

PE as part of balanced portfolio

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Good Investment?

- **Investments have characteristics that aren't good or bad**
 - “is PE a good investment” is non-determined question
- **Whether an investment is good or bad is determined by**
 - Characteristics
 - Your investments goals and preferences
 - Existing portfolio
- **There are good reasons to think your characteristics and preferences are different from markets!**
 - For example, markets do not have income from human capital – your job!
- **Good investment decisions are not defined by the outcome!**

Group Work – Problem based learning

- **Norway has amassed significant National savings in “Norges Bank Investment Management”**
- **The oil-fund has traditionally only invested in listed Equity and Bonds**
 - NBIM has everything out in the open – webpage is a valuable resource
 - In 2017, the government considered adding PE without luck
 - 2024 same another attempt at widening the investment universe
- **Your job is to use partly the same information and answer the question from the Finnish point of view:**
- **Should a Finnish Pension Fund (AUM EUR10bn) institution add PE?**
 - What has changed between 2017 and 2023?

Trigger Material

Exercise can be solved perfectly with the below material combined with the lectures, but you are free to use any other sources or data you think are relevant

- **Equity investments in unlisted companies, McKinsey 2017**
- **How Do Private Equity Investments Perform Compared to Public Equity? Harris, Jenkinson and Kaplan, 2016 (HJK2016)**
- **Private Equity, NBIM 2023**
- **Ministry of Finance, whitepaper 2024**
- **Excel sheet containing key index returns**

We consider 3 distinct but connected tasks

1. Use the McKinsey report and return data as your primary trigger material and design a buyout PE strategy for a mid-size (AUM ~EUR 10 bn) Finnish pension fund exposed to EQ and FI investments as of the **end of 2017**. (50/100 points)
2. Contrast the 2023 report to the 2017 McKinsey report. In particular, what can we learn from new evidence, new research, and the different roles of the report writers? (40/100 points)
 - Using data until 2022, does your analysis from 1. task change?
 - As of 2023, would you recommend your board to invest in your (revised) strategy?
3. Finally, read the decision of the Norwegian government from April 2024 and contrast it to your own from task 2. In particular, do you think the reasoning applies to our fund, or why is it different from NBIM? (10/100 points)

Task 1 should include:

- 1. Briefly summarize the (theoretic) rationale for PE investment in the fund context.**
- 2. In a portfolio context, perform a proper quantitative return/risk analysis, using the Thomson Reuters index for PE and the other indices provided until end of 2017.**
 - a. The PE index does not account for costs. You need to adjust the index with reasonable costs for Trading, liquidity and fees, see McKinsey report. The costs are a major driver for the profitability of the PE investment. (Briefly discuss.)
 - b. Risk/Return contribution to EQ/FI portfolio.
 - c. Tail-risks. Especially: How did PE perform, compared to Equity and Fixed income, during the financial crisis (2008) and the euro crisis (2011/2012)?
 - d. Could we replicate PE returns with the small-cap indices? (You can also reflect HJK2016)
 - e. Discuss potential data issues in using the Thomson Reuters index.
- 3. What are the main risks for your strategy, and how do you mitigate them?**
 - a. Financial (from above)
 - b. Reputational & other
- 4. Present a feasible PE buyout strategy for our fund**
 - a. Timeline
 - b. What is the type and size of your investment, and how will you build expertise?
 - c. Costs
- 5. Clear summary and recommendations for action: should the fund invest in PE**

Task 2 should include:

- 1. What new could you learn from the NBIM 2023 report about PE?**
- 2. Data related: Did the experiences from 2008 and 2011 help deal with the Covid period?**
- 3. Would you revise your recommendation from Task 1?**

Task 3 should include:

- 1. Discuss the government decision and whether you think it applies to our smaller fund. Did you reach the same or another conclusion in 2017 and 2023?**
- 2. Not graded self-reflection: How did you find the exercise? What was challenging? What did you learn? How did the group dynamics work? (Max 1 page)**

Guidelines 1

- **You don't need to follow the illustrative structure, but you should address all the points within it. There's much information, challenge is to summarize and present it.**
- **Everything cannot be made explicit; make a reasonable assumption and state it!**
- **In real-life finance, obtaining data is first-order problem. Discuss issues that you see with data.**

Guidelines 2

- **You need to have a portfolio view with self ran analytics, just summarizing McKinsey is not an answer**
 - Get you hands dirty!
- **You do NOT need to unsmooth the PE index**
- **Use regressions and correlations to make your analytical points.**
- **Aim for a 12-page + references + reflection document**
- **Groups of 3-4 people, if you don't have a group, contact me**
 - Please send the names of the people in your group as soon as you have them!

Guidelines 3, Analytics

- **First see the correlations between the assets: EQ, FI and PE**
- **See what the inclusion of PE does to historical returns and risk, you can:**
 1. Use the McKinsey report for a reference allocation to PE
 2. (Only if you familiar: use portfolio construction to see optimal portfolio, e.g. mean-variance, minimum vol.?)
- **What can Harris, Jenkinson and Kaplan (2016) teach us?**
- **Do increased returns justify the changes in risk?**

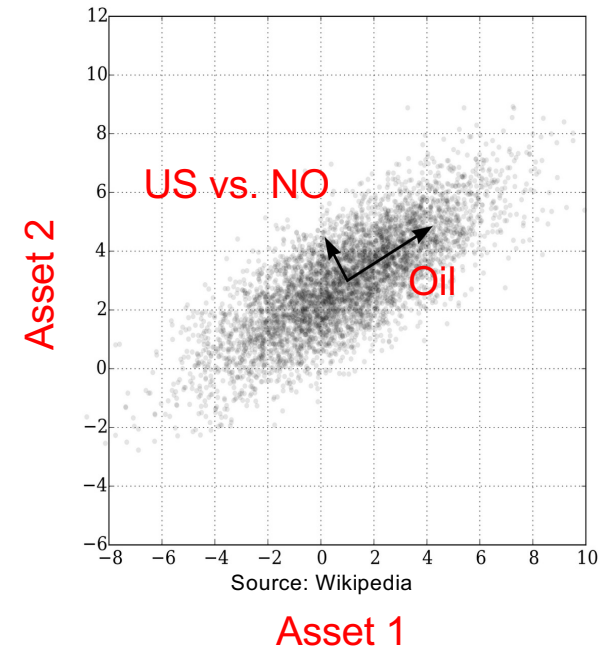
Grading.

- **The report has hard limit of 12 pages.**
- **Your main job is to summarize the available information in a coherent package that provides background for clear business recommendation(s). This is also the basis for grading.**
- **Introduction and Summary + clear recommendation are rewarded**
- **Using too small font, too full pages and irrelevant analysis does not make your case stronger.**

Factors

Why factors: Geometric interpretation of factors

- **Assume 2 assets**
 - Asset 1: oil company in Norway
 - Asset 2: oil company in Texas
- **On days when asset 1 does well, also asset 2 tends to do well**
- **It is more informed for the portfolio managers to talk about**
 - Oil
 - Norway vs. US
- **Right angle between factors means that the correlation between factors is 0**



Factors simplify covariance structure

- **Covariance matrix links all assets to all other assets: dimensionality becomes an issue quickly**
 - For 50 assets we need 1225 relations
 - 5 years of daily data
- **Risk based allocation require $INV(COV)$ – precision matrix**
 - We need to know how assets substitute each other
 - Inversion is less accurate when correlations are high -
> when we need the accuracy most
- **Modelling factors allows us to introduce hierarchy to the portfolio**
 - We consider all assets only against their substitutes
 - Follows investment process: asset class->geography
->stock
 - Most likely there's no one trading Kesko-Tesla spread

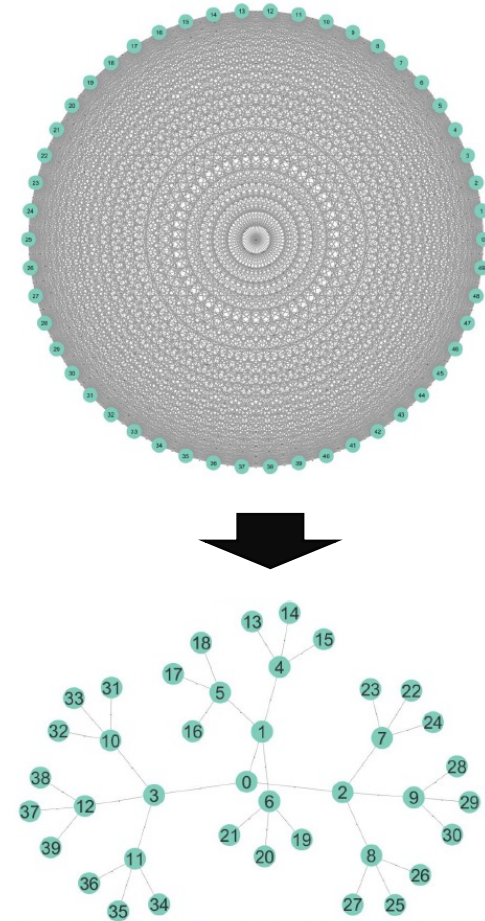


Exhibit 2 – The complete-graph (top) and the tree-graph (bottom) structures

Source: López de Prado, Building diversified portfolios that outperform out-of-sample, 2016

Clusters and Factors

- **Asset pricing theory tells us that there are (latent) drivers of the returns**
 - Well researched
- **If risk factors: we can expect to earn *risk premia***
 - Value or quality stocks
 - E.g. country or industry factors generally do not carry premium
- **In practice: There's no need for the factors to be theory driven**
 - Principal Component Analysis - PCA
 - Statistical factors have some attractive features
- **We can discuss factors in Asset space with *clusters*.**
 - A group of assets that move together
 - Machine learning

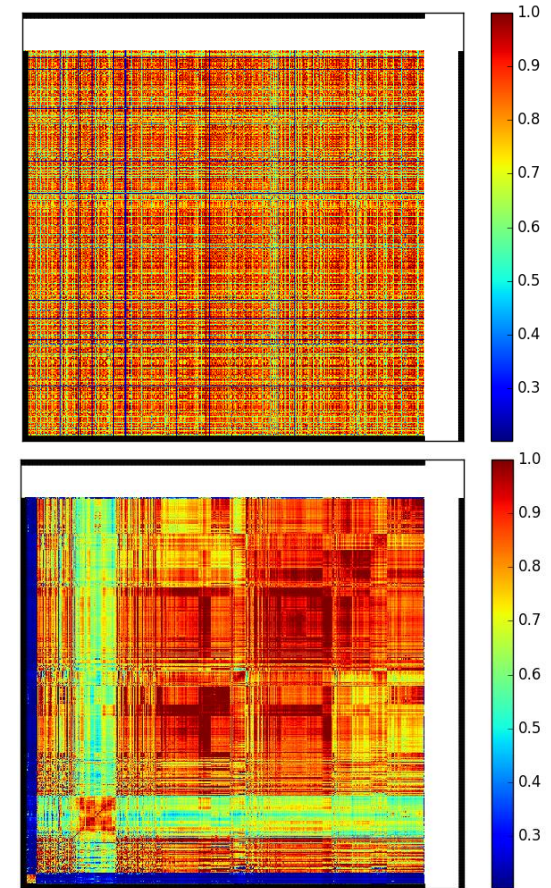


Exhibit 9 – Correlation matrix before and after clustering

Source: López de Prado, Building diversified portfolios that outperform out-of-sample, 2016

Machine Learning (AI) for finding asset clusters or factors

- **Machine learning very efficient in recognizing clusters**
 - E.g. from correlation matrix
- **What to do with clusters:**
 - Risk or portfolio management
 - Trading
- **Could be used to reduce unwanted factor exposure, by running strategies within clusters**
- **Define cluster mean returns as factor**

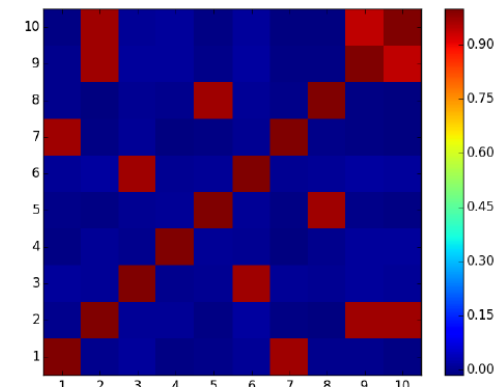


Exhibit 4 – Heatmap of original covariance matrix

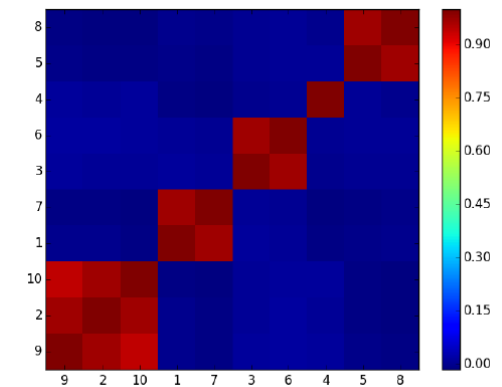
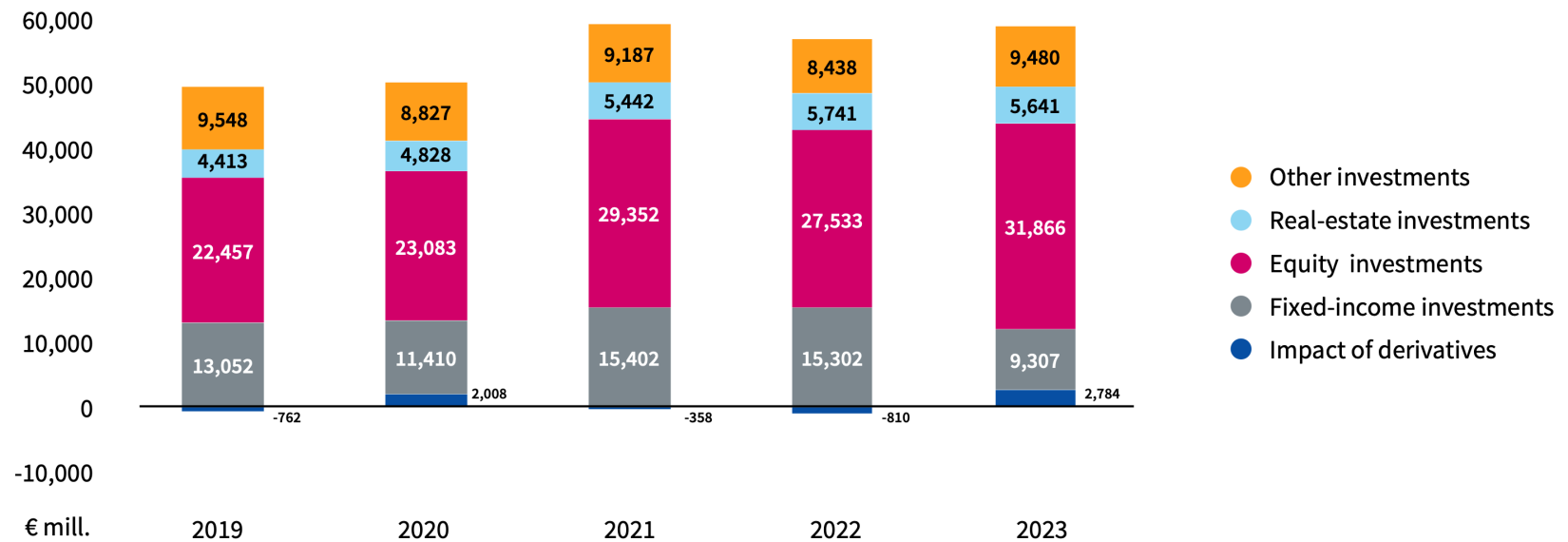


Exhibit 6 – Clustered covariance matrix

Source: López de Prado, Building diversified portfolios that outperform out-of-sample, 2016

Nominal Allocations - Varma

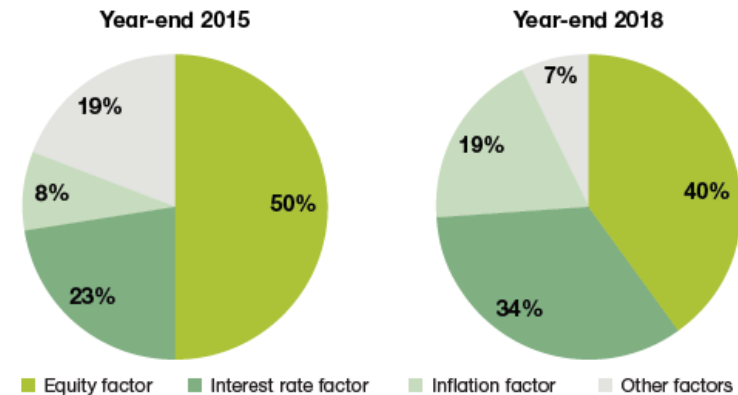
Investment portfolio (€ million)



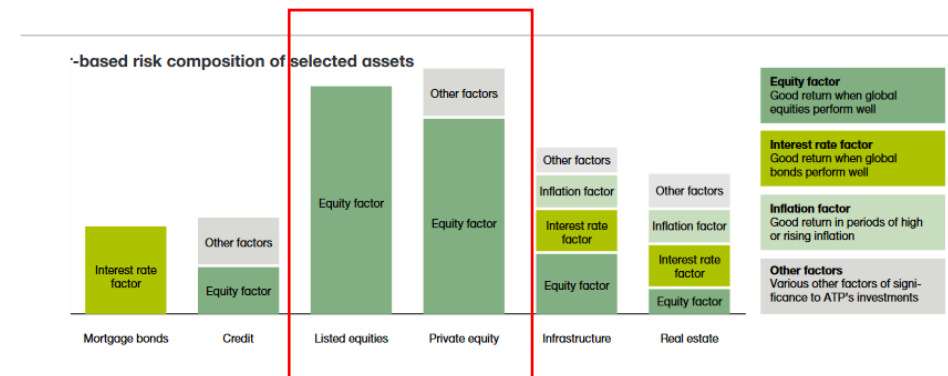
The low dimensionality of factors enables risk contribution discussion

- Danish ATP (+€110bn AUM)
- Belief that taking balanced risks will result in a stable portfolio return that harvests risk premia

Risk allocation in the investment portfolio 2015-2018



- Calculating risk contributions is not trivial problem
 - Full scale simulation and/or orthogonal risks



Source: ATP Group Annual Report 2018

PE returns and factors

Variance in unlisted assets

- PE and hedge fund returns are too smooth, i.e. they show autocorrelation
- Potential causes:
 - (incorrect) predictable returns
 - Low liquidity
 - Nonsynchronous trading
- Getmansky et al. 2003 show that this is due infrequent and sporadic trading

Source: Getmansky, An econometric model of serial correlation and illiquidity in HF returns, 2003

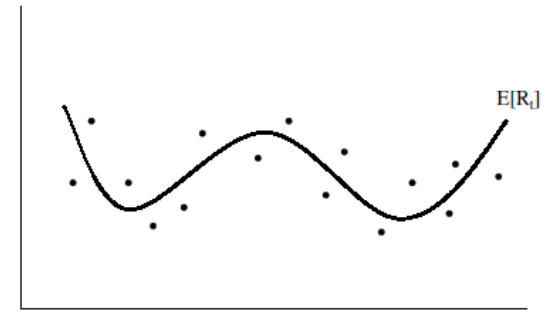
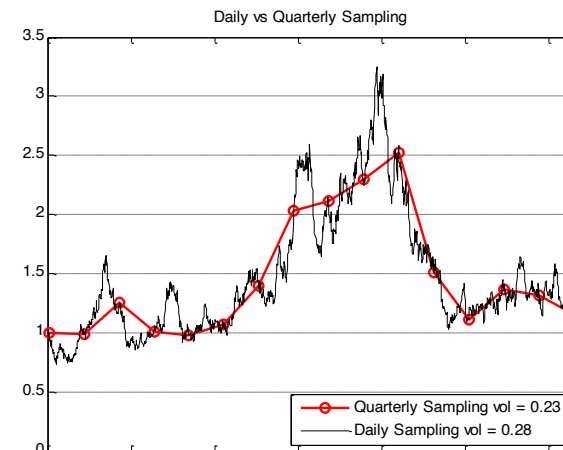


Figure 1: Time-varying expected returns can induce serial correlation in asset returns.



Unsmoothing asset returns

- **Basic idea: fit a model with autocorrelation, recover the parameters and estimate the raw returns**
- **For example, Getmansky et al. (2004) classic MA(H)-process**
- **Results in a return time-series that is “unsmoothed” and shows little autocorrelation, like the public markets**

$$\begin{aligned}R_{j,t}^o &= \theta_j^{(0)} \cdot R_{j,t} + \theta_j^{(1)} \cdot R_{j,t-1} + \dots + \theta_j^{(H)} \cdot R_{j,t-H_j} \\ &= \mu_j + \sum_{h=0}^H \theta_j^{(h)} \cdot \eta_{j,t-h} \\ R_{j,t} &= \mu_j + \eta_{t,j} \text{ with } \eta_{t,j} \sim IID.\end{aligned}$$

Rolling Annual (4th Quarter) Returns (1Q95-3Q14)

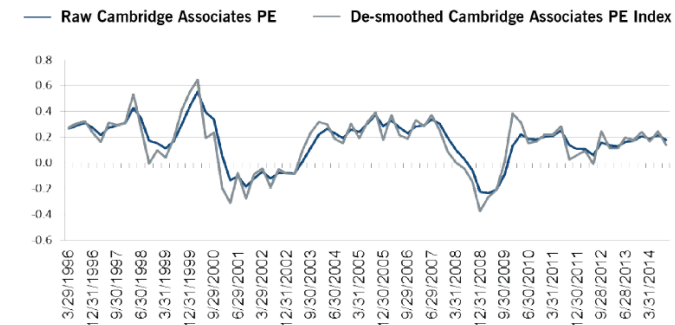
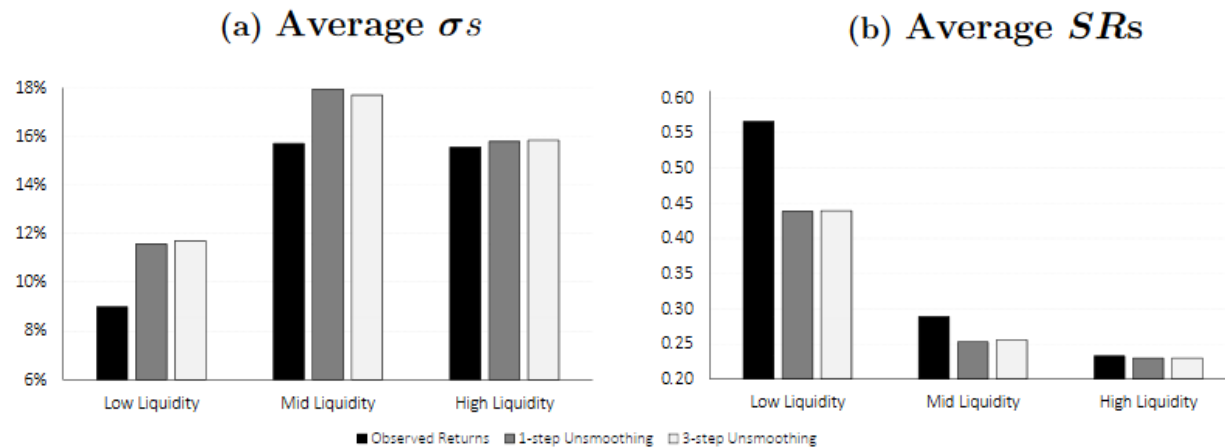


Exhibit 7: Comparison of Smoothed vs. De-smoothed Private Equity Returns
Source: Cambridge Associates, PAAMCO

Unsmoothing asset returns 2

- Unsmoothing results in a more comparable time-series

Source: Coutts, Goncalves, Rossi, Unsmoothing returns of illiquid assets, 2019



	S&P 500	CA Private Equity	Adjusted CA PE Returns
Return	8.51%	13.65%	13.78%
Volatility	16.45%	9.64%	16.63%
Sharpe ratio	0.517	1.416	0.829
Autocorrelation coefficient	0.247	0.487	0.070
Beta to S&P	1.00	0.46	0.74

Exhibit 6: Impact of De-smoothing Private Returns
Source: Cambridge Associates, PAAMCO

Factor structure in private markets

- Goetzmann, Gourier and Phalippou 2019

- Clustering PE funds
- Consider PCA
- But use correlation based clustering
- Use the common returns in clusters as “factors”

Table 4. Mapping of funds to clusters

This table reports the percentage of a given type of funds allocated to a given cluster. Fund types are formed by combining the three tier level fund classifications of Burgiss with geographical focus, size quartile (vintage year adjusted) and firm experience. The last column reports the Herfindhal index for each type of funds across the eight clusters. Cells are shaded when the fraction is more than one third, and when the Herfindhal index is above 0.25.

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	HERF
Generalist	7	3	11	14	10	7	31	17	0.18
Debt	7	5	6	19	4	3	45	11	0.26
Gen Debt	10	3	8	17	0	3	49	8	0.30
Mezzanine	7	7	7	4	5	3	59	8	0.37
Mezzanine US	1	7	9	3	5	3	64	8	0.43
Mezzanine WE	50	0	0	6	6	0	25	13	0.34
Distressed	5	3	4	40	4	4	25	15	0.25
Distressed Small	6	0	6	0	11	11	50	17	0.31
Distressed Non-Small	5	4	4	45	3	3	21	15	0.28
Real Assets	12	3	25	6	13	5	28	7	0.19
Real Estate	12	3	33	5	6	4	29	6	0.22
Real Estate WE	61	3	13	7	0	4	4	7	0.41
Real Estate US	5	3	41	2	5	4	35	5	0.30
Real Estate US Small	4	5	26	3	5	6	43	7	0
Real Estate US Non-Small	6	2	44	2	5	3	33	5	0
Nat. Resources	6	2	8	9	38	4	28	7	0.24
Nat. Resources Energy	4	3	4	2	61	3	17	7	0.41
Nat. Resources Timber	12	0	12	10	0	8	58	2	0.38
Infrastructure	20	8	7	9	8	13	28	9	0.17
Infrastructure WE	67	0	7	0	0	13	7	7	0.48
Infrastructure US	2	13	7	7	9	13	42	7	0.24
Generalist RA	11	0	0	5	42	5	5	32	0.30
Equity	14	16	10	11	7	10	21	12	0.14
Venture Capital	7	28	10	7	6	9	22	11	0.17
Buyout	21	5	11	14	7	11	20	12	0.15
Expansion	7	6	8	17	8	15	20	19	0.15
Gen Equity	14	11	8	15	7	9	21	15	0.14
Buyout WE	52	3	6	15	7	7	6	5	0.32
Buyout US	10	6	13	10	7	13	27	14	0.15
Venture Capital WE	28	17	8	8	4	6	15	13	0.17
Venture Capital US	6	30	10	6	5	9	23	11	0.18
Venture Capital Asia	10	21	14	12	3	12	23	6	0.16
Venture Capital Small	8	18	13	7	8	10	25	11	0.15
Venture Capital Non-Small	6	34	9	6	4	9	21	11	0.20
Venture Capital Early IT	6	33	10	6	4	8	24	9	0.20
Venture Capital Early Other	8	26	13	5	8	8	22	10	0.16
Venture Capital Gen VC	10	23	9	7	6	11	22	12	0.15
Venture Capital VC other	6	25	9	8	4	12	22	13	0.16
VC Early IT Small	8	23	11	5	6	8	29	8	0.18
VC Early IT Non-Small	5	39	10	6	3	7	21	9	0.23

Clustering PE funds

- Goetzmann, Gourier and Phalippou 2019

- **Mixed evidence**
 - I am not sure if we really have 8 factors here
- **Correlation between factors problematic**
 - Risk contribution
 - 1.principal component ~32%
 - Statistically 5.7 factors
- **Why only EQ related public market factors?**
 - Loading heavily on Market

Panel B. Correlation matrix of the eight private factors

Correlation	1	2	3	4	5	6	7	8
1	1	0.35	0.41	0.50	0.28	0.27	0.23	0.38
2	0.35	1	0.23	0.28	0.08	0.42	0.49	0.39
3	0.41	0.23	1	0.24	0.11	0.13	0.05	0.15
4	0.50	0.28	0.24	1	0.29	0.19	0.08	0.31
5	0.28	0.08	0.11	0.29	1	0.18	0.06	0.21
6	0.27	0.42	0.13	0.19	0.18	1	0.10	0.33
7	0.23	0.49	0.05	0.08	0.06	0.10	1	0.15
8	0.38	0.39	0.15	0.31	0.21	0.33	0.15	1

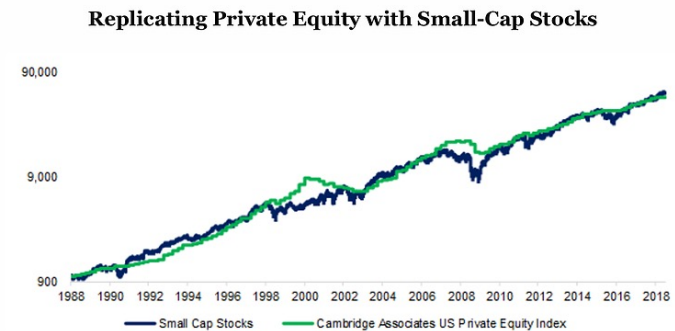
Table 7. Private factors vs. public factors

This table reports the results from regressions of the excess return for the eight private factors on the Domestic AQR model, which refers to the Fama-French 3-factor model augmented with the Quality Minus Junk factor of [Asness, Frazzini, and Pedersen \(2018\)](#) and the Betting Against Beta factors of [Frazzini and Pedersen \(2014\)](#).

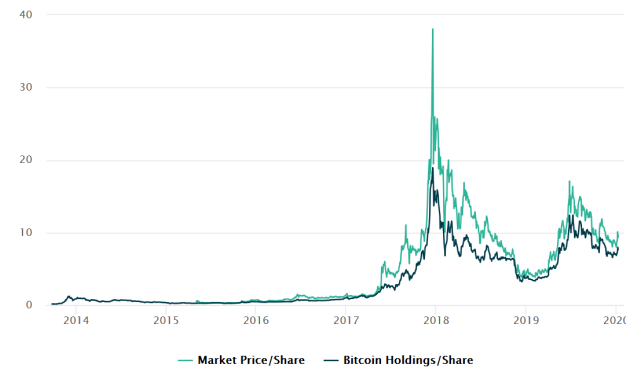
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Panel D. Domestic AQR								
Rm-Rf	0.616 <i>6.127</i>	0.288 <i>2.439</i>	0.168 <i>1.990</i>	0.510 <i>6.935</i>	0.113 <i>1.133</i>	0.256 <i>2.334</i>	0.032 <i>0.660</i>	0.284 <i>3.397</i>
SMB	-0.264 <i>-1.751</i>	0.161 <i>0.910</i>	-0.309 <i>-2.453</i>	-0.179 <i>-1.627</i>	-0.070 <i>-0.466</i>	0.193 <i>1.173</i>	-0.124 <i>-1.705</i>	0.238 <i>1.902</i>
HMLd	-0.161 <i>-1.773</i>	-0.705 <i>-6.603</i>	-0.127 <i>-1.672</i>	0.161 <i>2.418</i>	-0.009 <i>-0.101</i>	-0.250 <i>-2.519</i>	-0.144 <i>-3.275</i>	-0.088 <i>-1.163</i>
QMJ	-0.015 <i>-0.086</i>	-0.385 <i>-1.893</i>	-0.114 <i>-0.787</i>	-0.345 <i>-2.725</i>	-0.357 <i>-2.074</i>	-0.029 <i>-0.152</i>	-0.107 <i>-1.283</i>	-0.230 <i>-1.599</i>
BAB	0.328 <i>3.304</i>	-0.234 <i>-2.011</i>	0.238 <i>2.868</i>	0.498 <i>6.866</i>	0.228 <i>2.313</i>	-0.137 <i>-1.268</i>	-0.037 <i>-0.772</i>	-0.013 <i>-0.156</i>
R ²	48%	53%	19%	72%	21%	25%	18%	47%

Can we synthesize/securitize the exposure?

- **If there are no new factors:** we can replicate the new asset class with existing
- **Case:** can you replicate PE with small cap index?
- **If there are new factors:** it can be lucrative to securitize cash flows for constrained investors
- **Are we introducing other risks?**
 - Bitcoin Fund
 - REITs



Source: Cambridge Associates, FactorResearch



Source: grayscale.co

Adding PE to EQ/FI portfolio

Asset Allocation decisions start from existing portfolio and organizational structure

- After we have modelled the covariance structure of the new asset
 - Cost-benefit analysis
 - Do we have MANDATE to invest, can we convince asset owners?
- **For pension funds: Is investing in PE inline with maximizing the client, i.e. asset owner, lifetime benefits?**
 - New regulation in Norway 2024 explicitly mentions this
- **Other inclusion criteria:**
 - Other risks
 - Costs
 - Ease of exit

Other Risks?

- Reputation
- Operational
- Other ESG

Exhibit 6
Examples of nonfinancial risks controlled by institutional investors in private equity

NOT EXHAUSTIVE

	Risk category	Examples of risk exposure	Risk controlled by institutional investor			
			1 FoF investment	2 Fund investment	3 Co-investment	4 Direct investment
Partner level	Reputational	▪ Governance (e.g., corruption)	✓	✓	✓	
	People	▪ Succession of key personnel	(✓)	✓	✓	
	Process	▪ Investment process (e.g., diligence)	(✓)	✓	✓	
Asset level	Reputational	▪ Environmental, social, and governance (e.g., environmental damage)			(✓)	✓
	Regulatory	▪ Regulatory efficiency			(✓)	✓
	Political	▪ Safety and instability (e.g. social unrest) ▪ Politics and policies (e.g., tax legislation)			(✓)	✓
	People	▪ Unauthorized activity/employee misdeed (e.g. noncompliance)			(✓)	✓
	Process	▪ Corporate crisis management ▪ Third party risk			(✓) (✓)	✓ ✓
	Systems	▪ Cyber security and technology risk			(✓)	✓
	Other operational risks	▪ Health, safety and work environment ▪ Litigation			(✓) (✓)	✓ ✓

Institutional investors will be exposed indirectly to all these asset level risks, but will not be in control

Source: McKinsey, Equity investments in unlisted companies, 2017

Reputational risks – Norwegian Oil Fund and Formula 1

- Oil Fund could invest in companies planning listing
- Oil Fund invested in Delta Topco in 2012 that owned the marketing rights for F1
- Soon after IPO was cancelled and Ecclestone accused of bribes
- One of the worst crisis of the Oil Fund – no unlisted investments since

50% DN i ett år til halv pris Bestill nå - få 1 ekstra måned gratis

NBIM

Oljefondet fortsatt i racerbil

Formel 1 - selskapet bytter trolig hovedeier. Det norske Oljefondet er stadig med på eiersiden.

1 min Publisert: 04.09.16 – 19:47 Oppdatert: 3 år siden



Formel 1-satsingen ble et bomskudd for Oljefondet, og den planlagte børsnoteringen ble avlyst. Her fra australske Formel 1 Grand Prix i mars, hvor spanske Ferrando Alonso kom uskadet fra kollisjon. Foto: Max Blyton/AFP/NTB Scanpix (Foto: Afp)

Arne Grande

Source: dn.no

Inclusion criteria - costs

- Assuming we have a portfolio, we already have some capabilities – how much does the new investment demand investment?

- Systems
- People
- Culture – is this even feasible?
- Board
- Asset Owners
- Ease of getting out

Exhibit 4
Overview of skillset required for different investment models

	1 FoF investments	2 Fund investment	3 Co-investment	4 Direct investment
External fund-of-funds manager selection	✓	×	×	×
External PE fund selection	×	→ ✓	✓	×
Deal sourcing	×	×	×	→ ✓
Primary DD	×	×	×	→ ✓
Secondary DD	×	×	→ ✓	×
Deal structuring/execution	×	×	×	→ ✓
Portfolio company management	×	×	×	→ ✓
Exit strategy	×	×	×	→ ✓

Source: McKinsey, Equity investments in unlisted companies, 2017

Inclusion criteria – ease of exit

- **Before committing to an investment, consider the ease by which you can get out of it**
 - Not the same as liquidity
- **For example, if you invest 100 million to a Chinese PE-fund, can you get your money out of China if you need it?**

What do others do?



Figure 1. Asset allocation of pension funds. Source: CEM Benchmarking

Table 1. Asset Allocation of US Endowments

This table presents the portfolio allocation of US endowments across broad asset classes, as of June 30, 2018. Other investments (e.g. cash) bring the total to 100%. Source: NACUBO-TIAA survey.

Total Endowment Size	Domestic Equities	Fixed Income	Non-US Equities	Hedge Funds	Private Markets
	%	%	%	%	%
Over \$1 billion	13	7	19	19	32
\$501 million to \$1 billion	22	10	22	18	19
\$251 million to \$500 million	24	12	22	18	19
\$101 million to \$250 million	31	15	22	12	11
\$51 million to \$100 million	34	19	22	10	10
\$25 million to \$50 million	39	22	18	8	6
Under \$25 million	45	24	15	6	4
Dollar-weighted average	16	8	20	18	28
Equal-weighted average	31	16	21	13	12

- **Alternative? As in Metallica on Radio Nova**

How are the reported portfolio impacts?

	All Public Benchmark	With Buyout Funds		With VC Funds		Buyout and VC Funds	
		(1)	(2)	(3)	(4)	(5)	(6)
Return	8.05%	8.69%	8.91%	9.68%	9.89%	9.26%	9.49%
Standard Deviation	9.56%	8.19%	7.78%	9.72%	9.84%	8.90%	8.76%
Standard Deviation (adjusted)	10.39%	9.47%	9.22%	12.52%	12.99%	10.83%	10.95%
Sharpe Ratio	0.60	0.78	0.85	0.76	0.77	0.78	0.82
Sharpe Ratio (adjusted)	0.55	0.67	0.72	0.59	0.58	0.64	0.66
Semi-Deviation	11.59%	9.77%	9.22%	10.37%	10.18%	10.22%	9.91%
Semi-Deviation (adjusted)	12.59%	11.29%	10.93%	13.36%	13.43%	12.45%	12.39%
Skewness	-0.67	-0.65	-0.62	0.17	0.37	-0.33	-0.18
Kurtosis	0.68	0.70	0.72	3.22	4.04	1.58	2.04
Average Allocation Fixed Income	40.0%	39.7%	39.7%	39.6%	39.6%	39.7%	39.6%
Average Allocation Public Equity	60.0%	45.6%	40.6%	43.2%	40.6%	44.4%	40.7%
Average Allocation Private Equity	0.0%	14.7%	19.7%	17.1%	19.8%	15.9%	19.7%
Average Deviation from Target	-	-5.3%	-0.3%	-2.9%	-0.2%	-4.1%	-0.3%
Std. Dev. (PE allocation - PE target)	-	2.6%	3.4%	6.0%	7.0%	3.9%	4.7%
Probability (Return Sim > Return Base Case)	-	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Probability (Adj. SD Sim < Adj. SD Base Case)	-	100.0%	100.0%	1.3%	1.3%	0.7%	0.6%
Probability (Adj. SR Sim > Adj. SR Base Case)	-	100.0%	100.0%	98.3%	97.3%	100.0%	100.0%
Probability (Adj. Semi-D Sim < Adj. Semi-D Base Case)	-	100.0%	100.0%	1.8%	1.9%	72.5%	76.6%

Source: Brown, hu, Kuhn, Why Defined Contribution Plans need Private Investments, DCALTAL/IPC research paper, 2019

Number of funds

- **Diversification vs. costs**
- **Fund of funds vs. funds**
 - Do we want to pay for packaging?
 - Exercise!
- **Geographies?**
- **Capacity?**
 - People, monitoring

Figure 4. Return Distributions by Number of Funds

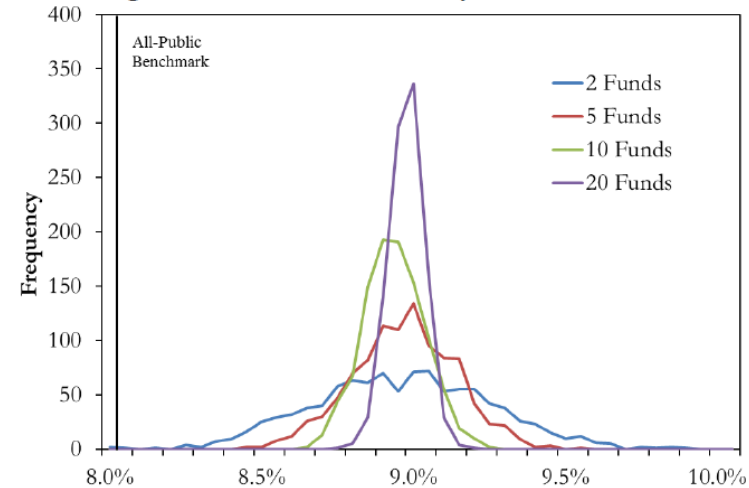
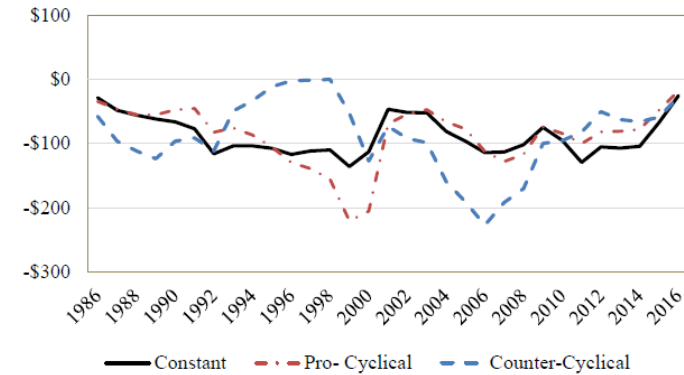


Figure 4. Return distribution by number of funds selected. This figure shows the return distributions for diversified portfolios with 20% average allocation to buyout funds (N=1000 simulations). Generated portfolios have investment in 2, 5, 10, 20 or all available buyout funds per vintage, randomly selected per vintage. DCALTA/IPC Research – 2019

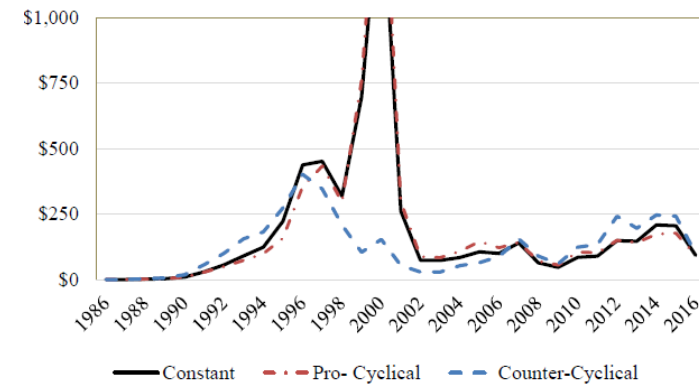
Timing PE - Brown et al. 2019

- Private equity returns are cyclical – with periods of high fund-raising being associated with subsequent low returns
- LPs control only commitments, GPs decide capital calls and returns
 - Conditional on markets
- PME sees through correlated public and private markets
 - Neutral 1.15
 - Counter-cyclical 1.17
 - Pro-cyclical 1.09

Panel A: Capital Calls (Drawdowns)



Panel B: Capital Distributions



Source: Brown et al. Can Investors Time Their Exposure to Private Equity, 2019