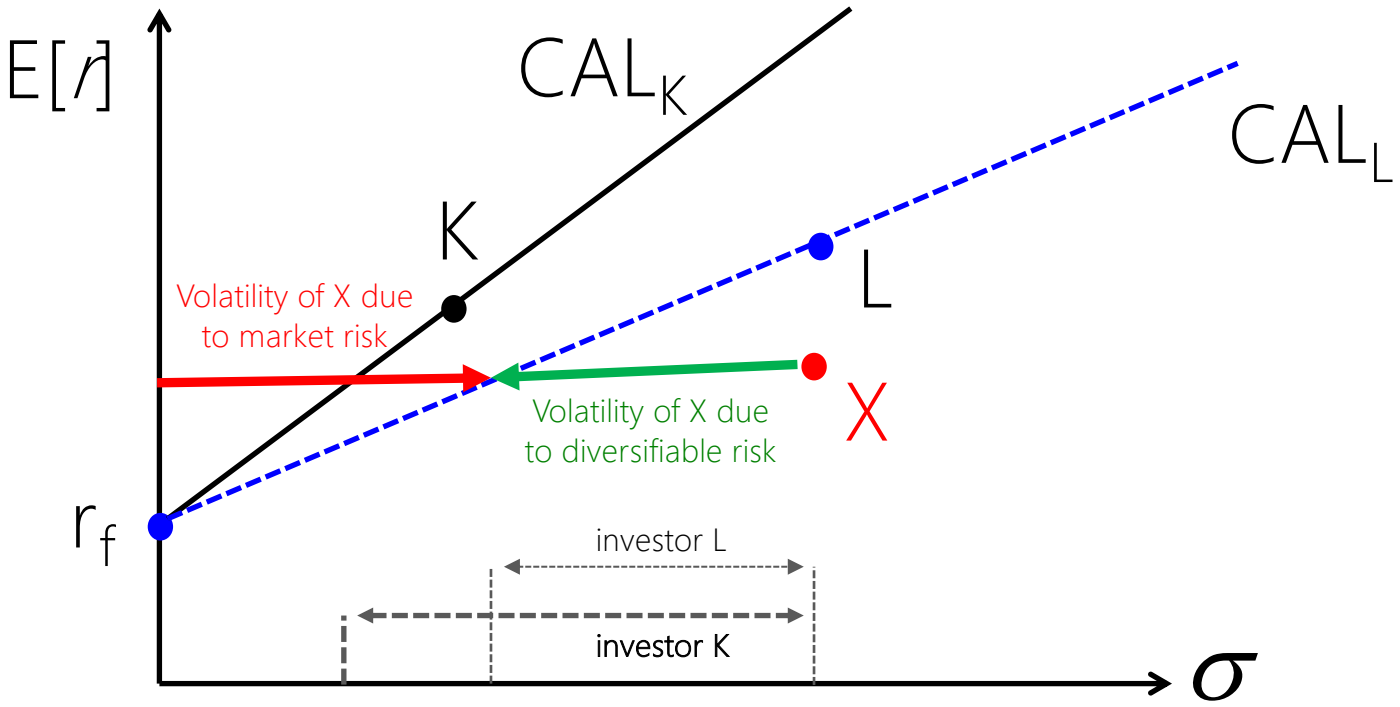


Portfolio theory makes a case for investing in the portfolio with the highest expected return per unit of risk ...

Efficient frontier & investment risks

CAL – capital allocation line (efficient frontier) for investors K & L

r_f – rate of return on a risk-free asset

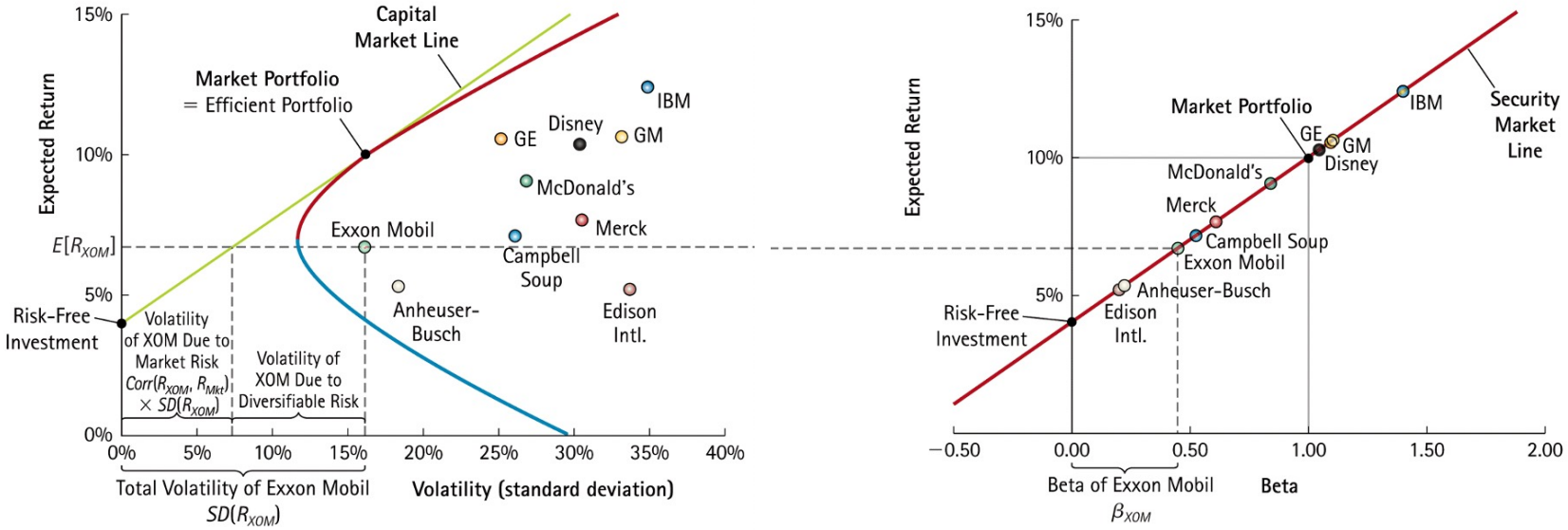


Portfolio theory makes a case for investing in the portfolio with the highest expected return per unit of risk …

Efficient frontier and SML

The CAPM predicts that a stock's required return depends on its beta: $E[r_S]=r_F+\beta_S(E[r_M]-r_F)$

NB: S="stock", F="risk-free asset", M="market"; $\beta_S = cov(r_S,r_M)/var(r_M)$



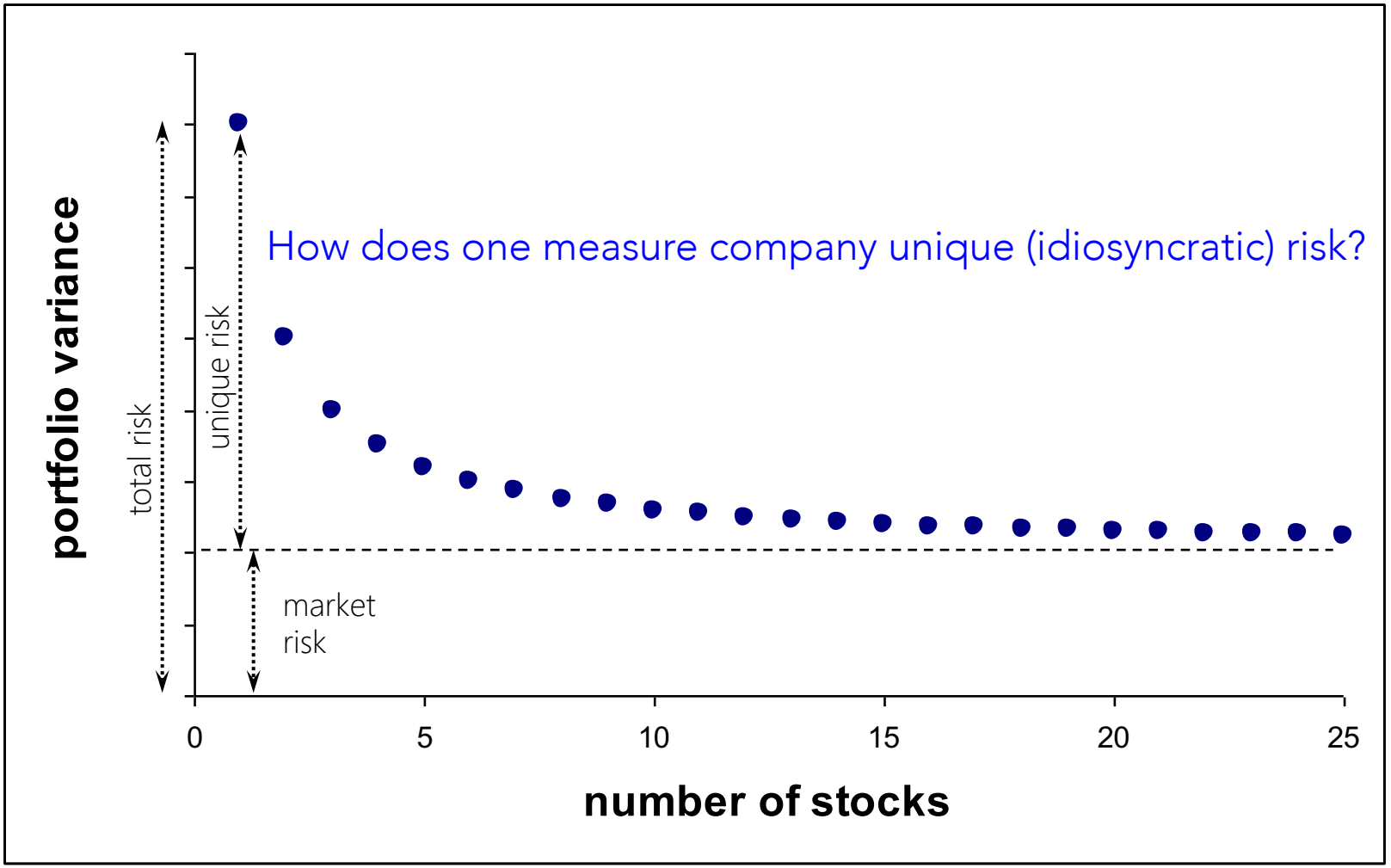
CML depicts portfolios combining the risk-free investment and the efficient portfolio, and shows the highest expected return that can be attained for each level of volatility.

SML shows the required return for each security as a function of its beta with the market. Under CAPM, the market portfolio is efficient ➔ the required return equals the expected returns for every security.

Source: Berk and DeMarzo

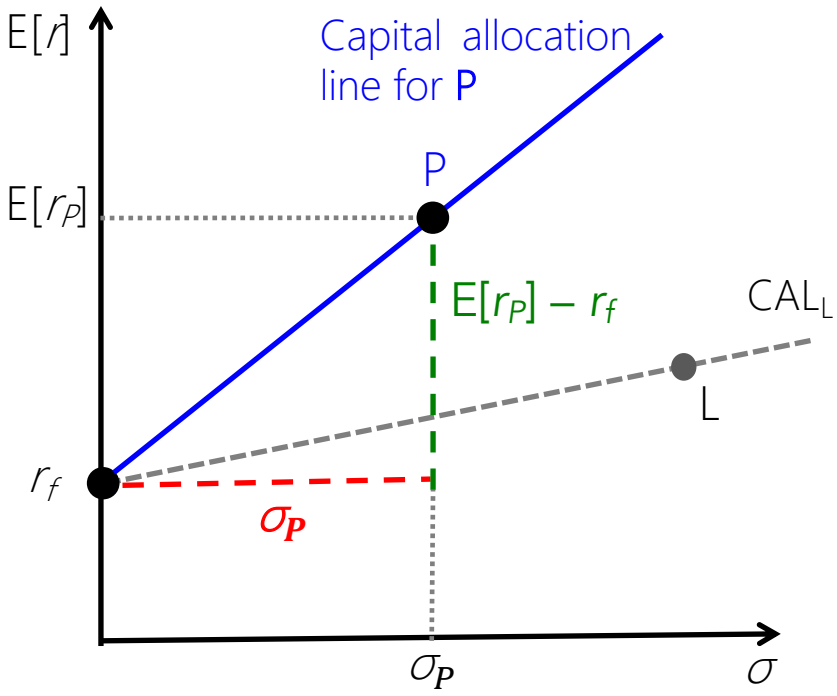
Portfolio risk diversification

Idiosyncratic risk can be eliminated by diversification.



Sharpe and Treynor ratios (SR, TR)

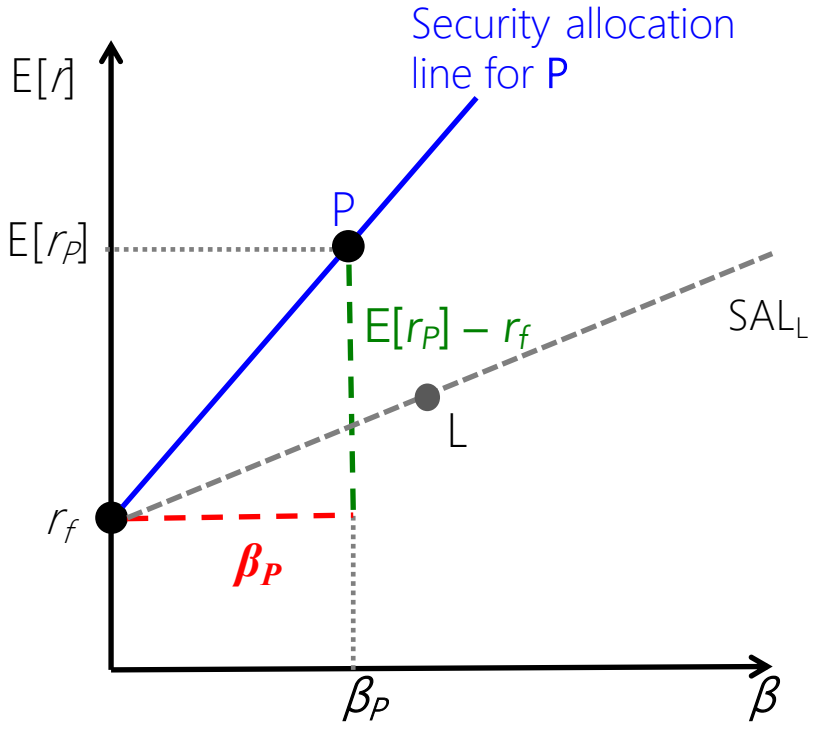
Concentrated investor



$$\text{Sharpe ratio}_P = \frac{E[r_P] - r_f}{\sigma_P}$$

Ex-ante SR captures the slope of the Capital Allocation Line

Diversified investor



$$\text{Treynor ratio}_P = \frac{E[r_P] - r_f}{\beta_P}$$

Ex-ante TR captures the slope of the Security Allocation Line

Sample exam question 2

A U.K. pension fund has employed three investment managers, each of whom is responsible for investing in one-third of all asset classes so that the pension fund has a well-diversified portfolio. Information about the managers is given below.

Manager	Average return	St. deviation	Beta
X	10%	20%	1.1
Y	11%	10%	0.7
Z	12%	25%	0.6
Market	9%	19%	
Risk-free	3%		

For Manager X, calculate the required return on the basis of the average market return and the CAPM. Then also calculate the manager's (ex post) Sharpe ratio, Treynor ratio, M^2 measure, and Jensen's alpha.

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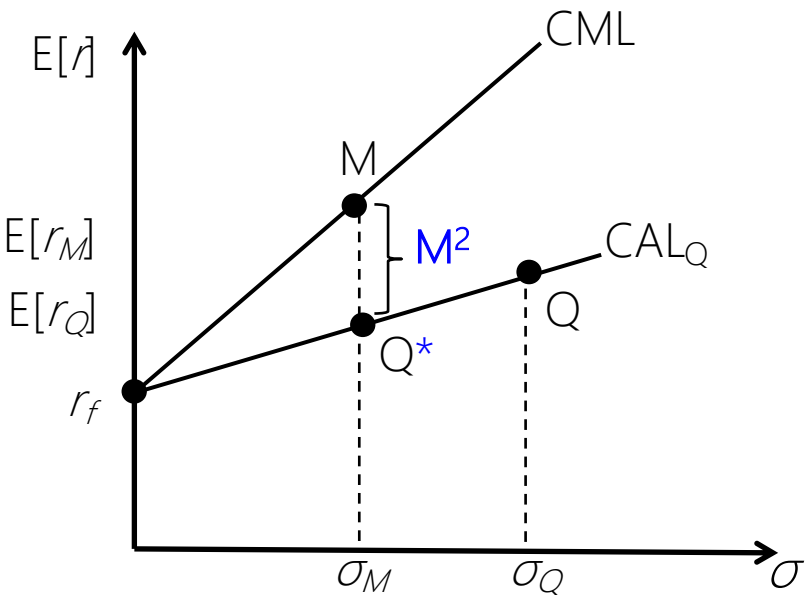
M^2 (Modigliani-squared, 1997)

Sharpe ratio works well for ranking portfolio performance, though its numerical value is not easy to interpret

An alternative measure based on Sharpe (SR), but represented in units of percent return, is Modigliani-Modigliani, aka M^2

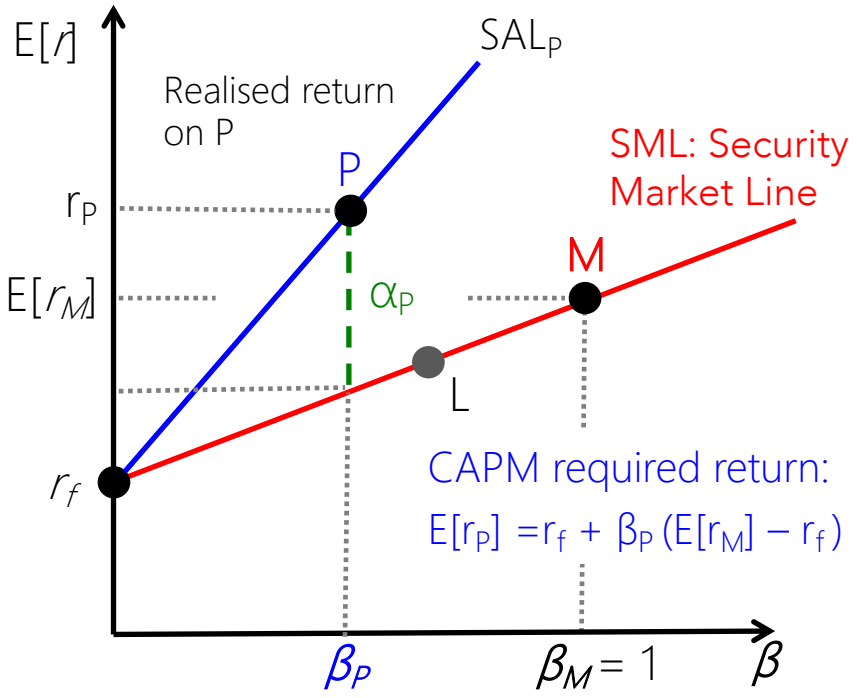


M^2 also focuses on total volatility as a measure of risk.

To compute M^2 for portfolio Q, we imagine that it is mixed with the risk-free asset, so that the resulting portfolio (Q*) matches the volatility of the market:

$$M^2 = R_{Q^*} - R_M = (SR_Q - SR_M)\sigma_M$$

Jensen's alpha



CAPM predicts what a security should earn given its systematic risk, as measured by beta

Difference between the realised (expected) return and CAPM required return is known as **Jensen's (1968) alpha**:

$$\alpha_P = r_P - E[r_P]$$

$$\alpha_P = r_P - [r_f + \beta_M (r_M - r_f)]$$

Practically, Jensen's alpha requires construction of a benchmark portfolio, with a specific β (e.g., benchmark specified in the IPS)

If managers outperform such benchmark then, arguably, they are superior investors earning higher risk-premia than the market risk-premium

Treynor ratio vs alpha

With some algebra we can show that the Treynor ratio of portfolio P (T_P) is just the **market Treynor ratio** + α_P/β_P

$$E(R_p) - r_{ft} = \alpha_p + \beta_p[E(R_m) - r_{ft}]$$

Dividing both sides by beta:

$$\frac{E(R_p) - r_{ft}}{\beta_p} = \frac{\alpha_p}{\beta_p} + [E(R_m) - r_{ft}]$$

Treynor ratio for P

Treynor ratio for Market

$$T_P = \frac{\alpha_p}{\beta_p} + T_M$$

Portfolios with higher Treynor ratios offer higher alpha per unit of systematic risk

Sample exam question 3

Lisa manages a corporate pension fund and she divides up available funds among several well-diversified portfolios. Having evaluated the recent performance of her investment portfolio, she decides to reallocate a small portion of her funds (roughly 5%) into one of the two portfolios - P or S. Which one should she choose (and why)?

	Portfolio P	Portfolio S	Market
Beta	0.90	1.60	1.00
Excess return ($r_i - r_f$)	11%	19%	10%
Alpha	2%	3%	0%

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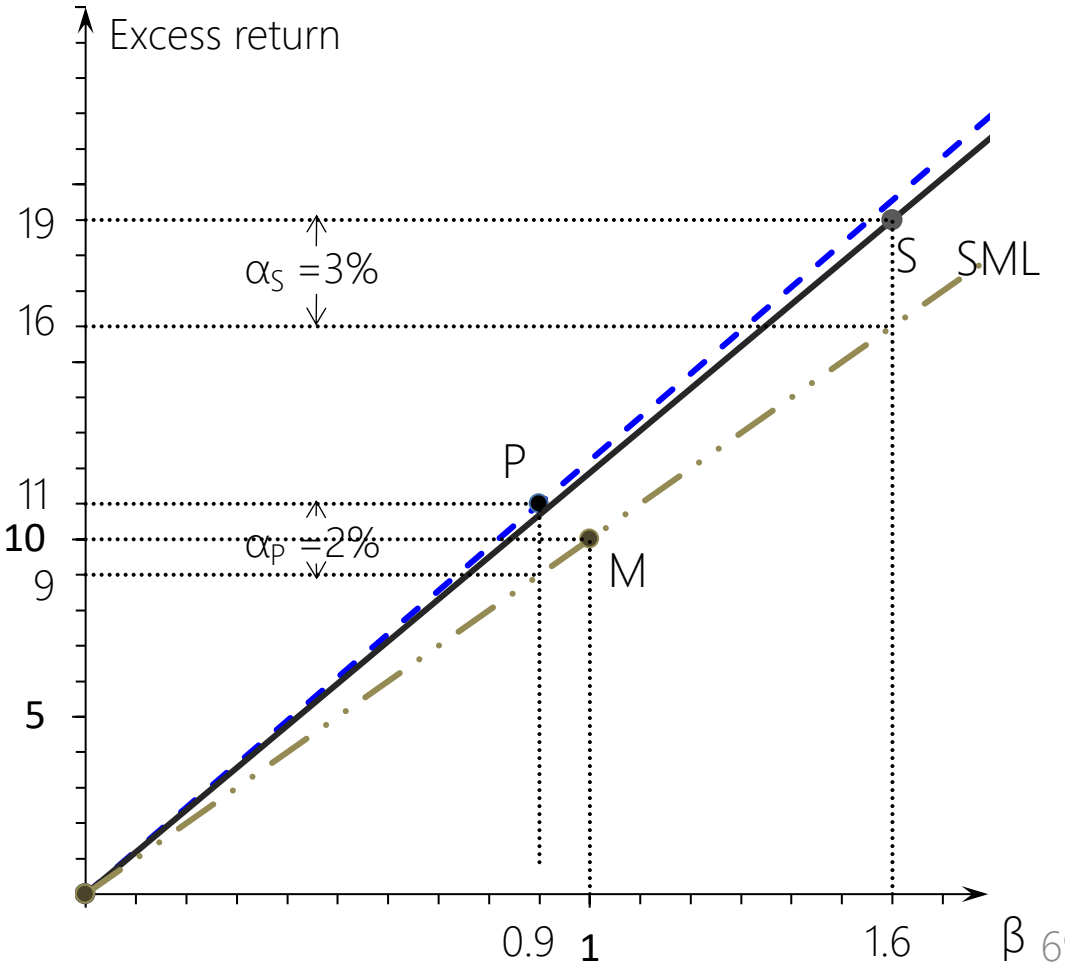
Treynor ratio vs alpha (2)

When comparing two managers with fully diversified portfolios, Jensen's alpha could provide us with misleading results.

The slopes of the lines through P & S are their respective Treynor ratios

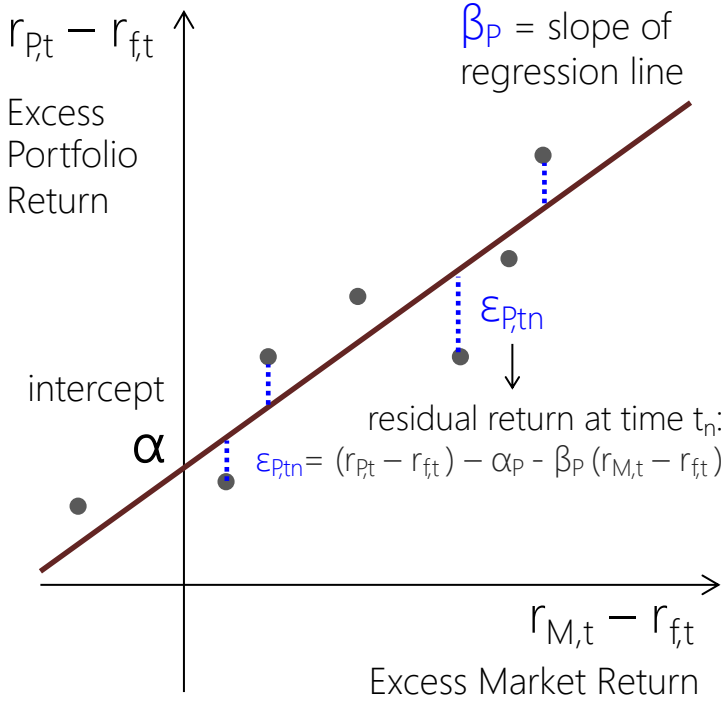
Portfolio P has a higher Treynor (higher SAL slope), despite its lower alpha. It offers higher excess return per unit of systematic risk.

For any given beta a mixture of P with T-bills delivers a higher α than that of S with T-bills.



Market model and alpha

Empirically, Jensen's α is the intercept of the **security characteristic line** (SCL) – i.e. coefficient of the constant in a **market model** regression:



$$(r_{P,t} - r_{f,t}) = \alpha_{P,SI} + \beta_P (r_{M,t} - r_{f,t}) + \varepsilon_{P,t}$$

where
- α_P – unexplained performance
- r_P – realised return (on portfolio/asset)
- r_M – realised market return
- r_f – risk-free rate of return

In an efficient market, the expected value of $\alpha = 0$. It captures the return on the portfolio over and above the return attributable to its systematic risk:

- $\alpha_P < 0$: inadequate return for the risk
- $\alpha_P = 0$: adequate return for the risk taken
- $\alpha_P > 0$: abnormal return for the risk taken

Jensen's alphas are estimated. Therefore, there is some uncertainty associated with their values and statistical significance.

Multi-index model (APT) and alpha

A more realistic model than the **Single Index Model (market model)** should allow the systematic risk to be driven by several factors

For instance, a two-factor model may account for interest-rate effect in addition to market effect:

$$(r_{P,t} - r_{f,t}) = \alpha_{P,IR} + \beta_{P,M}(r_{M,t} - r_{f,t}) + \beta_{P,IR}(r_{IR,t} - r_{f,t}) + \varepsilon_{P,t}$$

where r_{IR} – realised returns on a portfolio of bonds

Fama and French (1992) show that two further stock characteristics help explain the cross-section of stock returns: market value of equity (ME) and the market-to-book (ME/BE) ratio. They propose 2 factors:

SMB the size factor (small-minus-big). The average return on three small-cap stock portfolios minus the average return on three large-cap stock portfolios.

HML the value factor (high-minus-low. The average return on two value stock portfolios minus the average return on two growth stock portfolios.

Fama-French 3- & 5-factor models

FF model is used widely for mutual fund performance evaluation as many funds distinguish themselves along value and size dimensions (see Womack and Zhang, 2003).

$$(r_{P,t} - r_{f,t}) = \alpha_{P,FF3} + \beta_{P,M}(r_{M,t} - r_{f,t}) + \beta_{P,SMB} SMB_t + \beta_{P,HML} HML_t + \varepsilon_{P,t}$$

where SMB = 1/3(Small Value + Small Neutral + Small Growth)
- 1/3(Big Value + Big Neutral + Big Growth)

HML = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth)

Fama-French (2015) show the importance of two additional "quality" factors: **profitability (RMW) and investment (CMA) factors**:

$$(r_{P,t} - r_{f,t}) = \alpha_{P,FF5} + \beta_{P,M}(r_{M,t} - r_{f,t}) + \beta_{P,SMB} SMB_t + \beta_{P,HML} HML_t + \beta_{P,RMW} RMW_t + \beta_{P,CMA} CMA_t + \varepsilon_{P,t}$$

where RMW = difference between returns of firms with robust (high) & weak (low) operating profitability

CMA = difference between the returns of firms that invest conservatively (low total asset growth) and firms that invest aggressively (high total asset growth)

Carhart 4-factor model

Jegadeesh and Titman (1993) captures the momentum effect: stocks that out- (under-) performed for one year, tend to out- (under-) perform over the next year.

Carhart (1997): proposes to control for the momentum effect by constructing an additional momentum factor (PR1YR): return on a portfolio of high prior one-year return stocks, minus the return on a portfolio of low prior return stocks:

- use 11 month returns lagged by one month to form portfolios (to remove mechanical correlation with prior returns due to "stale" prices and the "bid-ask bounce")
- Carhart used equal-weighted portfolios, subsequent researchers used value-weighted to reduce transaction costs
- Carhart momentum factor goes by other names: MOM ("momentum"), WML ("winners-minus-losers"), UMD ("up minus down")

Carhart 4-factor model (2)

$$(r_{P,t} - r_{f,t}) = \alpha_P + \beta_{P,M}(r_{M,t} - r_{f,t}) + \beta_{P,SMB}\,SMB_t + \beta_{P,HML}HML_t + \beta_{P,UMD}UMD_t + \varepsilon_{P,t}$$

where UMD = is a zero-cost (long-short) portfolio that is long previous 12-month return winners and short previous 12-month loser stocks.

Table II

Performance Measurement Model Summary Statistics, July 1963 to December 1993

VWRF is the Center for Research in Security Prices (CRSP) value-weight stock index minus the one-month T-bill return. RMRF is the excess return on Fama and French's (1993) market proxy. SMB and HML are Fama and French's factor-mimicking portfolios for size and book-to-market equity. PR1YR is a factor-mimicking portfolio for one-year return momentum.

Factor Portfolio	Monthly Excess Return	Std Dev	*t*-stat for Mean = 0	Cross-Correlations				
				VWRF	RMRF	SMB	HML	PR1YR
VWRF	0.44	4.39	1.93	1.00				
RMRF	0.47	4.43	2.01	1.00	1.00			
SMB	0.29	2.89	1.89	0.35	0.32	1.00		
HML	0.46	2.59	3.42	−0.36	−0.37	0.10	1.00	
PR1YR	0.82	3.49	4.46	0.01	0.01	−0.29	−0.16	1.00

Multifactor model & return attribution

Multifactor models can help us uncover the sources of a manager's returns relative to a benchmark – i.e., the <u>active return</u> = $r_P - r_B$

- most active portfolio managers are evaluated relative to a pre-specified benchmark;
- to add value relative to a passive investment approach, they commonly hold securities in different-from-benchmark weights in a way that reflects their expectations and beliefs regarding the key return drivers;
- we can use multifactor models to gauge if manager's insights were translated into superior active returns and, if so, examine its sources:

$$\text{Active return} = \sum_{k=1}^{K} \left[\beta_{P,k} - \beta_{B,k}\right] \text{x Factor return}_k + \text{Security selection return}$$

where $\beta_{P,k}$ and $\beta_{B,k}$ are the portfolio's and benchmark's sensitivities to each return factor

Carhart: active return decomposition

Consider an analyst uses the Carhart four-factor model to evaluate the performance of a recently hired US fund manager:

$$(r_{P,t} - r_{f,t}) = \alpha_P + \beta_{P,M}(r_{M,t} - r_{f,t}) + \beta_{P,SMB}\,SMB_t + \beta_{P,HML}HML_t + \beta_{P,UMD}UMD_t + \varepsilon_{P,t}$$

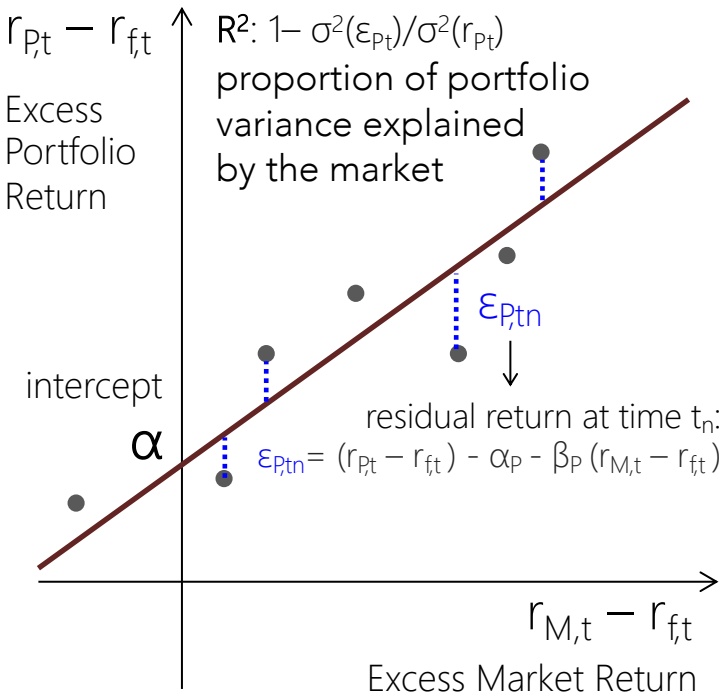
The manager describes himself as a "stock picker", and the following presents a Carhart model decomposition of that manager's active returns:

	Factor sensitivity				Contribution to active	
	Portfolio	Benchmark	Difference	Factor return	Absolute	Proportion of
Factor	(1)	(2)	(3) = (1) - (2)	(4)	(3) x (4)	Total Active
Market	0.95	1.00	-0.05	5.52%	-0.28%	-13.31%
SMB	-1.05	-1.00	-0.05	-3.35%	0.17%	8.08%
HML	0.40	0.00	0.40	5.10%	2.04%	98.36%
UMD	0.05	0.03	0.02	9.63%	0.19%	9.29%
				(A) Return from factor tilts =	2.12%	102.41%
				(B) Security selection (α_P) =	-0.05%	-2.41%
				Active return (A+B) =	2.07%	100.00%

What concerns might the analyst discuss with the manager given the above?

Information ratio

To the extent that Jensen's α captures superior selection ability, it also implies deviations from the benchmark holdings/weights



Information Ratio helps in assessing the benefits of non-perfect diversification [α_P] relative to its cost [$\sigma(\varepsilon_{Pt})$]:

$$IR_P = \frac{\alpha_P}{\sigma(\varepsilon_{P,t})}$$

IR>0.5 considered good
IR>1.0 are exceptional

$\sigma(\varepsilon_{jt})$: residual standard deviation
$\sigma(r_{jt})$: portfolio standard deviation

Jensen's α can be used to compare the performance of a portfolio with that of a risk-adjusted benchmark

Treynor & Sharpe measures can be used to compare the performance of two or more portfolios with one another.

Information ratio (UK funds)

Information ratio for UK equity mutual funds since 1988

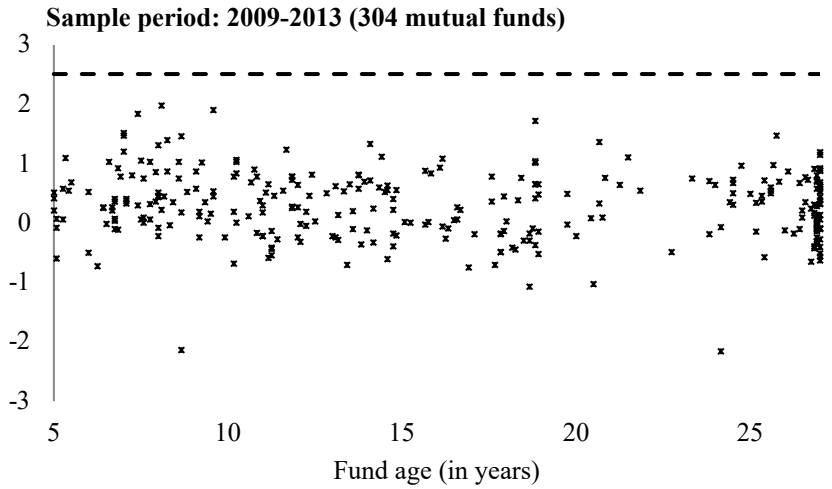
	Period	Distribution of information ratios			
		Count	Med	95th %ile	Max
Funds with at least 5-year history	2009-2013	304	0.313	1.149	1.983
Funds with at least 10-year history	2004-2013	225	0.042	0.723	1.060
Funds with at least 20-year history	1994-2013	98	0.136	0.575	0.693
Funds with at least 25-year history	1988-2013	76	0.011	0.475	0.710

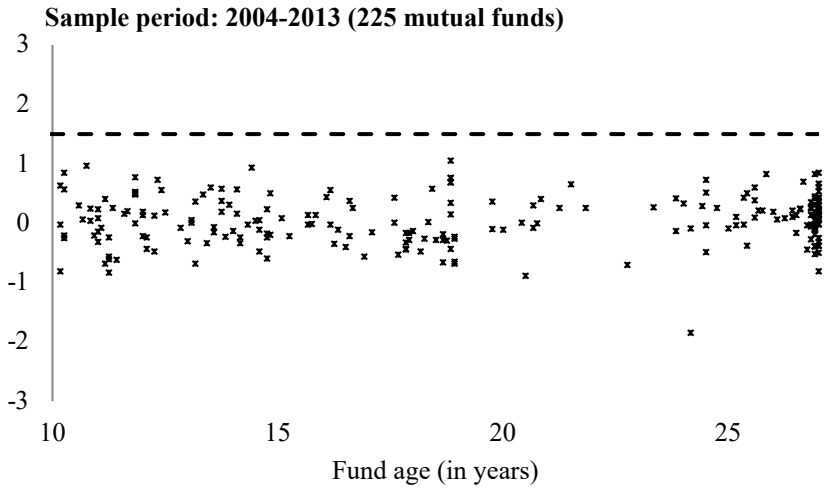
Manager (25+ years history)	Initial charge	Annual charge	Average excess return	Information ratio
EW Sector	-	-	0.071	0.641
5-Sector Momentum	-	-	0.087	0.610
Invesco Fund Managers Ltd	5.00%	1.67%	0.092	0.710
Aviva Investors UK Fund Services Ltd	n/a	1.50%	0.091	0.648
Fidelity [FIL Investment SVCS (UK)]	n/a	1.50%	0.086	0.413
Artemis Fund Managers Ltd	5.00%	1.50%	0.086	0.345
Invesco Fund Managers Ltd	5.00%	1.66%	0.085	0.548

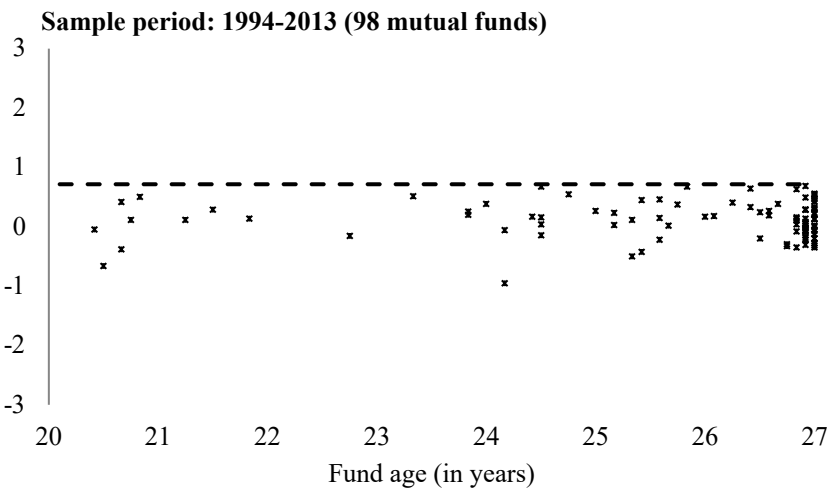
Source: Keswani, Stolin, Zagonov (2016)

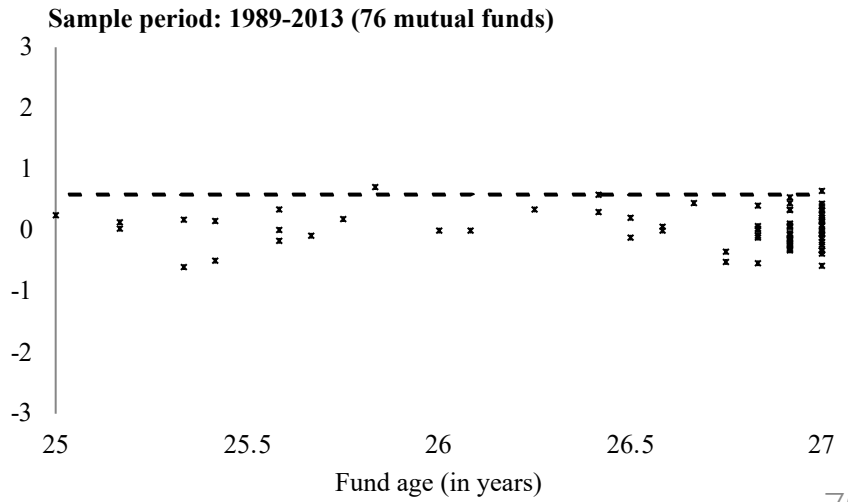
Information ratio of UK funds vs EW

Information ratio for EW Sector strategy relative to UK equity mutual funds



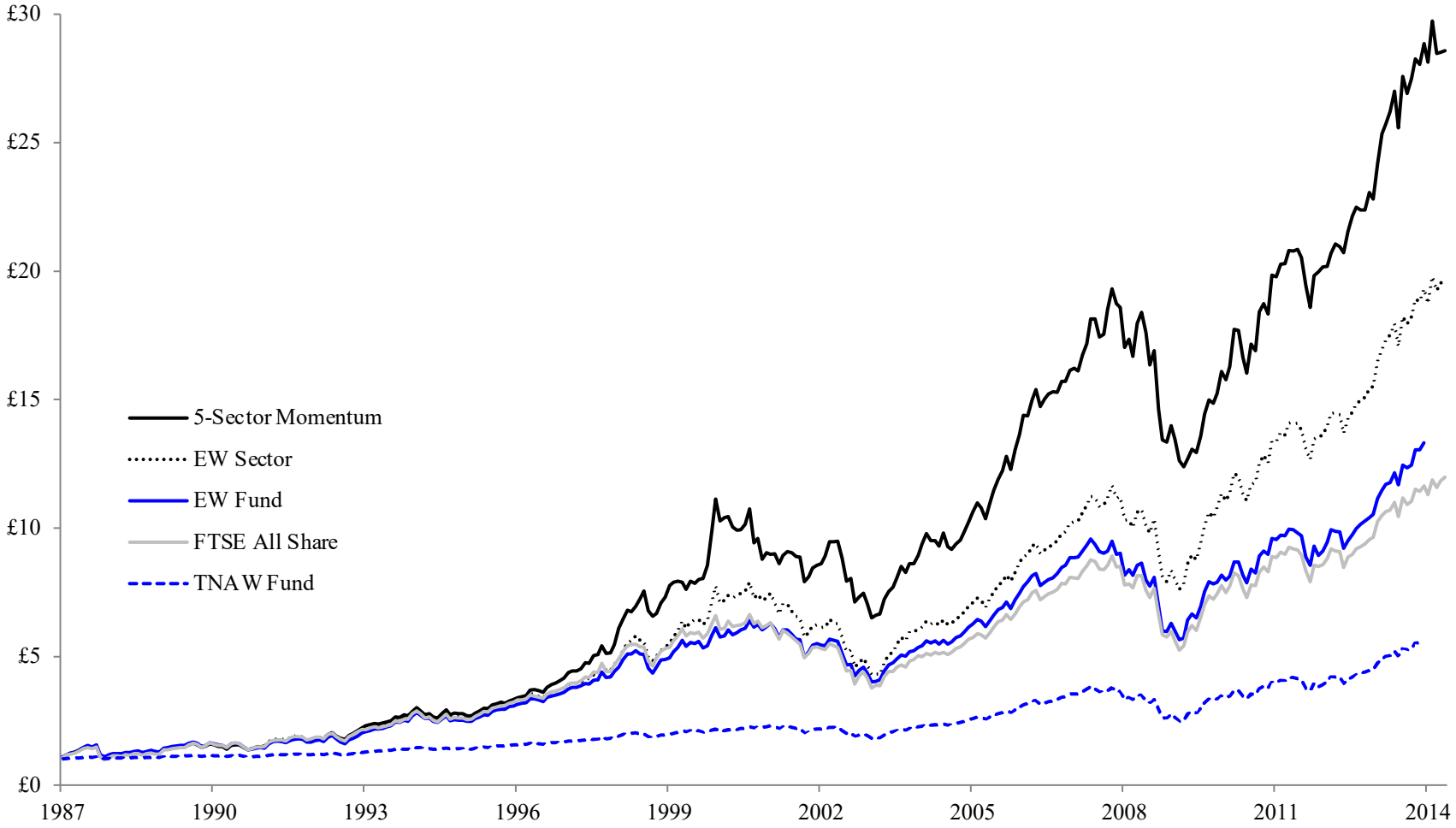






Source: Keswani, Stolin, Zagonov (2016)

EW Sector portfolio vs UK funds



Source: Keswani, Stolin, Zagonov (2016)

Sample exam question 4

A Japanese investor is holding the Nikkei 225 index, which is her version of the market. She thinks that stocks P, Q, and R, which are not in Nikkei, are undervalued and should form a part of her portfolio. She has the following information about the stocks, Nikkei 225, and the risk-free rate:

Asset	Average return	St. deviation	Beta
P	15%	30%	1.5
Q	18%	25%	1.2
R	16%	23%	1.1
Nikkei 225	12%	18%	1.0
Risk-free	2%		

Calculate (a) Information ratios for each stock. (b) Should any of the three stocks be included in the portfolio? If so, (c) which stock should have the highest weight in the portfolio and why?

wooclap.com/IF

Risk-adjusted measures summary

The choice of performance measure depends on investment assumptions

1. if the portfolio being chosen is not diversified, **Sharpe ratio** should be used
2. if the portfolio being chosen is well diversified, non-systematic risk is negligible and **Treynor measure** is the appropriate measure to use
3. if the active portfolio being selected is to be combined with a well-diversified portfolio, then we should compare the **Information ratios** of competing active portfolios. IR measures the abnormal return per unit of risk added by the security to a well-diversified portfolio

Market timing

Market timing refers to an investment strategy based on future market price movement predictions.

Two techniques for improving performance:

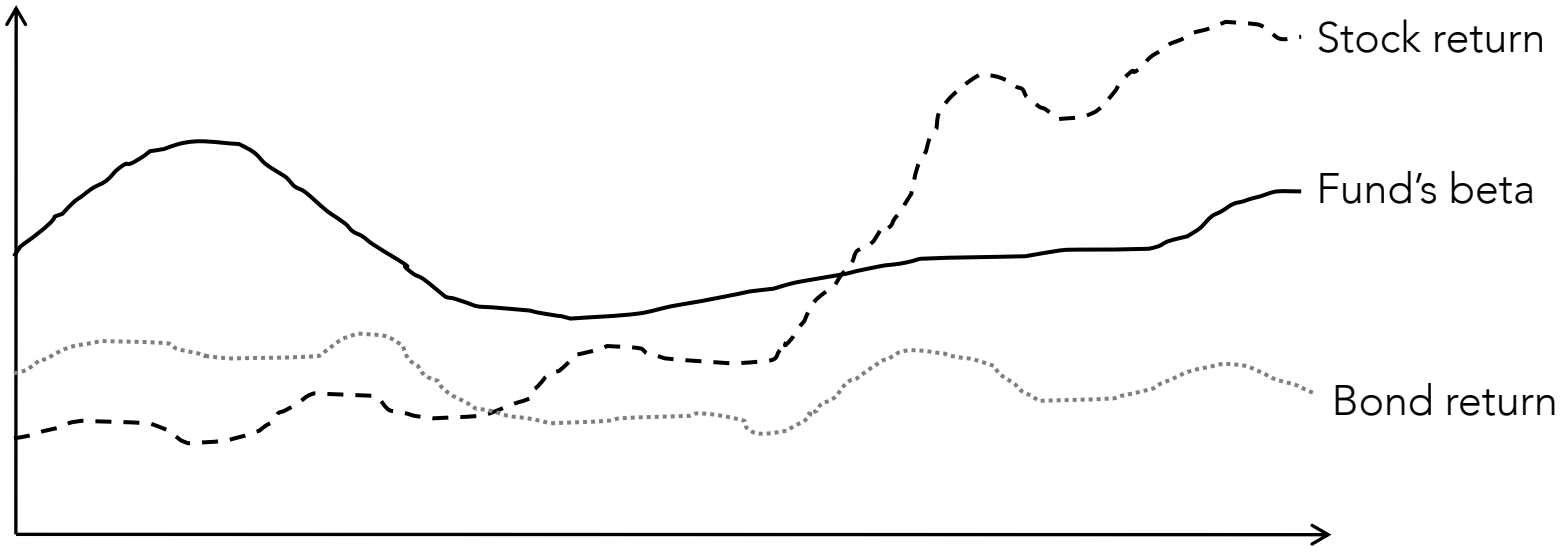
- shift from money-market instruments/bonds to equities when the stock market is expected to do well, and vice versa
- increase portfolios' betas when the equity market is expected to perform well and vice versa (expensive due to research costs, transaction costs and turnover)

Both techniques impact the average portfolio's beta. Therefore, one can use beta to analyse managers' market timing ability:

- no market timing: (fairly) constant average portfolio beta
- market timing: high β in rising market, low β in falling market

Measuring market timing ability

When market timing involves change of fund's beta to reflect managers' market outlook, one can use graphs to compare fund's beta with market movements



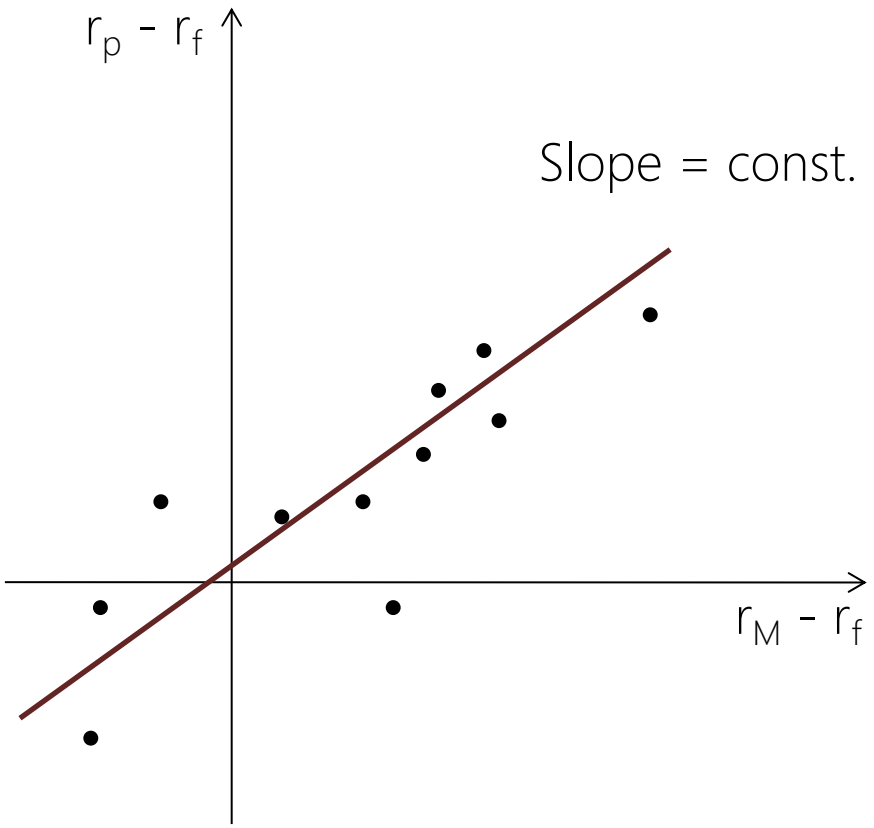
In this example, there is no apparent correlation between fund's beta and market returns

Measuring market timing ability

Suppose the manager holds only the market index and the risk free asset

If the weights of the market were constant, then the portfolio beta would be constant.

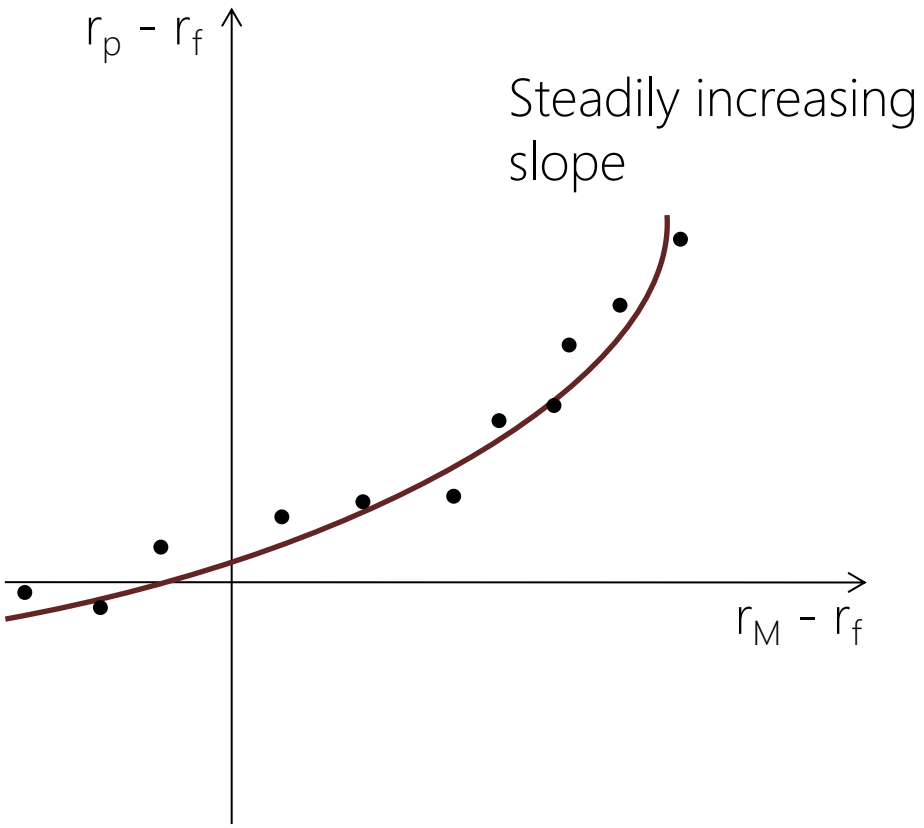
The security characteristic line (SCL) would then plot as a straight line on the right.



Measuring market timing ability

If the manager is able to predict bull and bear markets and time the market by shifting funds into the market when it does well, the security characteristic line will be non-linear.

Its slope will be higher in "bull" market and lower in "bear" market, resulting in the curved line as follows



Measuring market timing ability

There is evidence that the relationships between returns of a fund that uses market timing and the stock market index is not a linear one, but quadratic (see previous slide)

Hence, traditional Jensen's alpha would not be appropriate measure of performance of market timers

More appropriate measure of performance is proposed by Treynor and Mazuy (1966), who suggested that a security characteristic line be estimated by adding a squared term to the usual linear index model:

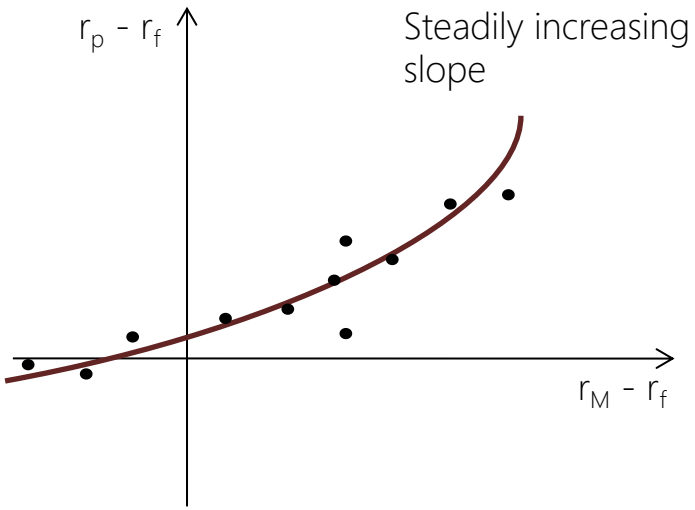
$$(R_{pt} - r_{ft}) = \alpha_p + \beta_p (R_{Mt} - r_{ft}) + \gamma_p (R_{Mt} - r_{ft})^2 + \varepsilon_{pt}$$

where coefficient γ_p indicates superior market timing ability if it is positive and significant

Market timing: Treynor-Mazuy

Benchmark timing: beta increases with the market excess return

The characteristic line has a higher slope in months in which the market goes up than in months in which the market goes down



$$(R_{pt} - r_{ft}) = \alpha_p + \beta_p (R_{Mt} - r_{ft}) + \\ + \gamma_p (R_{Mt} - r_{ft})^2 + \varepsilon_{pt}$$

Stock picking: $\alpha_p \geq 0$

Good market timing: $\gamma_p \geq 0$

Market timing: Henriksson-Merton

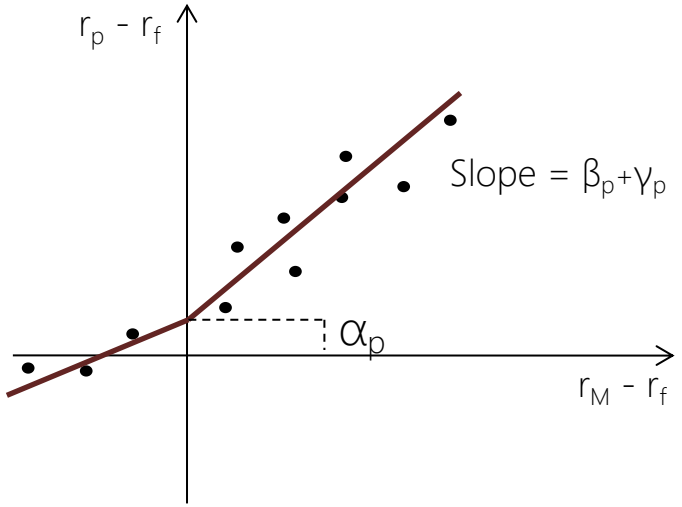
Henriksson and Merton (1981) suggest taking a different approach to market timing

They suggest that the beta of a portfolio takes two values:

- a high value if the market is expected to do well
- a low value otherwise

Hence the characteristic line has a higher slope in months in which the market goes up than in months in which the market goes down

Market timing: Henriksson-Merton



$$(R_{pt} - r_{ft}) = \alpha_p + \beta_p (R_{Mt} - r_{ft}) + \\ + \gamma_p (R_{Mt} - r_{ft}) D + \varepsilon_{pt}$$

D = dummy variable

$$\begin{cases} D = 1 \text{ if } R_{Mt} \geq r_{ft} \\ D = 0 \text{ if } R_{Mt} < r_{ft} \end{cases}$$

Stock picking: $\alpha_p \geq 0$

Good market timing: $\gamma_p \geq 0$

Hence the beta of the portfolio is β_p in bear markets and $\beta_p+\gamma_p$ in bull markets

Again a positive value of γ_p denotes market timing ability

Market timing: empirical evidence

Ferson and Schadt (FS, 1996) examine the performance of 67 mutual funds using monthly return data (including reinvestments of all dividends net of annual fees) from Jan. 1968 to Dec. 1990

The funds are classified in sectors as maximum capital gain, growth-income, growth funds, and income funds

These data are used to study managers' timing ability:

1. Researchers first estimate the Treynor and Mazuy model:

$$(R_{pt} - r_{ft}) = \alpha_p + \beta_p (R_{Mt} - r_{ft}) + \gamma_p (R_{Mt} - r_{ft})^2 + \varepsilon_{pt}$$

   the results are reported in the table on the next slide; coefficients are reported for equally-weighted averages of the funds in each group

Ferson & Schadt test Treynor-Mazuy

$$(R_{pt} - r_{ft}) = \alpha_p + \beta_p (R_{Mt} - r_{ft}) + \gamma_p (R_{Mt} - r_{ft})^2 + \varepsilon_{pt}$$

	Abnormal performance		Market timing	
Fund Objective	α_p	$t(\alpha)$	γ_p	$t(\gamma)$
Maximum gain	0.1370	1.03	-0.0096	-2.70
Growth	-0.0250	-0.41	-0.0023	-1.90
Growth-income	-0.0260	-0.70	-0.0014	-2.33
Income	0.0150	0.23	0.0005	0.38
Buy and hold	0.0820	2.01	-0.0040	-3.76
All Funds	0.0300	0.62	-0.0028	-2.47

Ferson & Schadt test Treynor-Mazuy

When FS estimate the Treynor-Mazuy model the find striking results:

- first, they find that two-thirds of alphas are negative
- in addition, they find that 44 out of the 67 estimates of the timing coefficient are negative and all the estimates for the maximum gain funds are negative
- of the 11 timing coefficients that are statistically significant, 8 are negative

Their results suggest that the majority of funds do badly and have poor market timing ability

Ferson & Schadt test Treynor-Mazuy

Taking the timing results at face value, the results of FS suggest that many funds have systematically perverse timing abilities

That interpretation is subject to a number of criticisms:

- if the funds have superior information about future market moves but systematically get the direction wrong the astute investors could take the opposite position and profit;
- perhaps the most telling piece of evidence that traditional market timing models give false signals about performance is the results for the "buy-and-hold" strategy in the previous table
- the timing coefficient on the buy-and-hold in the table is significant and negative (t-stats -2.47) – clearly the "buy-and-hold" strategy does not involve any market timing information

Ferson & Schadt test Henriksson-Merton

Ferson and Schadt (FS) get similar results when they estimate the Henriksson and Merton model

- evidence of poor timing ability for the majority of funds consistent with their findings for the Treynor-Mazuy model

FS then estimate a conditional version of the timing model of Treynor and Mazuy

- the idea of their model is to distinguish market timing based on public information from market timing that is truly superior to public information.

Conditional Treynor-Mazuy model

Ferson and Schadt argue that lagged values of the following variables can be used to predict the market return:

- the dividend yield
- the slope of the term structure (measured as the yield difference between short-term and long-term government bonds)
- the level of interest rates (measured as the yield on a short-term treasury bill)
- the corporate bond yield quality spread (measured as the yield difference between low and high quality corporate bonds)

Conditional Treynor-Mazuy model

FS estimate a regression model with an interaction between the lagged values of predictive variables & market risk premium

The aim is to capture that part of the risk premium that can be predicted by these variables:

$$(R_{pt} - r_{ft}) = \alpha_p + \beta_0 (R_{Mt} - r_{ft}) + \sum_{i=1}^{n} \beta_i (R_{Mt} - r_{ft}) \times \text{predictive variables}_{i,t-1} + \gamma_p (R_{Mt} - r_{ft})^2 + \varepsilon_{pt}$$

- coefficients β_i capture how the manager's beta varies in response to the lagged predictive variables
- the coefficient γ_p measures the sensitivity of the manager's beta to any private market timing signal, after taking into account the predictive variables

Conditional Treynor-Mazuy model

	Unconditional		Conditional	
Fund Objective	γ_p	t(γ)	γ_p	t(γ)
Maximum gain	-0.0096	-2.70	-0.0018	-0.44
Growth	-0.0023	-1.90	0.0009	0.57
Growth-income	-0.0014	-2.33	0.0010	1.07
Income	0.0005	0.38	0.0039	1.72
Buy and hold	-0.0040	-3.76	-0.0010	-0.93
All Funds	-0.0028	-2.47	0.0004	0.31

Using the conditional version of the Treynor-Mazuy regressions leads to very different results

Conditional Treynor-Mazuy model

The evidence of counter-intuitive bad timing ability disappears

- of the 67 timing coefficients estimated, only 27 are negative of which only two are statistically significant

Ferson and Schadt find that using a conditional model makes a large difference to the fraction of funds that have negative alphas

- going from the unconditional to the conditional Treynor - Mazuy model reduces the fraction of funds with negative alphas from 2/3 to 1/2

Ferson and Schadt also examine a conditional version of the Henriksson-Merton model and reach similar conclusions about timing abilities

Practitioner MF data sources

To help investors with fund choice, independent bodies rate them using a variety of metrics

These ratings are similar in spirit to credit ratings. Provided by the likes of:

- Lipper
- Morningstar
- CityWire
- FT, Bloomberg, Datastream, Factset
- and many more

Q: Can we be absolutely certain that all funds that have ever existed are included? Does it matter if not?

Morningstar sample report (1)

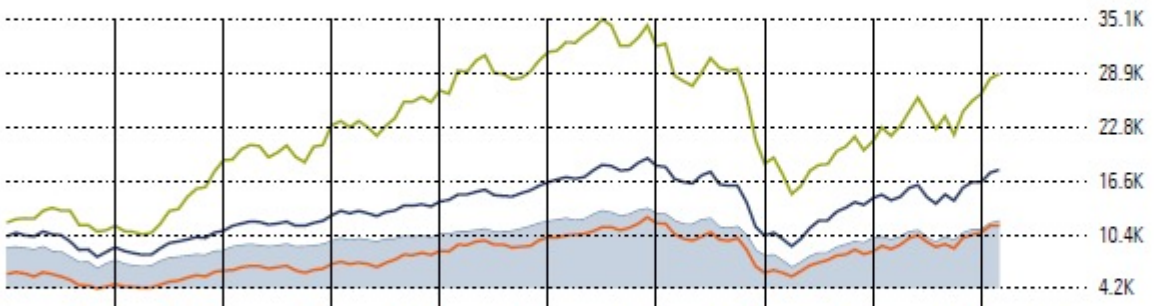
From Morningstar.com

Investment Comparison Report

From Morningstar.com

Performance

Historical Performance



2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	History
-27.48	42.81	15.72	16.14	19.01	15.98	-45.96	44.36	25.30	9.89	Alger Small Cap Growth A (ALSAX)
-11.41	76.38	23.18	13.39	18.71	2.49	-40.50	18.06	24.69	7.23	Allianz US Systematic Small Cap
-19.86	34.09	15.16	9.47	16.37	8.65	-41.52	40.94	16.88	5.65	T. Rowe Price Spectrum Growth (PRSGX)
-22.10	28.68	10.88	4.91	15.79	5.49	-37.00	26.46	15.06	5.92	Idx: S&P 500 TR

Relative Performance to

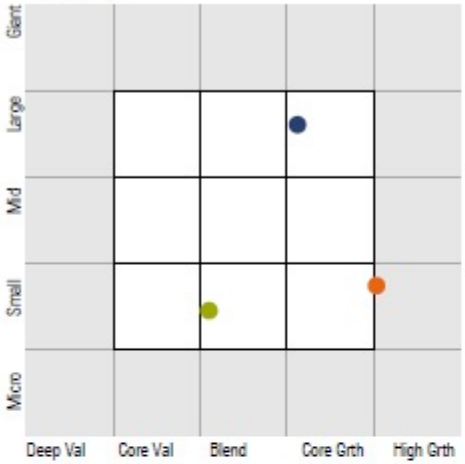
Excess Return	Alpha	Beta	R-Squared	Tracking Error	Info Ratio	Up Cap Ratio	Down Cap Ratio	
0.12	1.43	1.16	61.67	15.11	0.10	143.76	125.98	Alger Small Cap Growth A (ALSAX)
0.71	8.54	1.02	62.16	12.91	0.66	138.15	96.88	Allianz US Systematic Small Cap
0.31	3.65	1.03	91.51	5.11	0.72	117.62	99.25	T. Rowe Price Spectrum Growth (PRSGX)
0.00	0.00	1.00	100.00	0.00	–	100.00	100.00	Idx: S&P 500 TR

Morningstar sample report (2)

From Morningstar.com

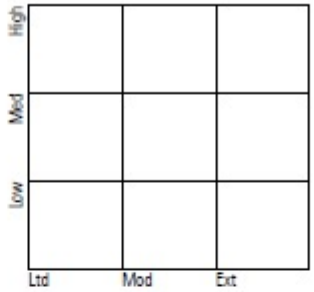
Style and Sector Trails

Equity Style



Sector Delta

Fixed Income Style



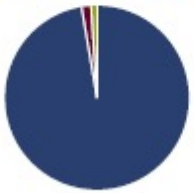
- Alger Small Cap Growth A (ALSAX)
- Allianz US Systematic Small Cap
- T. Rowe Price Spectrum Growth (PRSGX)

Asset Allocation

Alger Small Cap Growth A (ALSAX)

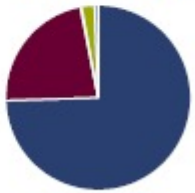
US	93.49
Non US	3.71
Bonds	0.00
Cash	2.79
Other	0.01

Allianz US Systematic Small Cap



US	97.32
Non US	1.65
Bonds	0.00
Cash	1.03
Other	0.00

T. Rowe Price Spectrum Growth (PRSGX)



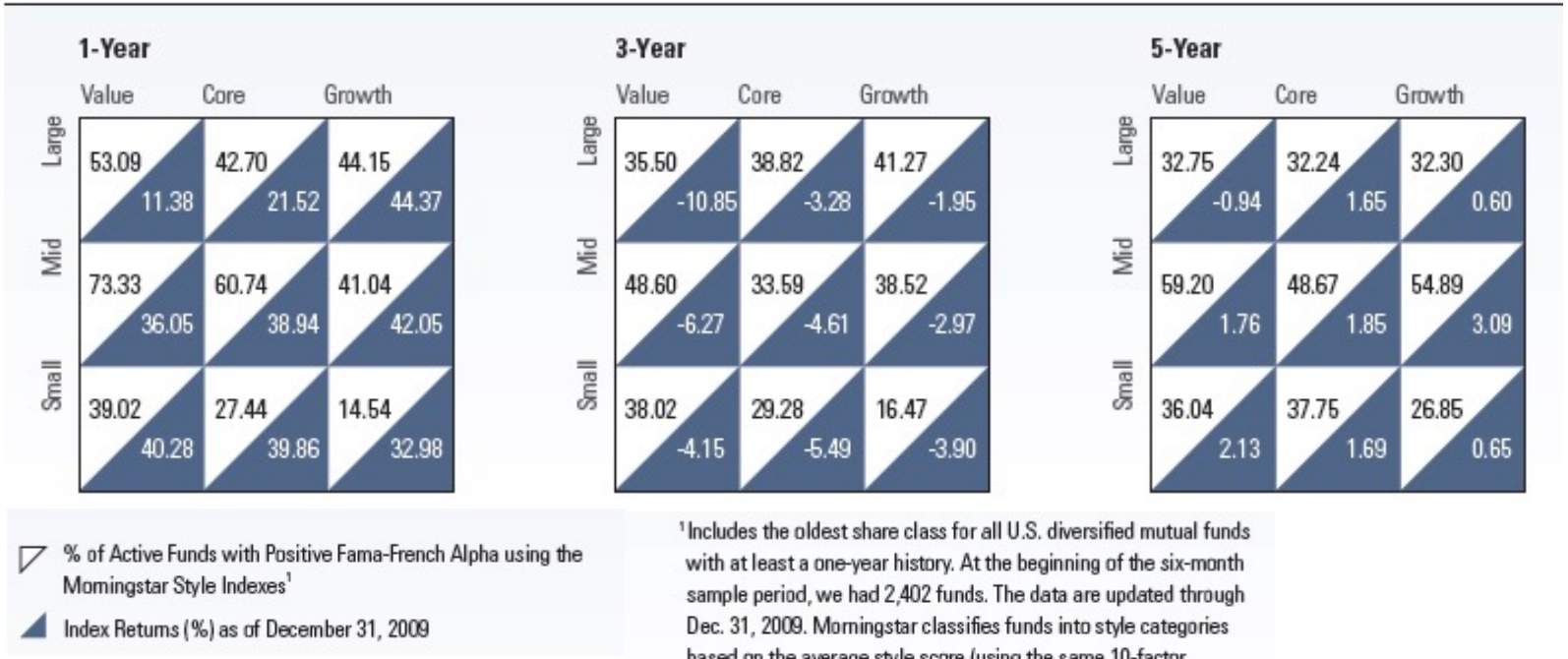
US	74.50
Non US	22.39
Bonds	0.22
Cash	2.22
Other	0.67

Morningstar example box score report

"After accounting for the sensitivity to risk, size and style as well as costs, only about a third of active funds in the study had positive alpha over the three years to 2009"

From Morningstar.com

Figure I: % of Active Funds with Positive Fama-French Alpha by Morningstar Style Box



% of Active Funds with Positive Fama-French Alpha using the Morningstar Style Indexes[1]

Index Returns (%) as of December 31, 2009

[1]Includes the oldest share class for all U.S. diversified mutual funds with at least a one-year history. At the beginning of the six-month sample period, we had 2,402 funds. The data are updated through Dec. 31, 2009. Morningstar classifies funds into style categories based on the average style score (using the same 10-factor methodology as underlying benchmarks) of all available portfolio holdings over a three-year period.

COURSE OUTLINE

1. PORTFOLIO MANAGEMENT PROCESS & PERFORMANCE EVALUATION*
2. ACTIVE EQUITY INVESTMENT STRATEGIES, INVESTMENT STYLES & FACTOR INVESTING*
3. PASSIVE EQUITY INVESTING (self-study)

* supported by practical assignments

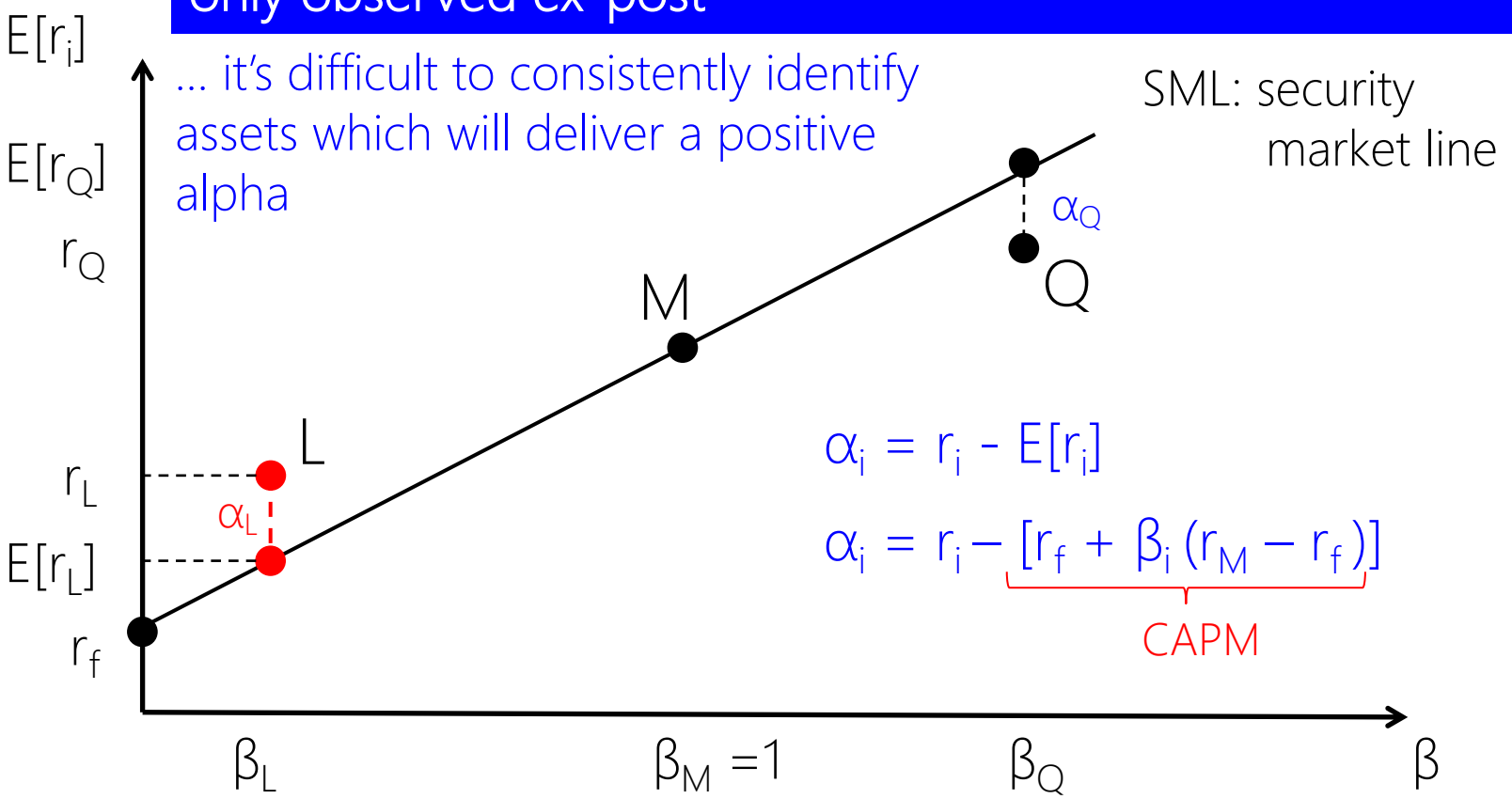
PART 2

ACTIVE EQUITY INVESTMENT STRATEGIES, INVESTMENT STYLES & FACTOR INVESTING

Brief recap of CAPM and SML

Active managers chase underpriced securities - because they deliver positive alphas

However, alphas cannot be predicted ex-ante and are only observed ex-post



Alpha-based asset selection: S&P500

Consider the Fama-French model for the following the S&P500 stocks:

The question is what determines alphas.

	AMAZON	BEST BUY	FOREST LABS.	HARLEY-DAVIDSON	CMS ENERGY	GOODYEAR
Alpha	0.069	0.042	0.040	0.028	-0.022	-0.037
t-stats	*2.16*	*1.67*	*3.04*	*2.94*	*-1.69*	*-2.58*
MRK	2.056	2.040	0.498	1.347	1.566	1.843
t-stats	*2.90*	*3.63*	*1.70*	*6.35*	*5.52*	*5.79*
SMB	-0.876	0.288	-0.307	-0.122	-0.111	0.767
t-stats	*-1.20*	*0.50*	*-1.02*	*-0.56*	*-0.38*	*2.35*
HML	-1.761	-0.326	-0.258	0.025	1.431	1.699
t-stats	*-2.00*	*-0.47*	*-0.71*	*0.10*	*4.05*	*4.29*
R-sq	0.35	0.31	0.12	0.52	0.45	0.39

abs(t-stats)	> 1.65	> 1.96	> 2.33
Significance	Marginally significant	Significant	Very significant

Empirical findings suggest that companies' fundamentals drive alphas: SIZE; Book value – to – market value; dividend yield; growth rate.

Determinants of alphas

It has been noted that stocks and portfolios with positive alphas outperform the market. What determines positive alpha?

- empirical tests show that market-adjusted excess returns (alpha) often differ with respect to stocks' fundamental characteristics: e.g., dividend yield, size, P/E ratio, Market-to-Book ratio, sales growth, leverage, etc…

If there is a sufficient commonality in managers' investment philosophies, portfolio characteristics and subsequent returns, then such type of investing is labelled style investing

The existence of style is confirmed by the observation of consistent return patterns following from the style:

- performance of indices of stocks selected using style characteristics
- average returns of managers following a particular style

Classification of investment styles

Investment styles have emerged because of evidence that stocks with common characteristics show tendency to move together:

Value style

cheap stocks, low P/E, low market-to-book, high dividend yield stocks

Growth style

expensive stocks, consistent earnings growth & earnings momentum

Market oriented style

more diversified, market like portfolios … value based or growth based

Small Cap style

investing in small cap companies has historically been popular with mutual funds and investment trusts

last 10 years – evidence that small companies underperform large in the US, but not in France, UK, or Global portfolio (on the value-weighted basis)

Small cap style

Invest in small capitalisation stocks, which can be defined as the smallest decile (bottom 10%) of stocks in terms of market cap

- some institutional investors may alter this definition by treating bottom 25% or 30% as small caps

Historically, small stocks outperformed, on average, large stocks but the volatility of small stocks is also larger

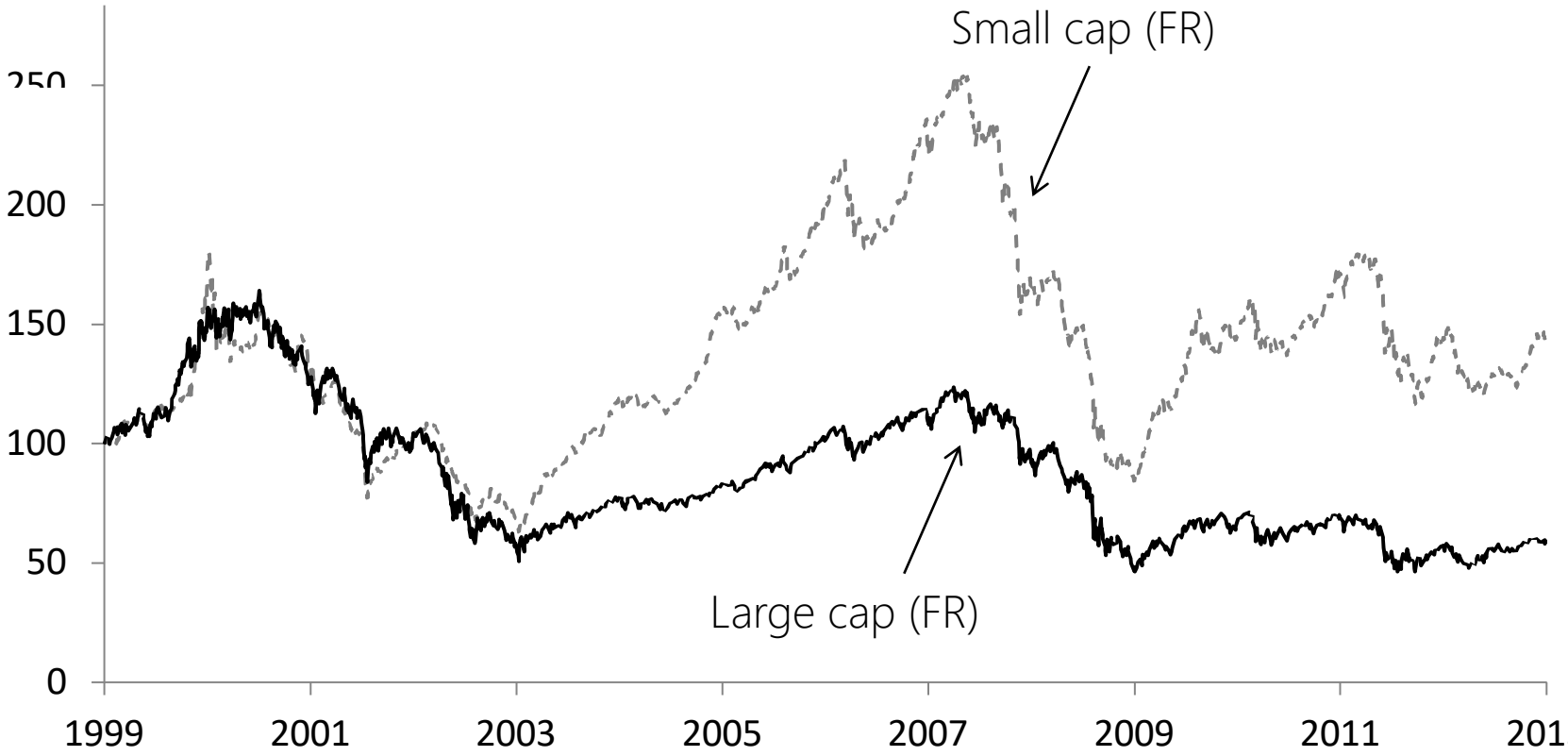
- there is evidence to suggest cyclicality of this pattern: small outperform large for a number of years and *vice versa*

Explanations for this phenomenon: small cap stocks are usually low priced, neglected, low liquidity, have higher betas, and susceptible to seasonality

- no clear evidence to support the validity of these explanations; behavioural explanation works well

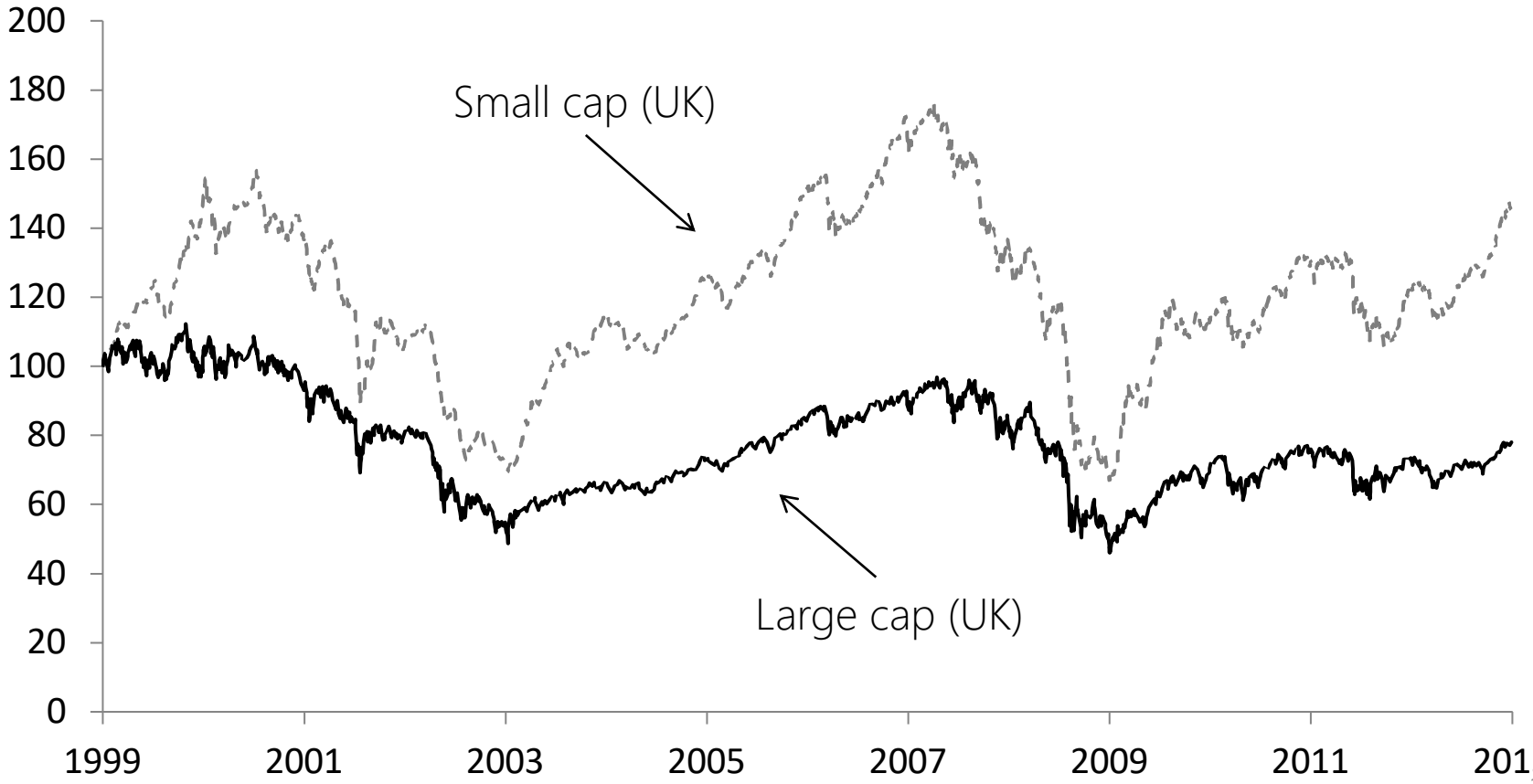
Small & Large: historical performance

Small & Large caps' performance in FRANCE, 1999-2014



Small & Large: historical performance

Small & Large caps' performance in the UK, 1999-2014



Small vs. Large: January performance

Whole January

	CAC SMALL	CAC 40	FTSE SMALL	FTSE 100
1/31/2003	-4.06%	-4.11%	-5.00%	-9.46%
1/30/2004	8.40%	2.26%	5.84%	-1.93%
1/31/2005	11.72%	1.50%	4.33%	0.79%
1/31/2006	3.77%	3.58%	4.68%	1.39%
1/31/2007	5.63%	-0.17%	0.55%	-1.71%
1/31/2008	**-18.86%**	**-12.26%**	**-8.57%**	**-8.37%**
1/30/2009	2.75%	-7.58%	-3.95%	-6.42%
1/29/2010	5.40%	-5.00%	1.09%	-4.14%
1/31/2011	3.56%	2.68%	0.91%	-0.63%
1/31/2012	8.09%	2.37%	6.27%	1.96%
31/1/2013	6.51%	2.51%	6.23%	6.43%
Average	2.99%	-1.29%	1.12%	-2.01%
Compound	2.66%	-1.42%	1.01%	-2.11%

Average without 2008	5.18%	-0.20%	2.09%	-1.37%
without 2007-2009	5.42%	0.72%	3.04%	-0.70%
Long-short	4.28%		3.13%	

Small vs. Large: January performance

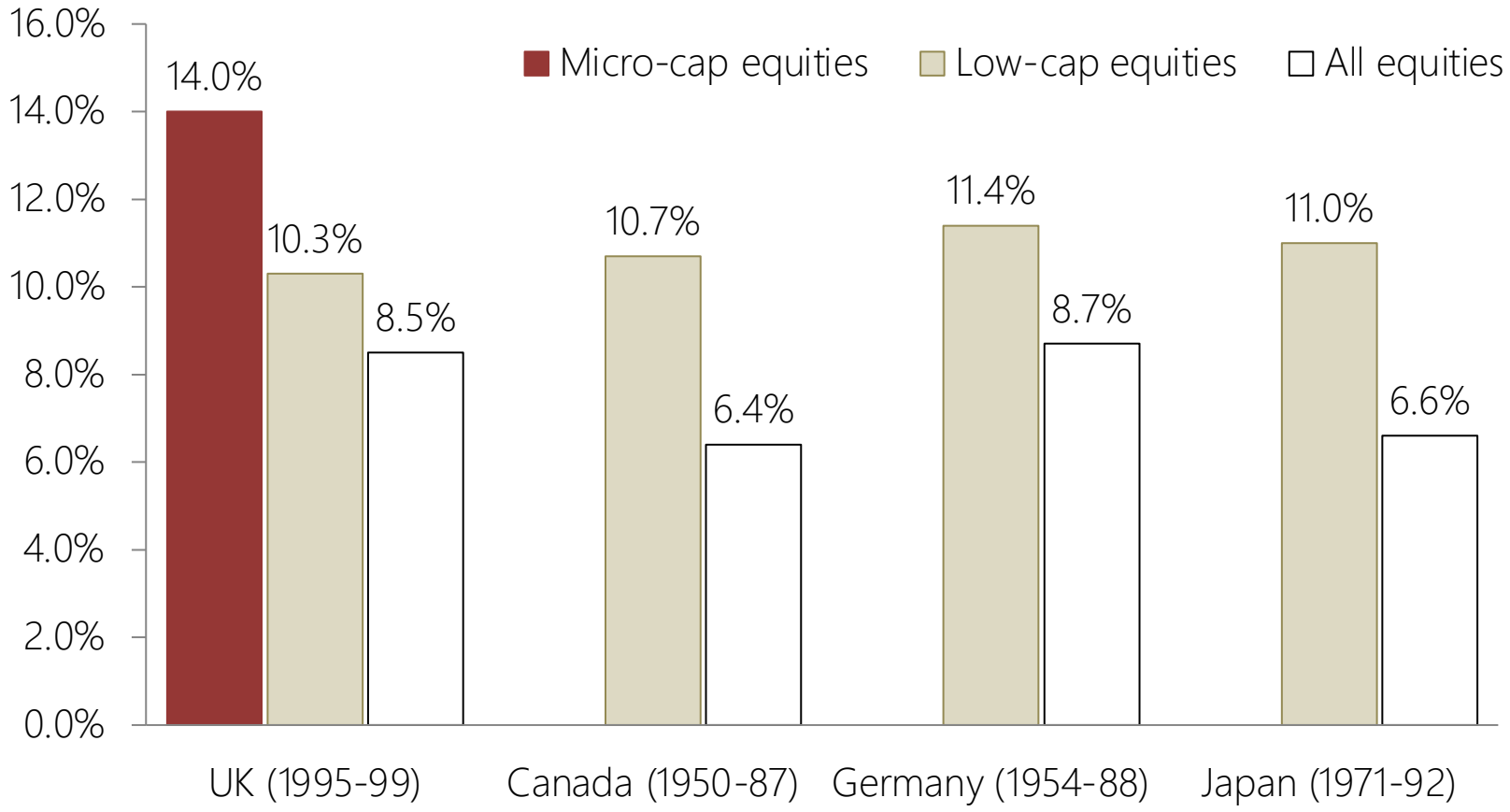
First 5 days of January

	CAC SMALL	CAC 40	FTSE SMALL	FTSE 100
1/7/2003	**2.33%**	**3.17%**	1.36%	0.43%
1/7/2004	2.51%	0.16%	1.53%	-0.09%
1/7/2005	1.37%	0.58%	0.84%	0.83%
1/6/2006	**1.63%**	**2.36%**	2.07%	2.01%
1/5/2007	2.04%	-0.44%	0.78%	-0.01%
1/7/2008	**-5.63%**	**-2.87%**	**-2.26%**	**-1.88%**
1/7/2009	7.88%	3.98%	4.71%	1.65%
1/7/2010	4.41%	2.25%	2.19%	2.10%
1/7/2011	1.59%	-0.90%	**0.45%**	**1.43%**
1/6/2012	0.02%	-2.64%	**0.35%**	**1.39%**
1/7/2013	3.41%	1.75%	3.06%	2.83%
Average	1.96%	0.67%	1.37%	0.97%
Compound	1.91%	0.65%	1.36%	0.96%

Average without 2008	2.64%	0.95%	1.59%	1.08%
without 2007-2009	2.16%	0.84%	1.48%	1.37%

Size anomaly: international evidence

Mean returns. Source: Dimson and Marsh (2001)



Value style (low P/E and high DY)

Value investors are interested in the price component of P/E ratio. They buy at low Price relative to company Earnings, expecting that the price will rise during the investment horizon resulting in profits

- approach based on low market valuation of stocks at the time of distress for a company – contrarian approach

Value investors are short-term investors, with high income (dividend yield) expectations

Historically, value stocks have outperformed growth stocks (not in the US)

Some explanations for such market anomaly:

- higher risk associated with low P/E ratio stocks ➔ greater returns
- explained by another anomaly: e.g., most value stocks are small size
- examples: utilities, banking sector, cyclical stocks

Growth style (high P/E and low DY)

Growth style is more pragmatic and less clear defined than value

Growth investors are interested in the earnings component of P/E

- Consistent growth strategy: investing in stocks that have consistent earnings growth rate, and are usually reasonably priced
- Earnings momentum strategy: investing in companies that have recently experienced large increase in earnings growth – aggressive approach to growth investing
- Investors are expecting the company will increase earnings in the future, which will be reflected in higher price and returns

Growth investors are long-term investors, expecting no or low income (dividend yield) and high growth of the company

Examples: technology, IT, pharmaceutical sectors

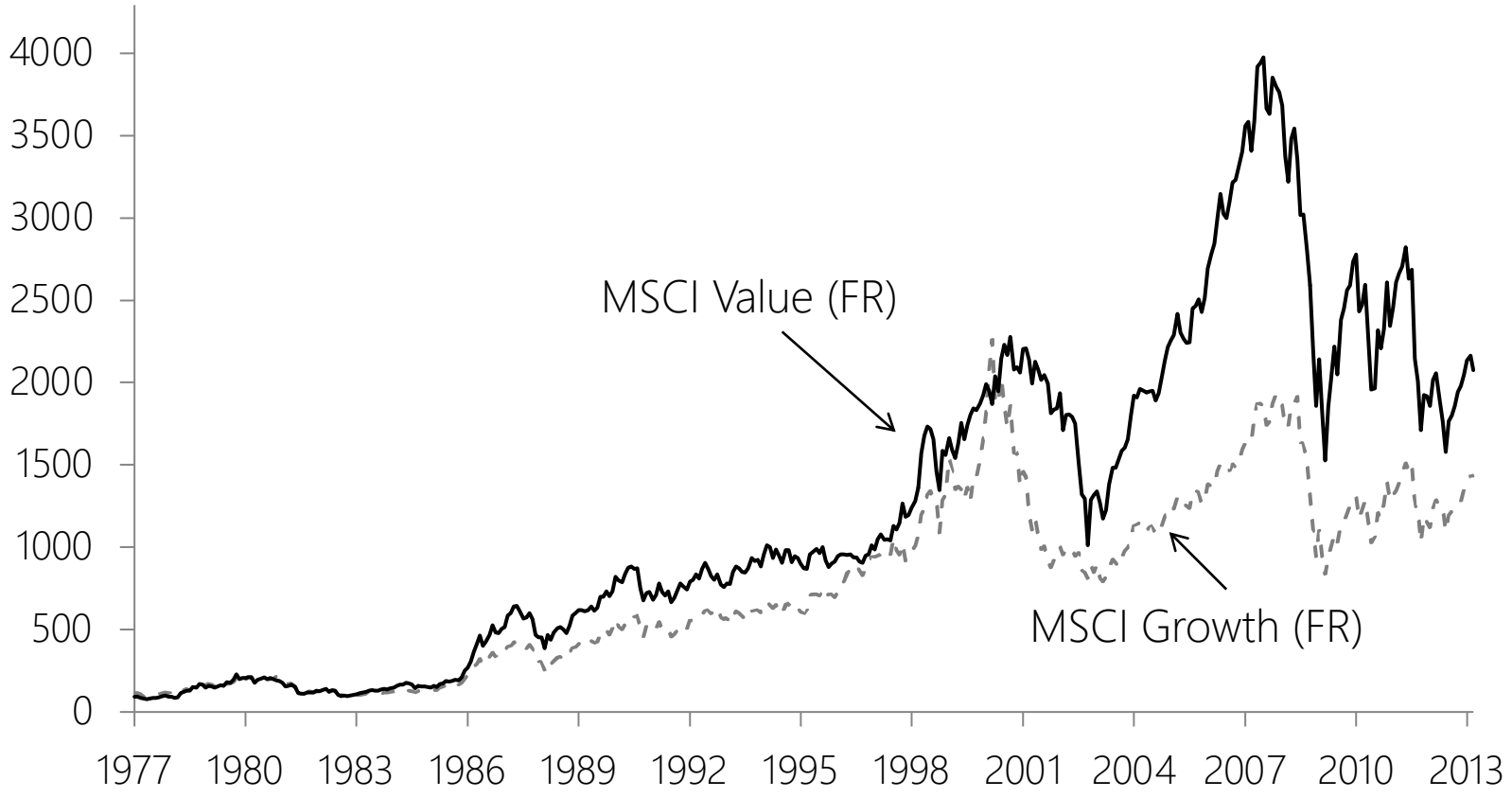
Value vs Growth styles

Appear to be mutually exclusive because investors have different risk profile and different strategy – but there is an overlap:

- A few growth managers would claim they buy expensive stocks and many value managers will include in their portfolio a cheap stock with good growth prospects
- Only in their extreme forms these styles are at the opposite end of investment spectrum
- Large number of stocks on the market exhibit both value and growth characteristics over time

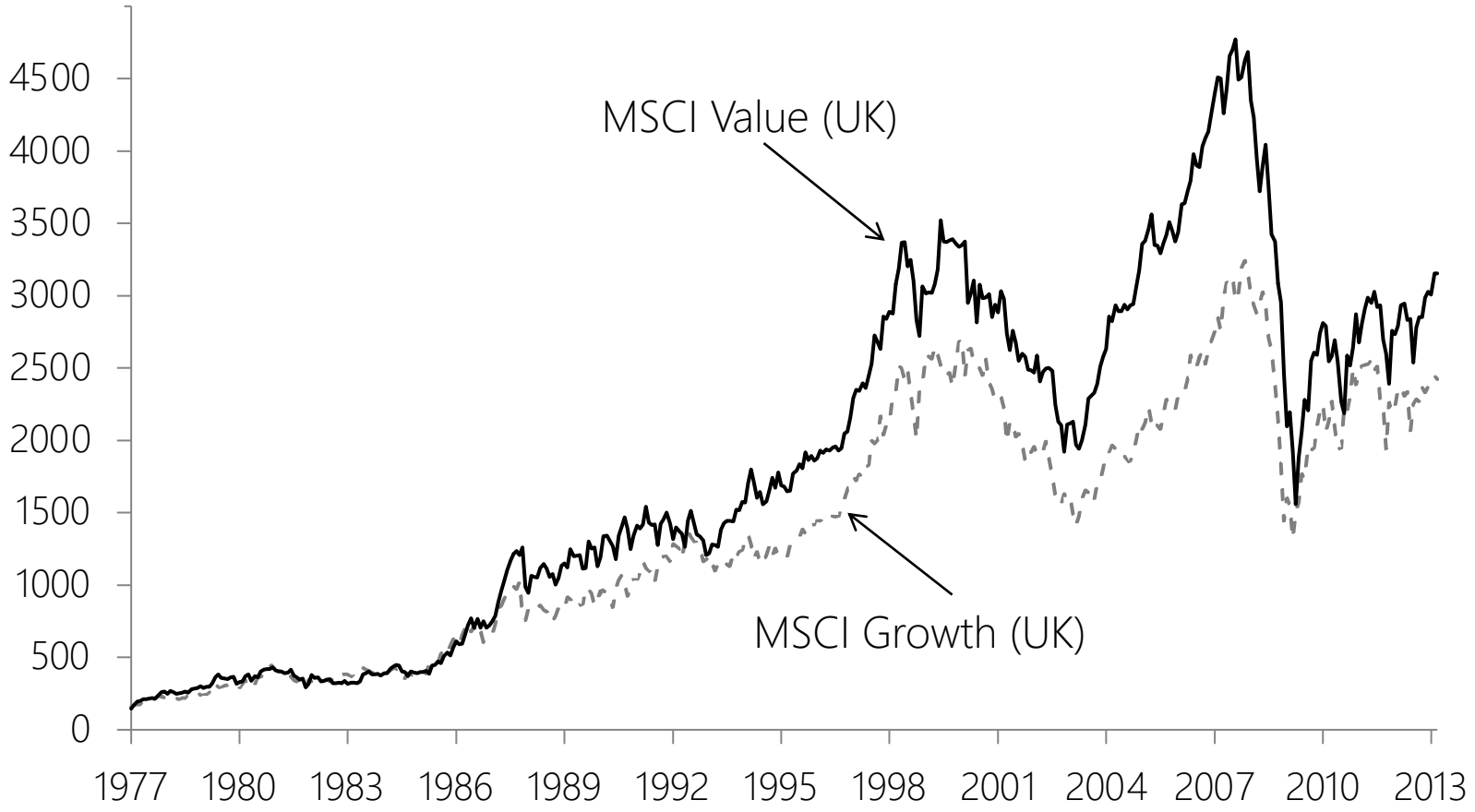
Value & Growth: historical performance

Value & Growth performance in FRANCE, 1977-2013



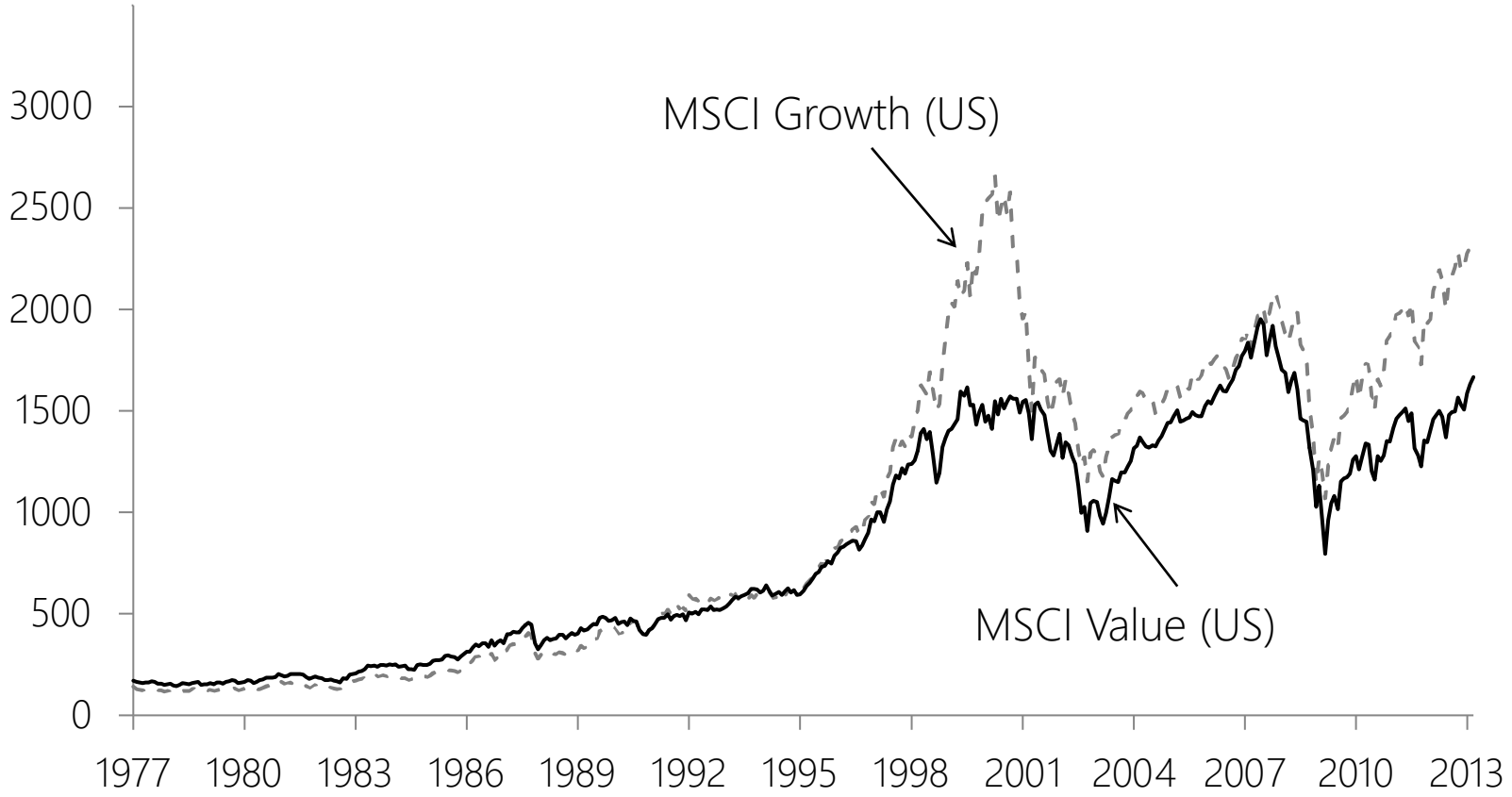
Value & Growth: historical performance

Value & Growth performance in the UK, 1977-2013



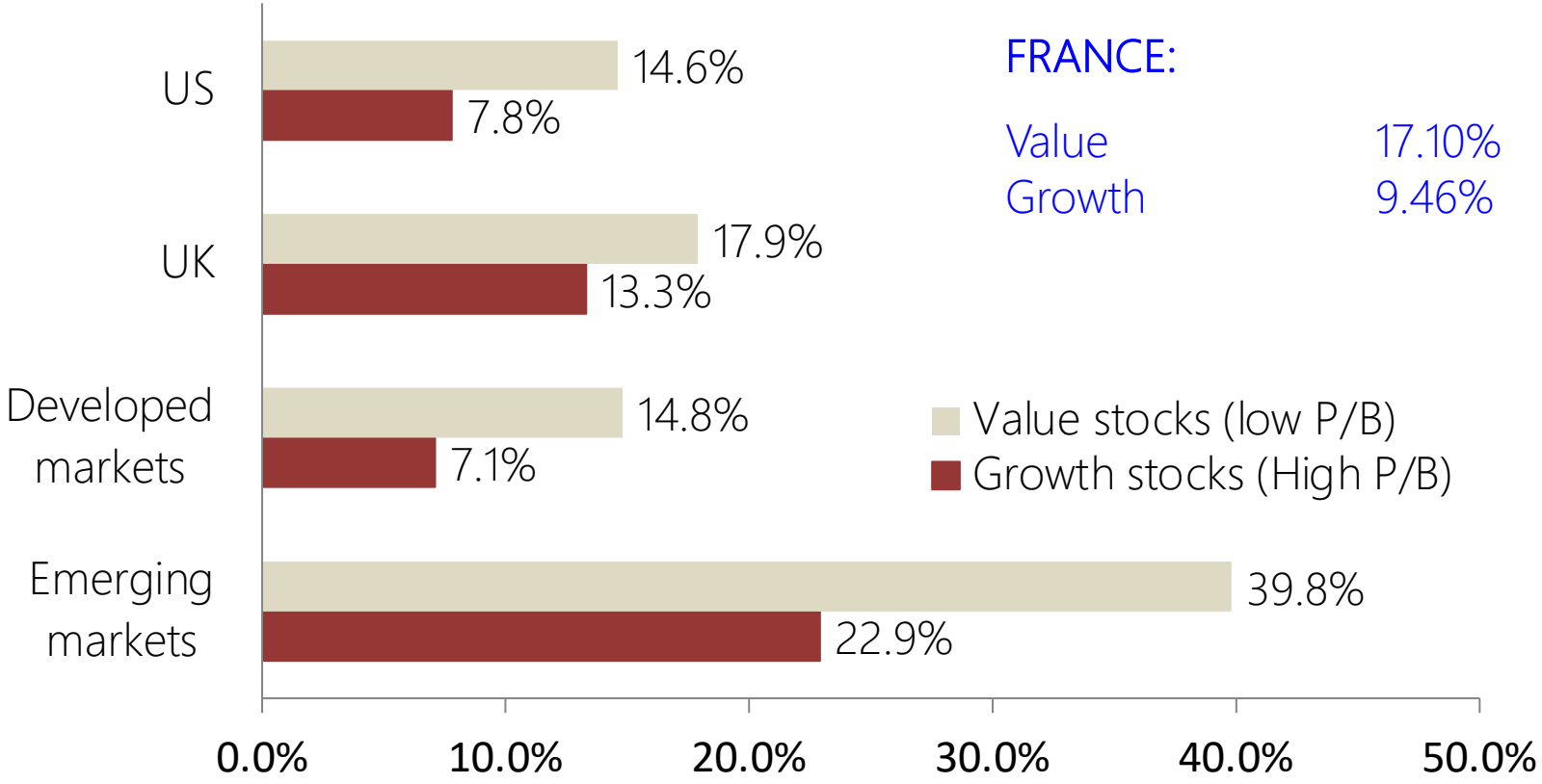
Value & Growth: historical performance

Value & Growth performance in the US, 1977-2013



Value anomaly: international evidence

Average excess return. Source: Fama and French (1998)



FRANCE:

Value	17.10%
Growth	9.46%

Value premium explanation

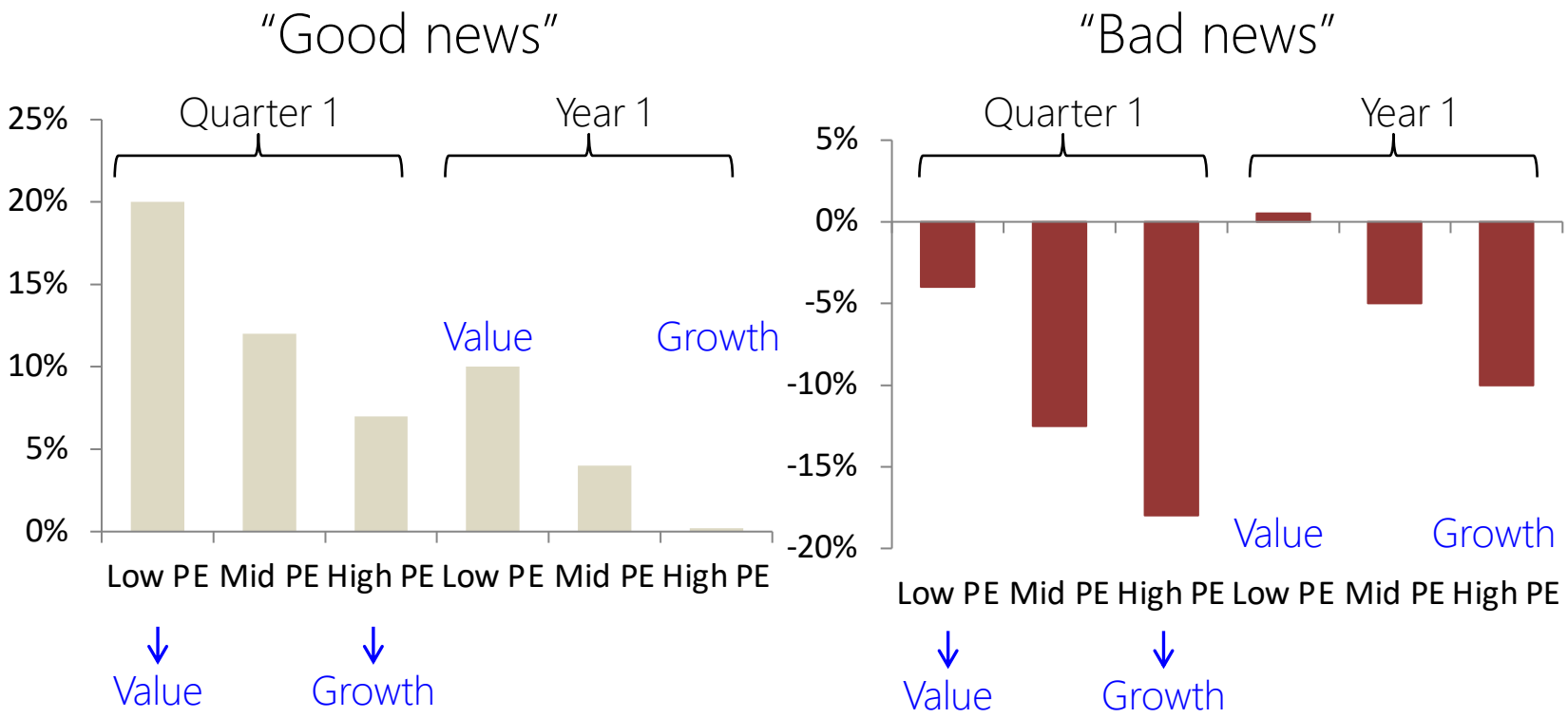
- Risk explanation for value premium
  - value companies are typically more leveraged: high D/E ratios
  - …have higher operating leverage (high fixed/variable costs)
  - …are unable to promptly cut fixed costs and expenses due to higher irreversible capital
  - …have higher volatility of dividends

  Value tend to underperform during recession ➔ higher risk premium

- Behavioural explanation
  - investors often misprice/overvalue growth companies
  - investors underestimate the speed at which abnormal earnings revert to the mean
  - investors overreact to news about growth companies

Biased reaction to earnings news

Annualised market adjusted holding period returns, 1973-1993



- It pays to hold stocks that have experienced recent large positive earnings surprises; market takes 3 quarters to reflect the "good news"
- Long/short investment strategy is possible in such case

Style favoured by investors

- Morningstar's December & April 2016 mutual fund asset flow report suggests that US open-end MF investors favour growth funds to value funds in all asset classes:

Total AUM ($B)	Growth	Value	Value %
Large Cap	1,381	983	42%
Mid Cap	269	216	45%
Small Cap	198	118	37%
Total	1,848	1,317	42%

All data as of December , 2015

Total AUM ($B)	Growth	Value	Value %
Large Cap	1,327	1,000	43%
Mid Cap	260	221	46%
Small Cap	186	122	40%
Total	1,773	1,343	43%

All data as of April , 2016; Total AUM in equity funds: $8,972B

Style favoured by investors (2009/16)

- Morningstar's December 2009 & 2016 mutual fund asset flow report suggests that US open-end MF investors favour growth funds to value funds in all asset classes:

Total AUM ($B)	Growth	Value	Value %
Large Cap	750	509	40%
Mid Cap	163	91	**36%**
Small Cap	95	57	38%
Total	1,008	657	39%

All data as of December , 2009

Total AUM ($B)	Growth	Value	Value %
Large Cap	1,327	1,000	43%
Mid Cap	260	221	**46%**
Small Cap	186	122	40%
Total	1,773	1,343	43%

All data as of April , 2016

Returns by style, 2011-2020

Total annual return by Morningstar's mutual fund category and year:

Total AUM ($B)	Large Cap		Mid Cap		Small Cap	
	Value	Growth	Value	Growth	Value	Growth
2011	-0.75%	-2.46%	-3.96%	-3.95%	-4.45%	-3.55%
2012	12.82%	14.69%	13.98%	12.10%	12.16%	10.62%
2013	31.21%	33.92%	35.14%	34.93%	36.22%	40.91%
2014	22.74%	24.09%	22.51%	13.67%	9.05%	4.97%
2015	-2.02%	10.88%	-3.63%	5.11%	-3.91%	7.01%
2016	12.39%	2.64%	16.01%	5.70%	21.70%	10.29%
2017	17.59%	28.87%	14.04%	24.56%	9.46%	21.67%
…						
2020	2.68%	34.84%	2.84%	37.32%	3.84%	36.91%
2018-2020	5.46%	20.22%	3.81%	19.25%	2.13%	18.01%
2016-2020	9.30%	18.04%	8.37%	17.43%	7.88%	17.31%

All data are from Morningstar's mutual fund asset flow reports.

Returns by style (2)

Morningstar market barometer provides value-weighted performance of key investment styles

1 Year

2021

	Value	Core	Growth
Large	18.14	27.81	21.10
Mid	25.79	26.27	14.67
Small	29.21	19.76	–1.26

3 Years

2019-21

	Value	Core	Growth
Large	11.32	25.04	30.44
Mid	12.41	22.25	31.22
Small	13.95	16.76	21.47

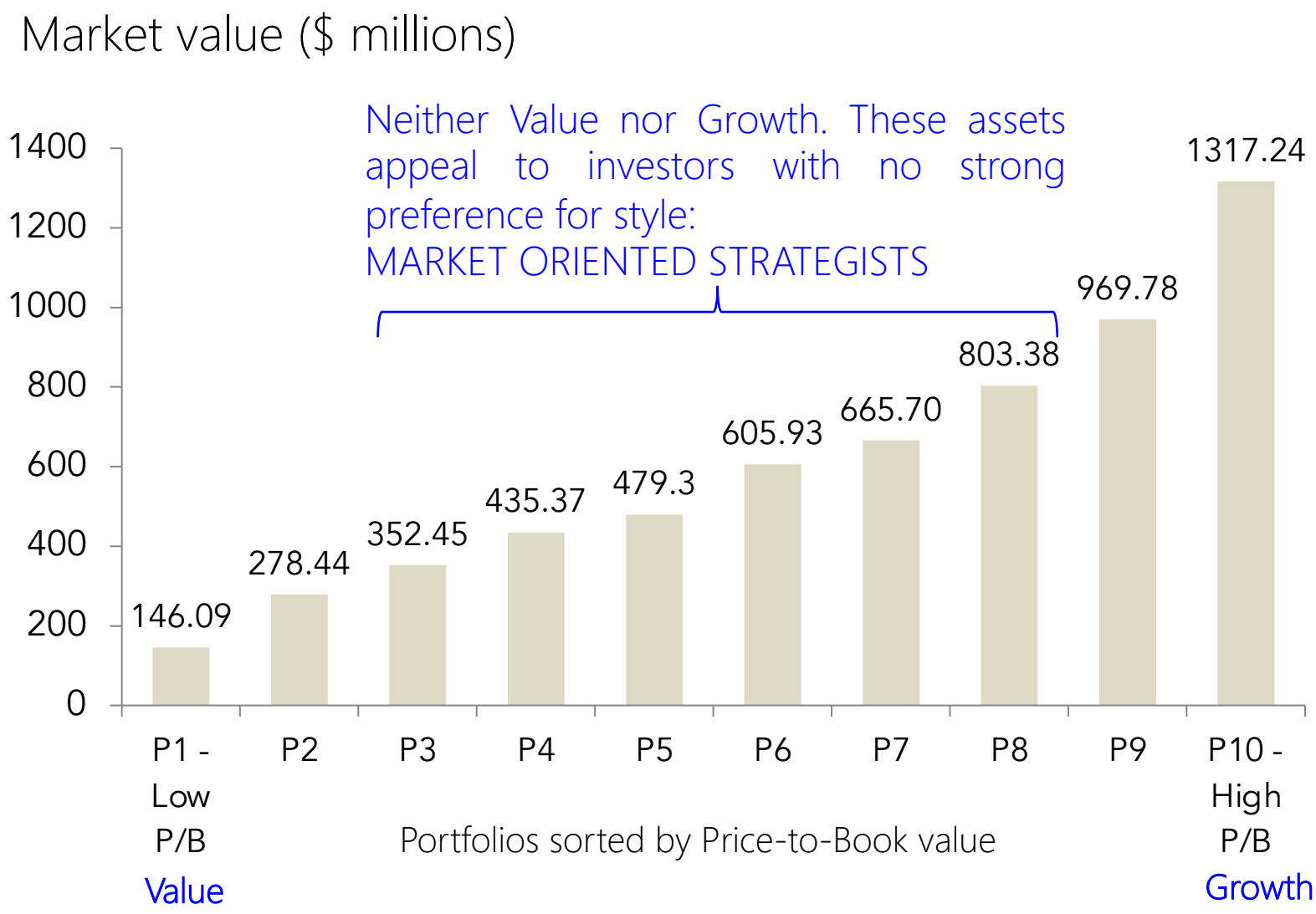
5 Years

2017-21

	Value	Core	Growth
Large	7.12	16.01	24.03
Mid	6.37	13.46	22.09
Small	4.98	8.55	15.63

Source: Morningstar market barometer, 2022

Value premium & size premium



Growth at reasonable price (GARP)

- There are investors who want to have a cheap stock with a good growth potential
- GARP investors typically relate P/E ratios to growth rates:

$$\text{GARP} = \frac{\text{P/E}}{\text{Earnings growth rate}}$$

- Imagine 4 stocks with P/E ratios of 10, 20, 30, 40 and growth rates of 8%, 20%, 20%, and 30% respectively
- The GARP ratios would be 1.25, 1, 1.15 and 1.33. The stock with P/E of 20 would be the cheapest although it is neither the lowest P/E or highest growth stock. Is it growth or value then?
- GARP is neither pure value nor pure growth tool – it lies somewhere in between

Sample exam question 5

You are given the following information about eight stocks:

Stock:	P/E ratio:	Earnings growth rate:
1	12	9%
2	5	3%
3	6	4%
4	13	14%
5	14	10%
6	18	15%
7	11	12%
8	22	17%
Average	12.625	10.5%

Explain the characteristics of value, growth and growth-at-reasonable price stocks and select two stocks from the above table for each of these three groups.

Sample exam question 5 (ans)

You are given the following information about eight stocks:

Stock:	P/E ratio:	Earnings growth:	GARP
1	12	9%	1.33
2: Value	5	3%	1.67
3: Value	6	4%	1.50
4: GARP	13	14%	0.93
5	14	10%	1.40
6: Growth	18	15%	1.20
7: GARP	11	12%	0.92
8: Growth	22	17%	1.29
Average	12.625	10.5%	

Explain the characteristics of value, growth and growth-at-reasonable price stocks and select two stocks from the above table for each of these three groups.

Investment styles recap

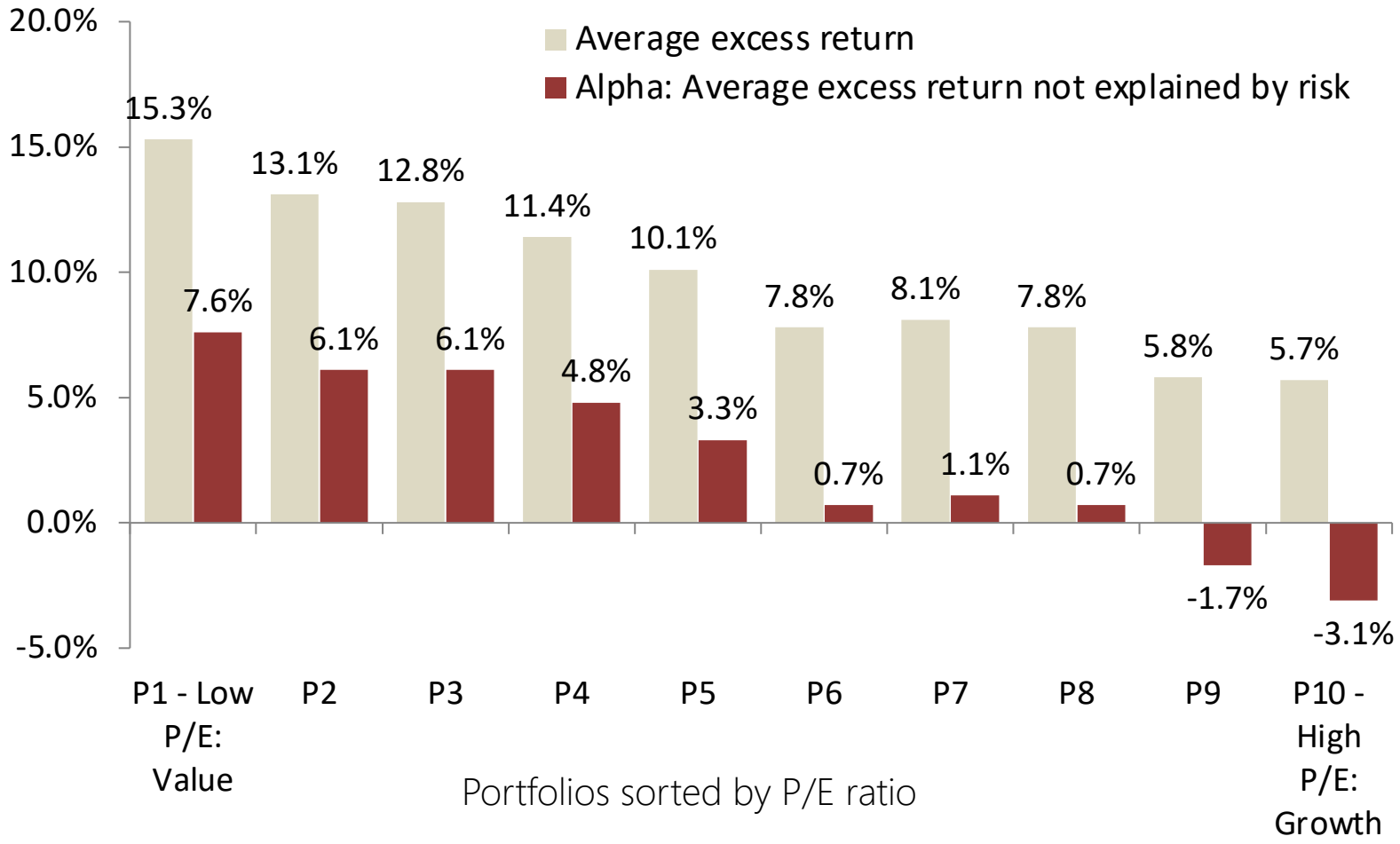
- We have considered 5 popular investment styles
  - Small capitalisation and Large Capitalisation
  - Market oriented style (e.g. GARP investors)
  - Value and Growth
- Historically, value and small stocks outperformed, on average, growth and large stocks
  - evident cyclicality of the pattern
  - multiple exceptions to the rule
- How does one select value vs. growth & small vs large stocks?

Selecting value and growth stocks

- Select a universe of stocks (e.g., CAC40) and calculate (or collect from a data source) P/E (or DY) for each company
- Sort stocks according to P/E (or DY) in ascending order
- Pick stocks from the top of the list until you have 50% of all companies – these are the value (growth) stocks, and the rest are growth (value) stocks
  - problem with this method: stocks which are neither pure value nor pure growth are included
  - need to create minimum three (or even more) portfolios
- Alternative stock characteristics used to define style: P/B ratios, earnings growth estimates, etc.

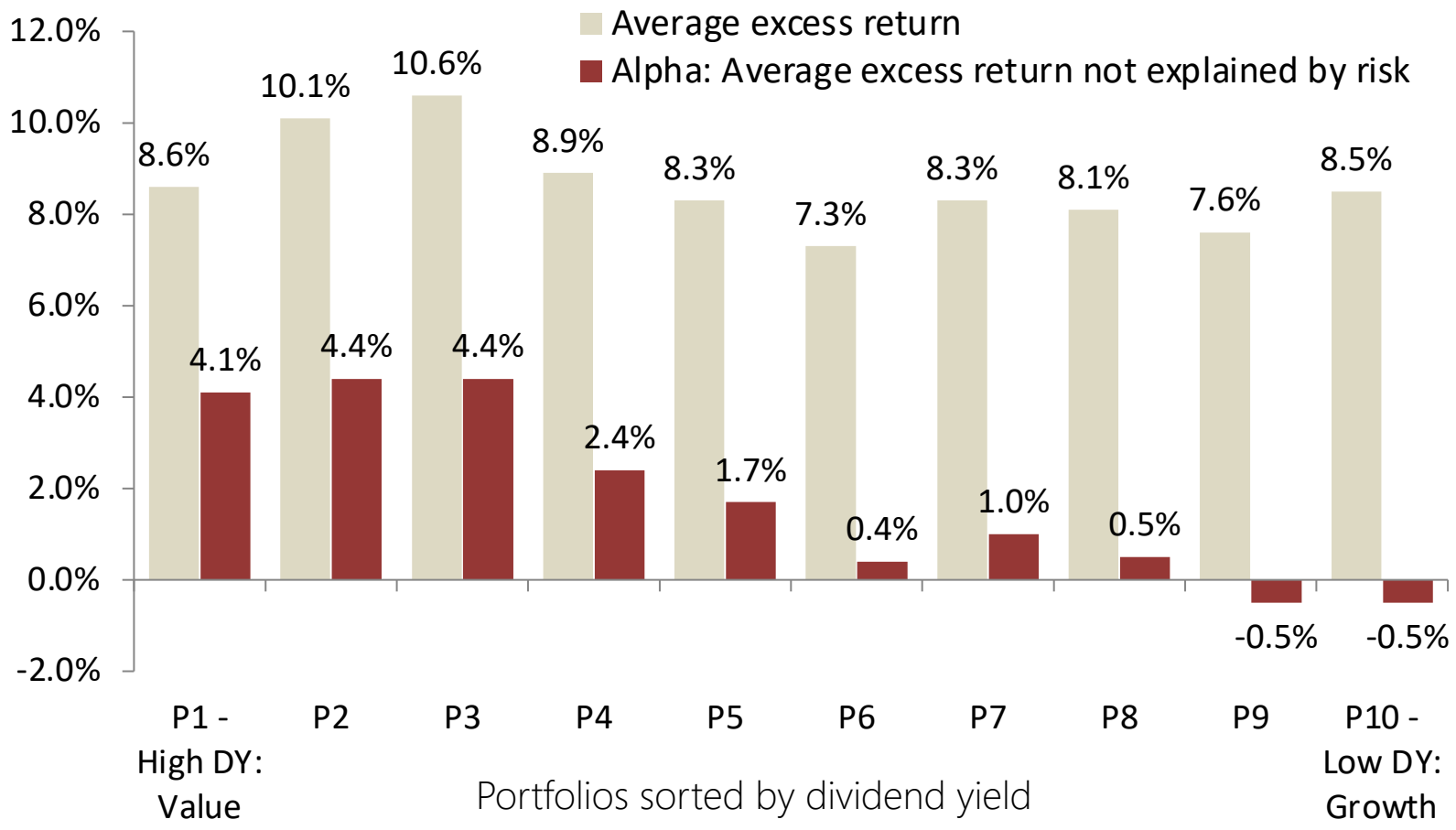
Size anomaly: P/E as value proxy

Stock alpha is lower for stocks with a higher P/E ratio



Size anomaly: DY as value proxy

Stock alpha is decreasing with dividend yield



Defining style & style mathematics

SIM theory suggests: the return on a stock/portfolio is dependent on the market return which is observed through the beta coefficient:

$$r_{i,t} = \alpha_i + \beta_M r_{M,t} + \varepsilon_{i,t}$$

Style mathematics suggest: take 60 consecutive observations of monthly returns for a given stock/portfolio and regress them against monthly market index and style index returns for the same period to generate "style betas":

$$r_{S,t} = \alpha_S + \beta_{S,M} r_{M,t} + \beta_{S,Value} r_{Value,t} + \beta_{S,Growth} r_{Growth,t} + \\ + \beta_{S,Small} r_{Small,t} + \beta_{S,Large} r_{Large,t} + \varepsilon_{S,t}$$

Value & Growth index methodologies

Most index providers use similar methodologies with some minor differences:

S&P/ BARRA	P/B; top half of market cap is growth, bottom half value; reconstructed semi-annually
Prudential	**growth stocks**: sales growth > 10%; IBES est. 5-year growth > median; low dividend pay-out; low debt/capital
	value stocks: earnings/price > median; dividends constant or rising

The validity of the value and growth benchmarks is crucial for the fund performance evaluation

Defining style & style mathematics

- Independent variables in the model on the previous slide are highly correlated which may lead to unstable coefficients
- Accordingly, a minor modification of the model is needed:

$$r_{S,t} = \alpha_S + \beta_{S,M} r_{M,t} + \beta_{S,Value-Growth} r_{Value-Growth,t} + \\ + \beta_{S,Small-Large} r_{Small-Large,t} + \varepsilon_{S,t}$$

- $\beta_{V\text{-}G}$ is the sensitivity of a given stock/portfolio returns to the difference between the value and growth indices
  - if this beta is positive and significant, the stock is a value stock and vice versa (HML: High [book-to-market] Minus Low)
- $\beta_{S\text{-}L}$ is the sensitivity of a given stock/portfolio returns to the difference between the large and small indices
  - if this beta is positive and significant, the stock is a small stock and vice versa (SMB: Small [market cap] Minus Big)

Sample exam question 6

An investor who is testing the presence of styles in a portfolio of stocks obtained the following result of the time-series regression (the values in brackets are *t*-statistics):

$$r_P = \underset{(0.51)}{0.015} + \underset{(5.48)}{0.51}r_M + \underset{(3.56)}{1.1}r_{HML} + \underset{(0.76)}{0.78}r_{SMB} + \varepsilon_p$$

Explain the model that the investor is using to test the presence of styles and interpret the values of style betas obtained. What are the main uses of these style betas?

Alpha-based asset selection: SP500

Consider the Fama-French model for the following the S&P500 stocks from Mini-case 1:

	AMAZON	BEST BUY	FOREST LABS.	HARLEY-DAVIDSON	CMS ENERGY	GOODYEAR
Alpha	0.069	0.042	0.040	0.028	-0.022	-0.037
t-stats	*2.16*	*1.67*	*3.04*	*2.94*	*-1.69*	*-2.58*
MRK	2.056	2.040	0.498	1.347	1.566	1.843
t-stats	*2.90*	*3.63*	*1.70*	*6.35*	*5.52*	*5.79*
SMB	-0.876	0.288	-0.307	-0.122	-0.111	0.767
t-stats	*-1.20*	*0.50*	*-1.02*	*-0.56*	*-0.38*	*2.35*
HML	-1.761	-0.326	-0.258	0.025	1.431	1.699
t-stats	*-2.00*	*-0.47*	*-0.71*	*0.10*	*4.05*	*4.29*
R-sq	0.35	0.31	0.12	0.52	0.45	0.39

abs(t-stats)	> 1.65	> 1.96	> 2.33
Significance	Marginally significant	Significant	Very significant

What can you say about these stocks in terms of Value and Size?

Use of style betas

Style betas help to determine whether a company is a pure value, growth, small or large company. This helps to avoid misclassification of securities.

Style betas show the evolution of a company/portfolio or sector over time

- some companies/sectors may have been growth and then they became value over years (e.g. Apple Inc.); the same for small and large stocks

Style betas enable finding stocks suitable for pairs trading

- style indices serve as a proxy for risk
- two stocks that have the same sensitivity to the styles should have the same returns

Deviation from a style – reality case

We have used statistical criteria to define a style. But only because a style does well/badly statistically will not imply that a manager will also perform well/badly

Stock picking bias: stocks within a particular style may exhibit diverse performance; a manager can over-/under-perform the style by picking different stocks

Example: low P/E ratio stock will be classified as cheap (by the model) and it will be a part of a value portfolio. In reality, a value manager may note that this stock has been receiving earnings downgrades, meaning that the future earnings forecast of the stock will go down and this stock has, in reality, a higher prospective P/E ratio. A good value manager will most likely avoid this stock while a poor one might buy it.

Deviation from a style – reality case

Cap bias: a low P/E criterion for buying stocks will probably produce a small-cap bias, which manager may prefer (or be obliged) to avoid. Avoiding small cap stocks will compromise dedication to investing in lowest P/E stocks

Sector bias: Further, low P/E stocks tend to be concentrated in a few sectors (these sectors may change over time). Accordingly, to get representation in other sectors, managers may be forced to buy a few stocks with high P/E ratios

Clearly, this alters the value approach and fund returns may be quite different from those suggested by academic studies which identify "value" stocks as simply bottom P/E stocks

Style rotation

In France and the UK, over the long time period, value stocks have outperformed the growth stocks

- in the second half of 1990s – technology boom – growth outperformed value (for instance in the US)
- therefore, style rotation is used by a number of managed funds, including hedge funds

Style rotation strategy

- invest 100% of funds in value stocks when they are expected to do better and switch all your funds to growth when growth stocks are expected to do better
- based on forecasts and successful market timing
- bare in mind the transaction costs (this can be a very expensive strategy)

Basics for style rotation

A difficulty is to identify the style that is expected to perform well in the longer term

- essentially the task becomes one of style selection rather than stock selection
- regression and other quantitative techniques may be of help

There are several ways to construct style-timing models, which are based on one of the following hypotheses:

Economic cycle hypothesis:

- a strong economy favours the investment of value style and vice versa

Stock valuation hypothesis

- style trend reflects the fundamental value of individual stock in each style pool

Mean reversion hypothesis

- assumption that the style trend reflects the mean reversion of the overvalued and the undervalued stocks

Economic indicators for style rotation

Forecast GDP growth

- based on the 1990s data, the relationship between the consensus real GDP growth forecast and the relative cumulative return on the S&P 500 Value index and S&P 500 Growth index is showing that the value style index did well when the economy was expected to do well and vice versa
- large stocks pick up expansion earlier than small ones

Interest rates and yield curve

- rising rates and upward slopping yield curve affect growth stocks in a negative way more than value stocks since the investors investing in growth stocks:
  1. receive almost all the income at the end of their investment horizon
  2. in general, they follow a more longer term investment approach than value investors

Fundamental indicators & style rotation

Earnings revision model:

- for example, if one uses average 1-year consensus earnings forecasts changes (that can be obtained on Thompson Financial database) for value and growth index, they can find that when Earnings revisions are higher for value stocks, they will perform better than growth stocks and vice versa

Rising risk premium of small stocks warns investors to shift their investment to larger ones

Mean reversion and style rotation

Residual risk spread model

- residual risk is simply calculated as the standard deviation of the alpha of the value and growth index
- when the residual risk spread is increasing it indicates that the portfolio is deviating more from the market portfolio and it is more likely that high alpha would be generated
- therefore, when there is positive residual risk spread between value and growth index, value stocks are expected to outperform

Forecast P/E ratio spread model

- value stocks traditionally have low P/Es whereas growth have high P/E ratios
- when this long term trend is disturbed, i.e., when there is narrowing forecast P/E ratio value-growth spread, value stocks will outperform growth

Further indicators & style rotation

Lagged Value-Growth or Small-Large spread

- past trends used as an indicator of a future trend

Seasonal indicators

- value, small cap stocks tend to outperform the rest of the market during the first five days in January generating returns of 40%

Technical analysis indicators

- charts and patterns in share prices as well as quantitatively based indicators such as moving averages

In general, the choice of indicators is subjective and more than one indicator is used to reach the style switching decision

Tactical asset allocation with style

Style rotation can prove to be expensive strategy having high transaction costs and turnover of assets

One should consider that style oriented portfolio does not have to have all the investment placed in one style only but rather employ TAA with style stocks/indices

TAA approach, called active style management, implies:

- tilting the equity portfolio with either growth stocks or value stocks in order to capture more superior return generated by in-favour style

Modest bid: 55% - 45% and Aggressive bid: 75% - 25%

How aggressive it is going to be depends on the risk tolerance of the plan sponsor and the confidence level of the investment manager

Advantages of the TAA with styles

Locks in excess return

- if allocation to winning style is not reduced from the, say 50%-50% proportion, that style will eventually underperform and return of the portfolio would revert to average
- can be implemented using judgemental rules, regression models or automatic rebalancing: when either style reaches 55% in the portfolio, it would be reduced back to meet 50/50 criterion

Provides diversification

- portfolio with similar proportion of value and growth stocks is automatically diversified by sector
- active stock-picker can concentrate his bets within each style and gain advantage (e.g., high-tech stocks)

Advantages of the TAA with styles

Complements other portfolio management techniques

- its function is as in tactical asset allocation
- it can be a separate style or it can give flexibility to existing growth and value managers

Saves time and fees

- there is one manager instead of two
- price discounts can be offered as portfolio size increases
- fewer managers to correspond to saves time

Disadvantages of the TAA with styles

If there are so many advantages, why isn't active style management more widely used?

Very difficult to market:

- investors used to be misinformed and not educated about this
- this picture is changing nowadays

Complicates the task of research and portfolio management especially when combined with active stock selection

- growth are risk takers and value are more risk averse

In some instance both the style rotation and the TAA with styles is pointless

- there can be periods when both value and growth stocks underperform the market

Introduction to sector rotation

Callahan (2000)

If the leading style in the market is large cap, it is simply because it is time when sectors concentrated in that style are leading the way

Style management heavily tilted towards certain industries

Industries are not constant through time on their style grid: as industries are in favour they move up and to the right as they become larger and higher in price to book ratio

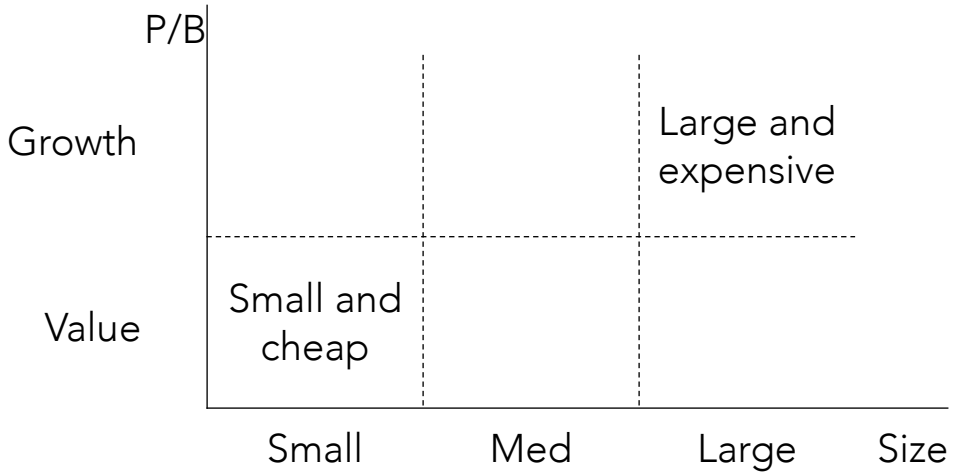
Analysed 115 industries over the 1991 to 1998 period

- S&P 1500 Composite index
- ranking size: 1-38 small sector; 39-76 medium sector; 77-115 large sector
- ranking P/B ratio: 1-57 value sectors; 58-115 growth sectors

Example of sector rotation, Callahan

Some findings of the study:

- basic materials industries have moved down and to the left in the grid
- managers in the midcap value, growth and small cap style boxes are dealing with different industries in 1998 compared to 1991
- financial services industry moved up and to the right



More on sector rotation

As demonstrated by Callahan (2000), industries do not remain in the same style box trough time

Hence, a manager dedicated to a given style may, unwittingly, engage in sector/industry rotation

This makes manager's performance difficult to predict as investors may not have analytical skills to analyse sector tilts

Capturing shifts in industries appears more important than style diversification

Core manager with a sector rotation abilities would provide a valuable foundation for a successful strategy

PART 3

PASSIVE EQUITY INVESTING

(SELF-STUDY)

Index definition and uses

Indices are designed to provide concise summary of the price movements of their constituents

Indices are mainly used to:

- provide a record of historical price movements, which facilitates determination of trends
- serve as benchmarks in performance measurement
- act as a basis for index tracking funds, exchange traded funds (ETFs) and index derivatives
- support portfolio management research and asset allocation decisions

Index weighting schemes

There are three index weighting schemes:

(1) Market value (capitalisation) weighting

- largest stock has the greatest influence on the index value
- example: CAC 40, FTSE 100, S&P 500, NASDAQ 100*

(2) Price weighting

- stock with highest price has the greatest influence on the index value
- example: Dow Jones Industrial Average index; Nikkei 225

(3) Equal weighting (arithmetic or geometric)

- all stocks are assigned an equal weight (unweighted indices)
- example: Russell 100 Equal Weight Index; S&P 500Equal Weight Index; Value Line (uses geometric averages)
- difficult to replicate equal weights, so rarely used as a benchmark in index tracking

Methods of index averaging

Arithmetic vs geometric

- All indices are calculated as arithmetic averages, except unweighted indices (e.g., FT 30 and Value Line)
- As a price of a stock increases, the weights adjust automatically for the consistency with the share amount
- Although weights change, the share amounts do not and, consequently, no rebalancing is necessary
- Accordingly, arithmetic indices can be tracked exactly by owning all stocks in the index in the proportions suggested by their weights in the index

Sample exam question 5

Period	Stock X [800 shares in issue]	Stock Y [100 shares in issue]	Stock Z [100 shares in issue]	Price weighted arithmetic index	Unweighted geometric index	Value weighted arithmetic index
t_0	100p	100p	100p	100	100	100
t_1	90p	105p	120p	105	104.3	94.5
t_2	100p	0p	100p	?	?	?

Calculate the value for these indices at time t_2. Refer to the next slide for some hints.

Example – calculations for t_1

1. Price weighted arithmetic index:

$$\frac{\sum P_{t_n}}{\sum P_{t_0}} \times \text{index base value} = \left[\frac{(90+105+120)}{(100+100+100)}\right] \times 100 = 105$$

2. Unweighted geometric index:

$$\sqrt[n]{\frac{\prod P_{t_n}}{\prod P_{t_0}}} \times \text{index base value} = \sqrt[3]{\frac{(90 \times 105 \times 120)}{(100 \times 100 \times 100)}} \times 100 = 104.3$$

Example – calculations for t_1

3. Value weighted arithmetic index:

$$\frac{\sum P_{t_n} q_{t_n}}{\sum P_{t_0} q_{t_0}} \times \text{index base value} =$$

$$= \left[\frac{(90 \times 800 + 105 \times 100 + 120 \times 100)}{(100 \times 800 + 100 \times 100 + 100 \times 100)} \right] \times 100 = 94.5$$

Equal weighted (arithmetic)

- Cumulative values of the arithmetic average of the percentage changes in price for all stocks in index.
- Equivalent to investing the same $ amount in each stock, then rebalancing each period.
- An equal weighted (unweighted) index is biased towards the returns of smaller companies relative to a value weighted index because small companies are quite numerous.
- Constant portfolio rebalancing is needed to track such an equal weighted index.

Index averaging methods: comparison

1. Price weighted arithmetic indices (e.g., DJ)
   - ignore the number of shares in issue and favour highly priced shares
   - not representative of the real world portfolio – limited use as performance measurement benchmarks
2. Unweighted geometric indices
   - always understate the price rises and overstate the price falls of constituents relative to that of price weighted indices
   - collapse when the price of an index constituent is zero

Index averaging methods: comparison

3. Value weighted arithmetic indices
   - more complex calculations and significant data requirements
   - replicate the precise effect that changing share values would have on a portfolio comprising the same underlying index constituents weighted in accordance with their relative market capitalisations
   - have a broad coverage of the market being represented
   - Accordingly, they are the most suitable indices to asses market trends, act as performance benchmarks and provide a basis for index tracking

Free floatation

- The applicability of the market value index as a performance measurement benchmark can be compromised if the index constituents make significantly less that 100% of their issued shares available to the market but are, nonetheless, accorded a full market value index weighting
- Restricted supply of such stocks prevents a portfolio manager from holding a full weighting of the stock within their portfolio
- Price of the stock will be distorted given the need of index tracking funds to hold the stock in accordance with their index weighting
- Hence, free flotation rules were introduced to get around this problem

Dealing with the free float

CAC 40 (as of December 2020)

- Includes only top 40 Euronext companies ranked by free float market capitalisation and share turnover (no illiquid)
- Free float factors are rounded up to the next multiple of 5%.
- Factors are reviewed annually (based on the information available on the last day of August & new factors come into effect on the 3rd Friday of September).
- A weighting limit of 15% is applied to CAC 40 constituents. If the weight of a given stock exceeds this limit, it is scaled down by so-called "capping factor"

Dealing with the free float

FTSE (as of December 2020)

• Less than or equal to 5%	Ineligible
• Greater than 5% but less or equal to 15%	Actual(rounded)
• Greater than 15% but less or equal to 20%	20%
• Greater than 20% but less or equal to 30%	30%
• Greater than 30% but less or equal to 40%	40%
• Greater than 40% but less or equal to 50%	50%
• Greater than 50% but less or equal to 75%	75%
• Greater than 75%	100%

Main equity indices

in France

CAC 40	Top 40 Euronext stocks by free float adjusted market capitalization and turnover
CAC Large 60	Includes CAC 40 and CAC Next 20
CAC Mid 60	60 largest companies after CAC 40 & CAC Next 20
SBF 120	120 most actively traded stocks listed in Paris (combines CAC Large 60 and CAC Mid 60)
CAC Small	All eligible companies afters SBF 120 index companies
CAC Mid & Small	All companies in CAC Mid 60 & CAC Small
CAC All-tradable	All eligible companies listed in Paris

Main equity indices

Examples of other major indices:

FTSE 100	100 largest companies in the UK
S&P 500	500 most widely held NYSE stocks; 70-80% of NYSE market capitalisation
Nikkei 225	Price weighted index of 225 Japanese companies representative of the market
Nikkei 300	Capitalisation-weighted index of Japanese top 300 companies
FTSE All World	3100 stocks, 47 countries, 90%-95% of investable market capitalisation
MSCI All Country (ACWI IMI)	almost 9000 stocks across 50 developed and emerging markets (99% of global equity set)

Fundamental weighted indices

- Share prices are volatile in the short-term and consequently mislead…potentially causing misdirected capital
- To remedy this, the index components may be chosen based on fundamental criteria rather than market capitalisation
- Companies' ranks and weights are selected by firm financial data such as sales, cash flow, book value, dividend yield and net profit

How do they work?

- Stocks are reviewed using fundamental factors and not the stock price/market capitalisation
- The constituents are then weighted in the index according to the factors themselves and not their market cap

Fundamental weighted example

- FTSE Global Wealth Allocation (FTSE GWA) Index series
- FTSE GWA constructs portfolios without referring to share prices – stocks should be weighted according to their proven ability to create wealth
  - Wealth is measured by three fundamentals – net income, cash flow & book value
- Each company weight in the index is directly proportional to these three fundamentals
- The review process holds for every company in the index, but weights it according to wealth

Definition of indexing

- Index fund: portfolio of securities that replicates the returns of a selected index (aka "tracker" or "passive" funds)
- Process of investing in such a portfolio – indexing/indexation
- Index funds exist across asset classes but are predominant in equities: indexing helps achieving optimal diversification
- This strategy is supported by theoretical and empirical findings:
  - responds to the concept of the efficient market hypothesis and CAPM
  - maximises control over investment outcomes and minimises cost of investment compared to active strategies (no need for research analysts, little trading needed)
  - no outperformance* but assurance of no underperformance

Development of index funds

- In 1970 Wells Fargo Bank introduced the Stagecoach Fund
  - tracks NYSE Composite index; discontinued due to lack of interest
  - research published thereafter helped in understanding how difficult it is to outperform the market through active strategies
- In 1973, Wells Fargo introduced the fund to track more widely followed S&P 500 Index
- J. Bogle introduced one of the most popular index tracking funds Vanguard 500 Index Fund in 1976 (also tracks S&P 500)
- Increased popularity in 1990s and nowadays 20-30% of the US funds are managed passively
- Three largest pension fund managers in the UK (£800bn) are index-tracking specialists

Classic index fund

One example of a classic index fund is Vanguard 500 Index Investor (VFINX), data as of December 31, 2020:

- Inception 8/1976
- TNA $636.9bn
- no purchase or redemption fees, min investment $3000 (closed)
- 0.17% expense ratio (of which management fee 0.14%), 1.8% turnover
- 99.86% in 502 stocks, 0.14% in cash
- 2020 tracking error relative to S&P500: -0.15%
- 2018-20 alpha = - 0.14%, beta = 1.00, R-squared = 1.00, Sharpe = 0.71

Minimising the costs with indexing

Costs are minimised in three important ways:

- Transaction costs: reduction in brokerage commission by minimising necessity to transact
  - almost a "buy and hold" strategy with a very low turnover
  - need to transact only to contribute or withdraw funds, reinvest income or accommodate the changes in the benchmark index
- Market impact is minimised when transaction cost do occur
  - investment in securities in proportion to their actual weights on the market
  - largest investment in securities with greatest liquidity
- Management fees: no asset selection or market timing research involved, so management fees are low

Fist step in creating an index fund

Step 1: Selecting a benchmark

- Fund performance may be measured against the 'market' portfolio or a subset of sectors' portfolios (> 3000 to choose from)
  - pure index fund, by definition, would tend to perfectly replicate the underlying market portfolio
- Selection of appropriate benchmark is primary driven by the desired level of diversification and cost effectiveness
  - CAC 40 (large mature companies) is feasible to buy and hold with no need for particular adjustments
    - less diversified, but more cost effective
  - CAC All share (younger, smaller cap firms) is less liquid, includes more expensive stocks, more frequent revision needed
    - more diversified, but less cost effective

Customised benchmark

- Choosing the right benchmark is crucial
- With an increasing trend in global oriented investment strategies, benchmark error is magnified if an inappropriate international index is chosen as a benchmark
- Customised benchmarks are available – used in performance measurement of specific, custom-made portfolios
- These may include benchmarks based on fundamentals (e.g., P/E, dividend yield, etc) or simply (weighted) combinations of different indices

Approaches to replicating an index

Step 2: How perfect should the replication be?

- "Census" approach [full replication]
  - perfect replication; buying every stock in the index
  - stocks have same weights as in the index
- Sampling approach
  - select a subset of index optimised to track the benchmark as closely as possible
  - needed when: certain securities in the index are illiquid, or when investor is restricted by policy from owning them
  - 3 approaches: optimisation, stratified sampling and capitalisation replication
- Synthetic indexation: using derivative products on the index
  - possibility to create a synthetic index fund as an alternative to holding underlying equities that make up the index

Sampling approach: optimisation

- Use mathematical algorithms to identify a suitable sample
- The solution obtained through optimisation is the efficient frontier
- Investor's utility defines where the optimal portfolio lies
- Equalise the beta of the replicating portfolio with the beta of the benchmark
- Key issue:
  - optimisation relies on the historical estimates of expected returns, variances, and covariances; it also assumes normal distribution of returns
  - mathematics that underlies optimisation is difficult to apply to heterogeneous groups of stocks
- Not the most widely used approach for tracking a benchmark

Sampling approach: capitalisation

- Capitalisation method involves constructing a basket with fewer stocks than in the index
- Purchasing a number of top capitalisation stocks in actual weights and equally weighting the residual stock weighting in the basket
- Example: if 100 top market cap stocks selected for the basket represent 80% of the total capitalisation of the index (e.g., CAC 40 and CAC All share), then invest 80% of available funds in these stocks as per their weightings in the index; the remaining 20% is evenly proportioned among the remaining stocks

Sampling approach: stratification

- Universe of stocks is stratified using certain criteria (e.g., industry)
- Stock selection within each stratum:
  - matching the weight of the stratum in the basket portfolio as it naturally exists in the index (e.g., IT is 10% of the benchmark => invest 10% of funds in a few selected IT stocks)
  - stocks within each stratum are selected using either capitalisation ranking, valuation methods or optimisation
- Problems: no mathematical backing
- Strength: not concerned with historical data
- Appropriate for high turnover indices, since historical estimates are less relevant
- Widely used approach for benchmark replication

Initiating a fund (step 3)

- Program trading or package trading
  - refers to the purchase or sale of a diversified portfolio of stocks
- The cost of executing such a transaction should be smaller than for individual stocks as the risk of portfolio is smaller than the risk of individual stocks - informationless trade
- Investors transfer execution risk to the broker (complete package trading)
  - broker provides investor with an insurance protection option, the cost of which is negotiated with a broker
  - price protection – "best efforts" basis

Tracking Error Management (step 4)

- Index tracking objectives:
  - minimise the cost while retaining the replicating portfolio's ability to track the benchmark index
- Holding fewer stocks than in the index generates tracking error
- Tracking error represents the risk that the replicating portfolio will perform differently to the benchmark
- In statistical terms, there are two commonly used definitions of ex-post tracking error
  - tracking error as residual risk
  - tracking error as performance volatility

TE as residual risk

- Market model suggest:

$$R_{it} = \alpha_i + \beta_B R_{Bt} + \varepsilon_{it}$$

where R_i is return on the replicating portfolio i, R_B is return on the benchmark portfolio, and ε_i is the residual

- TE is then defined as:

$$TE = \text{st.dev}(\varepsilon_{it})$$

$$= \text{st.dev}(R_{it}) \times \sqrt{1 - \text{Corr}(R_{it}, R_{Bt})^2}$$

- TE is model dependant in this definition (model risk)
- Residuals and variance of residuals can easily be obtained in excel or more sophisticated statistical packages

TE as performance volatility

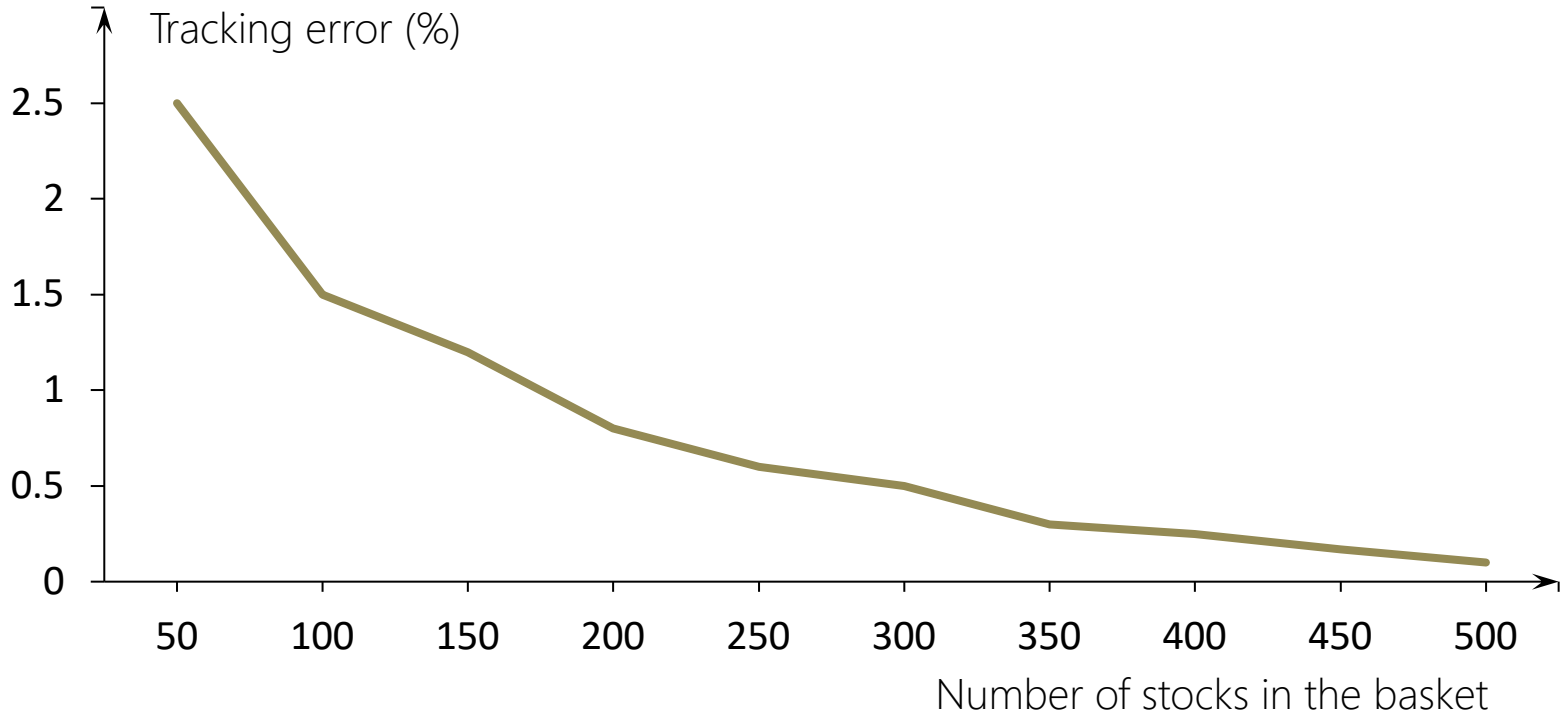
- TE is defined as the standard deviation of the difference in expected returns between the replicating portfolio and the benchmark portfolio:

$$TE = st.dev(R_{it} - R_{Bt})$$

- The size of the TE depends on benchmark volatility which cannot be controlled by investment manager
- For all portfolio betas not equal to 1, the volatility of performance is larger than residual risk, so the TE will be different

TE and size of replicating portfolio

Hypothetical replication of a benchmark consisting of 500 equities will result in the following tracking errors for different sizes of the basket portfolio:



Reasons for TEs in perfect baskets

Example shows that even when the benchmark is perfectly replicated, TE is still present. The reasons are:

- Odd-lot purchases of stocks vs round lots
  - index funds are comprised of round lots: the number of shares of each stock in the basket is rounded off to the nearest hundred from the exact number of shares indicated by basket building model. This might affect the ability of smaller baskets to track the index
- Changing composition of the benchmark index (changing weights of stocks & changing index composition)
  - hold all stocks as in the index and weights will self-adjust
  - if fewer stocks held, rebalancing is needed

Tracking error interpretation

TE statistics has some desirable properties:

- fund with a TE of 2% pa is expected to have 2/3 of its annual returns falling within -2% to +2% of the benchmark returns and 95% of its returns within -4% to 4% of the benchmark (recall the normal distribution)

Is 2% TE small or large?

- this depends on the volatility of the underlying benchmark, the type of the benchmark and the method used to construct the basket/replicating portfolio

Empirical evidence on TEs

Larsen and Resnick (1998)

- Data: US; 1981-1997 period; 200 high capitalisation (HC) and 200 low capitalisation (LC) stocks used to create value weighted and equally weighted indices

- Main conclusions:
  - indexed portfolios from HC indices have less tracking error and lower standard deviation of tracking error than indexed portfolios of LC indices
  - value weighted portfolio can be indexed more accurately than equally weighted portfolio
  - the more stocks in a tracking basket portfolio, the smaller the tracking error

Empirical evidence on TEs

Tracking error (TE)/Standard deviation of TE for all indexed portfolios

	EQUALLY WEIGHTED		VALUE WEIGHTED	
No of stocks	Stratified	Non-stratified	Stratified	Non-stratified
	HIGH CAPITALISATION PORTFOLIOS			
10	1.60/1.29	1.89/1.38	1.50/1.19	1.53/1.13
20	1.40/1.11	1.47/1.08	1.37/1.01	1.22/0.95
40	1.14/0.79	1.27/0.91	1.02/0.74	1.06/0.80
80	0.78/0.64	0.82/0.65	0.75/0.57	0.71/0.56
	LOW CAPITALISATION PORTFOLIOS			
10	2.50/2.07	2.59/1.85	2.43/1.90	2.42/1.75
20	1.84/1.38	1.75/1.36	1.79/1.19	1.68/1.27
40	1.51/1.24	1.44/1.04	1.42/1.10	1.43/0.99
80	1.08/0.84	1.08/0.81	1.04/0.89	1.08/0.81

Difficulties in trading the basket

- Difficult situation arises when stocks are deleted from or added to the benchmark index
- Benchmark is calculated as though the changes were made at closing prices
- However, changes are not publically announced until the market has already closed
- Accordingly, the index fund manager must trade the following day at prevailing prices which may (and most likely will) be less advantageous than the previous day's closing price – market impact

Market impact

- The price at which a basket of stocks can be bought or sold will differ substantially from the cash index price which is based on the prices at which each of the individual stocks comprising the index last traded
- To sell a basket of stocks, the seller would receive the current bid prices of the individual stocks and vice versa
- Market impact is the difference between the cash index and the cost of buying/selling a basket of stocks
  - major component of transaction costs of index funds
- Level of market impact varies over time and depends upon:
  - liquidity – better liquidity implies smaller bid/ask spread and smaller market impact
  - size of the basket – market impact increases with the size of the basket

Return enhancement strategies

There are two strategies by which the indexer can enhance the returns on the portfolio without compromising the goal of tracking the benchmark index:

- Manager can lend securities in basket portfolio to brokerage firms who need them for short-selling
- Indexer can engage in index futures arbitrage: manager can sell the basket portfolio and replace it with a position in the futures (when they are undervalued), investing the cash proceeds in money market instruments until the futures are settled – use of synthetic indexation

Synthetic indexation

- By purchasing futures contracts and Treasury bills it is possible to create a synthetic index fund that will have the same returns profile as if one was holding the stocks that make up the index (roll over the futures every 3m)
- Constraint: benchmark with available liquid futures contracts has to be chosen
- Advantages of holding long stock position rather than synthetic fund are mainly related to special corporate events such as dividend payments and special dividends
- However, the major drawbacks of holding the replicating portfolio of stocks are high initial transaction costs, market impact, custodial costs and tracking error

Synthetic fund: pros and cons

Advantages:

- low transaction costs, no tracking error, no problems due to dividend reinvestment

Disadvantages:

- price risk related to the fact that: (a) futures may be overpriced when purchased, or (b) futures position may have to be rolled over to the next contract (spread overpriced)
- variation margin risk that arises from the fact that futures are marked-to-market daily
  - futures position will outperform the index in the upmarket and vice versa
  - underhedging techniques could used to minimise the risk of underperformance due to variation margin

Empirical evidence on synthetics

Hill and Naviwala (1999)

- Data: futures on the US S&P 500; 1992-1998 period
- Demonstrate that quarterly return tracking error is smaller than the monthly one
- Over the period of 5 years, an S&P 500 synthetic strategy has delivered returns within 0.01% of the underlying benchmark

Period	Synthetic index returns	S&P 500 returns	Difference
1992-1998	19.45%	19.51%	-0.06%
Last 5 yrs	23.12	23.13	-0.01
Last 3 yrs	31.08	31.22	-0.14

- The range of relative returns on the annual basis has been from -0.58% to +19% before transaction costs. The worst case scenario of underperformance would be between -50 to -75 bp

Link between passive & active mgmt

Purely passive "plain vanilla" index fund vs. purely active styles (market timing and stock picking)

- pure passive funds assume beta of portfolio equal to one, i.e., tracking the stock market index
- pure active funds assume constant deviation from the market portfolio in search for positive alphas

Index fund management can be extended into active to a fairly modest degree being aimed at controlling risk in the following ways (see following slides):

- tilted index funds or core-satellite approach to indexation
- exploiting different sector exposures in indices
- asset allocation model applied to the question of rebalancing

Passive & active: core-satellite

- Build a low risk, low cost core to a portfolio using index funds, while pursuing higher returns with more aggressive, satellite active funds or individual stock proportions
- It is based on the belief that only some sectors of the market (e.g., large cap equities) are efficient and they should be indexed and a proportion should be invested in a less efficient market sector
- Exposure of a portfolio to factors that are expected to outperform: P/E ratio, growth, value, momentum, etc.
- Allows the investor to place active bets in the market while retaining the diversification of the index fund
- Tilted fund is unlikely to outperform the benchmark index dramatically (usually 1 to 2 percent)

Passive & active: sector exposures

By combining a long basket/replicating portfolio with one or more short futures positions, sector exposure can be realised at a low cost and additional returns could be generated

Example:

Small Cap exposure can be achieved when holding a portfolio which tracks Russell 1000 Index (CAC All shares) and shorting the S&P 500 (CAC 40) futures contracts

Passive & active: asset allocation

- Additional cash is not added to the basket unless the expected return of the stock exceeds that of the short-term investment fund or money market instrument (MMI)
- Basically, investor holds an option to exchange one asset (MMI) for another (equity in the basket portfolio)
- The cost of having this choice is the price of the option
- Strategy may involve stock index and bonds futures for implementation of asset allocation decisions to reduce the costs of investing in actual equities and MMIs

Indexing in emerging markets

Example: Asia Pacific by Liu (2000)

- Passive management relies on the notion of market efficiency. BUT, are emerging markets efficient?
- Index funds have combined expense advantage and increased turnover advantage of up to 2.26% in the emerging markets
- Difficult task to persuade investors that index funds can accurately track emerging market indices and educating them about the benefits of indexation
- Hong Kong Tracker Fund is example of a reasonably well performing fund