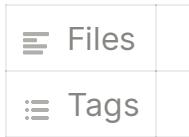


Week 3 - Section 2



1. Extracting Implied Expected returns

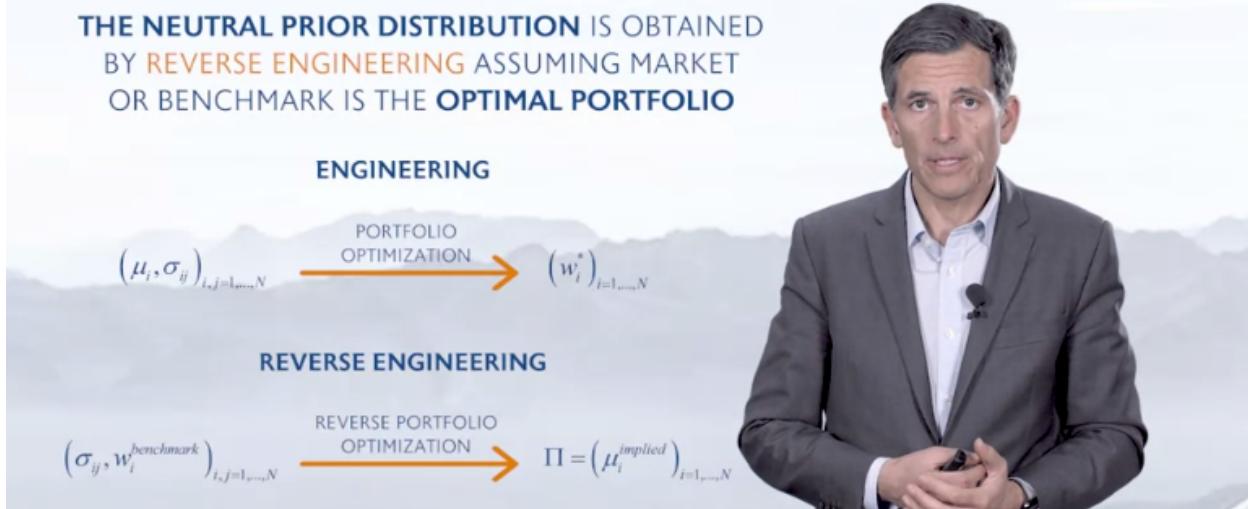
- Input 1 : expected return estimates which are uncertain
- Input 2 : risk parameters estimates which are sort of certain using statistical model.
- active view? The value skill of active portfolio management to be able to generate views.

A video thumbnail with a man in a grey suit and white shirt speaking. The background is a blurred landscape. The title 'FINDING AN ANCHOR POINT' is at the top. Text on the left includes 'WE SHOULD USE THE BENCHMARK AS AN ANCHOR POINT' and 'THE BLACK-LITTERMAN MODEL USES THE MARKET PORTFOLIO WHICH IS THE TRUE OPTIMAL PORTFOLIO ACCORDING TO CAPM AS AN ANCHOR POINT'.

- Benchmark portfolio → starting point(anchor point)

NEUTRAL/IMPLIED EXPECTED RETURNS

THE NEUTRAL PRIOR DISTRIBUTION IS OBTAINED BY REVERSE ENGINEERING ASSUMING MARKET OR BENCHMARK IS THE OPTIMAL PORTFOLIO



- Engineering?

input = mu, sigma

output = optimized portfolio (w_i^*)

- Reverse Engineering?

input = w_i^* (benchmark), sigma

output = mu(expected return)

WRAP-UP

TO INCORPORATE ACTIVE VIEWS ABOUT
EXPECTED RETURNS IN A MEANINGFUL WAY
WE NEED AN ANCHOR POINT

THE ANCHOR POINT IS GIVEN BY NEUTRAL/IMPLIED
EXPECTED RETURNS ESTIMATES THAT WOULD MAKE
THE BENCHMARK PORTFOLIO OPTIMAL

THE B&L MODEL WILL MIX THESE
BENCHMARK-CONSISTENT EXPECTED
RETURNS WITH ACTIVE VIEWS

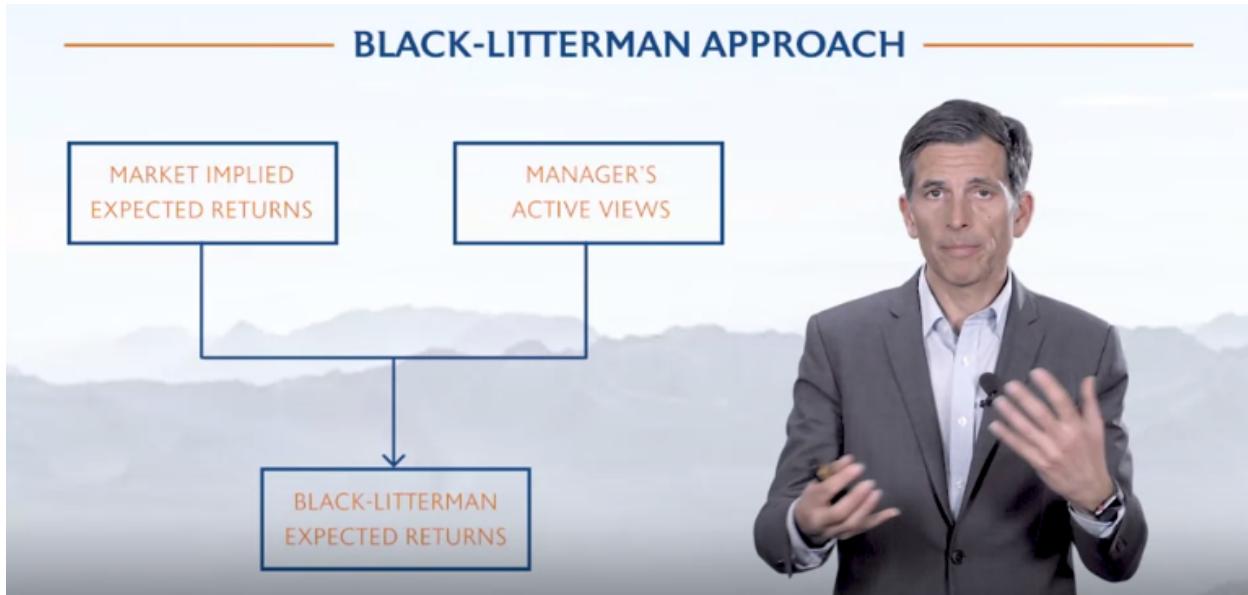
재생



Black-Litterman model is mix of benchmark consistent expected return and active views

2. Introducing Active views

- Black-Litterman approach



Black-Litterman model is mix of benchmark consistent expected return and active views

ACTIVE VIEWS

A VIEW IS EXPRESSED AS A NORMAL DISTRIBUTION WITH MEAN EQUAL TO Q AND A STANDARD DEVIATION GIVEN BY Ω

$$P\mu = Q + \varepsilon^v$$

where $\varepsilon^v \sim N(0, \Omega)$

- portfolio P has a normal distribution
- portfolio P mean \rightarrow Q (expected return on these different assets) with error (standard deviation, Omega is uncertain)

ACTIVE VIEWS

A VIEW IS EXPRESSED AS A NORMAL DISTRIBUTION WITH MEAN EQUAL TO Q AND A STANDARD DEVIATION GIVEN BY Ω

$$P\mu = Q + \varepsilon^v$$

where $\varepsilon^v \sim N(0, \Omega)$

K IS THE TOTAL NUMBER OF THE VIEWS

P IS A KxN MATRIX THAT IDENTIFIES THE ASSETS INVOLVED IN THE VIEWS

Q IS A K-VECTOR OF THE EXPECTED RETURNS ON THESE PORTFOLIOS

- N: total number of assets

BLACK LITTERMAN MODEL

COMBINE BENCHMARK IMPLIED EXPECTED RETURNS (PRIOR RETURN VECTOR)

$$\mu = \Pi + \varepsilon^e$$

where $\varepsilon^e \sim N(0, \tau \Sigma)$

WITH ACTIVE VIEWS

$$P\mu = Q + \varepsilon^v$$

where $\varepsilon^v \sim N(0, \Omega)$

IN A BAYESIAN FRAMEWORK NEW EXPECTED RETURN (POSTERIOR RETURN VECTOR) CAN BE WRITTEN AS

$$\bar{\mu} = \left[(\tau \Sigma)^{-1} + P' \Omega^{-1} P \right]^{-1} \left[(\tau \Sigma)^{-1} \Pi + P' \Omega^{-1} Q \right]$$



Benchmark implied expected return의 결과와 active views의 결과를 합쳐서 Bayesian Framework에 대입하면 새로운 Mu(posterior return vector)을 얻을 수 있다.

WRAP-UP

IN BLACK-LITTERMAN ANALYSIS, THE EXPECTED RETURN USED IN PORTFOLIO OPTIMIZATION IS A COMPLEX AVERAGE OF THE BENCHMARK IMPLIED NEUTRAL EXPECTED RETURN ESTIMATE AND THE MANAGER'S ACTIVE VIEW

IN CASE THE MANAGER HAS NO VIEWS, OR ZERO CONFIDENCE IN THEIR VIEWS, THEN THE PROCESS ENSURES THAT THE PORTFOLIO CONVERGES TOWARDS THE BENCHMARK, AS IT SHOULD



3. Black-Litterman Analysis

실제 적용해 봅시다

1. No Views

첫번째 열은 단순 평균을 기대수익률로 사용한 것. 마이너스도 있고 숫자가 너무 우왕좌왕하고 전반적으로 노이즈가 많이 껴 있음

두번째 열은 CAPM으로 구한 기대수익률(=Sharpe Ratio)

세번째 열은 Black-Litterman 분석의 리버스엔지니어링으로 찾아낸 수익률 (포트폴리오 비율과 변동성으로부터 도출해낸 수익률)

CAPM과 B&L implied는 상관계수가 매우 높음 (0.99 이상)... 왜?



2. Active Views

절대적 또는 상대적으로 표현 가능

- A 섹터는 XX%의 수익률을 보일 것이다
- B 섹터는 C 섹터에 비해 YY% 높은 수익률을 보일 것이다

각 Active view의 Confidence는 prior의 분산으로 표현됨

3. Weights

PORTFOLIO WEIGHTS – WITH ACTIVE VIEWS

	B&L ER - No View	B&L ER - Views	Diff (Views - No View)	B&L Weights - No View	B&L Weights - Views	Diff (Views - No View)
Food	2.04%	2.75%	0.71%	2.28%	19.99%	17.71%
Bear	1.81%	2.69%	0.88%	0.88%	9.87%	8.99%
Gas	1.6%	3.29%	1.69%	0.83%	9.34%	8.51%
Gamer	4.01%	2.85%	-1.16%	1.06%	1.05%	0%
Books	4.03%	2.71%	-1.32%	0.11%	3.78%	-1.71%
Habit	1.39%	2.24%	0.85%	1.65%	1.63%	0%
Cthu	2.33%	1.8%	-0.53%	0.95%	0.95%	0%
Hith	3.31%	2.29%	-0.52%	10.99%	10.99%	0%
Chema	4.18%	2.92%	-1.26%	1.46%	9.00%	-10.46%
Tatle	4.36%	3.18%	-1.18%	0.05%	0.05%	0%
Cntr	4.22%	3.08%	-1.14%	0.77%	4.73%	-5.5%
Steel	4.59%	2.95%	-1.64%	0.21%	1.31%	-1.52%
Fair	4.2%	2.89%	-1.31%	1.69%	1.69%	0%
EdEc	4.21%	3.37%	-1.04%	0.39%	0.39%	0%
Autor	3.74%	2.88%	-0.86%	0.08%	0.08%	0%
Carry	3.62%	2.83%	-0.79%	1.59%	1.59%	0%
Mines	3.12%	1.76%	-1.36%	0.34%	0.34%	0%
Coal	2.82%	0.29%	-2.03%	0.03%	0.03%	0%
Oil	3.52%	2.42%	-1.1%	4.35%	4.35%	0%
Util	0.91%	2.05%	1.14%	3.32%	33.77%	30.65%
Telcom	2.66%	2.56%	-0.1%	4.4%	4.4%	0%
Servs	3.4%	2.87%	-0.53%	15.98%	15.98%	0%
Boat	3.71%	3.29%	-0.42%	10.62%	10.62%	0%
Paper	3.58%	3.34%	-0.44%	0.99%	0.99%	0%
Trans	3.85%	3.34%	-0.71%	2.39%	2.39%	0%
Whal	3.4%	2.88%	-0.52%	1.1%	1.1%	0%
Rtail	3.47%	3.05%	-0.42%	7.71%	7.71%	0%
Meals	2.29%	2.13%	-0.16%	1.63%	1.63%	0%
Fin	3.07%	2.52%	-0.17%	16.31%	16.31%	0%
Other	2.74%	2.56%	-0.18%	5.01%	5.01%	0%

ONLY THE WEIGHTS OF THE 8 SECTOR INDICES FOR WHICH VIEWS WERE
EXPRESSED CHANGED FROM THEIR ORIGINAL MARKET CAP WEIGHTS
AND THE DIRECTIONS OF THE CHANGES ARE INTUITIVE



1열: no views일 때의 수익률

2열: views일 때의 수익률

3열: 1열과 2열의 차이

4열: no views일 때의 가중치

5열: views가 있을 때의 가중치

6열: 4열과 5열의 차이

view를 제시한 종목에 대해서만 가중치의 차이가 발생함