Asset Allocation II

FINC-460 Investments

Kellogg School of Management

Introduction

- In the previous class, we saw situations where the CAPM did not work very well in practice.
- Can we take advantage of this?
- In this lecture we will learn how, and in the process focus on the way the Markowitz theory most often is used in practice.

  ↪ This is sometimes referred to as the TOP-DOWN APPROACH.

- This type of approach is favored by large institutional investors such as insurance companies and pension funds.

The top town approach

- In the US there are tens of thousands of traded securities.
- Clearly, we cannot solve Markowitz with these many assets.
- We can dramatically reduce the dimensionality of the problem by choosing across *portfolios* of assets.
- By specifying our choice set over a small number $(N \leq 50)$ of portfolios, we can find the optimal combination with the highest Sharpe ratio.

The top town approach

- How to group securities into portfolios?
- We should group them based on an economically meaningful characteristic:
  - ↪ Industry
  - ↪ Geography
  - ↪ Asset class

The top town approach

- We can also group them based on firm characteristics that we *know* are correlated with expected returns:
  - ↪ book-to-market
  - ↪ size
  - ↪ momentum
  - ↪ profitability
- In this way, we can take advantage of the ‘anomalies’ we discovered in the previous lecture.

The top town approach

- Are there other advantages to portfolios rather than individual securities in Markowitz ?
- Portfolios already diversify some of the idiosyncratic risk
- This reduces estimation error in
  - ↪ Expected returns
  - ↪ Betas/covariances
- Recall that measurement error in expected return of asset i equals $\sigma/\sqrt{T}$.
- Diversified assets have lower volatility σ, hence lower measurement error.

The top town approach

- Using portfolios rather than individual securities, we can use more data.
- Individual firms may appear for a small part of the sample.
- However, as long as there exist similar firms, using portfolios we can use a much longer history
  - ↪ Example: we have data on portfolios of value/growth firms since 1926
  - ↪ How many firms today existed in 1926?
- Increasing T reduces measurement error.

The top town approach

- Are there any disadvantages to not using individual securities?
- Our choice of which portfolios to focus on, will determine how well we will be able to do.
- For instance, we can only take advantage of the value effect, if we consider portfolios of firms with different book-to-market.
- Choice is only meaningful if the menu contains more than one item!
- Portfolios need to be different in economically meaningful ways.
- What will happen if you consider 26 portfolios, each grouping firms according to their first letter of their name?

Beating the market

- Over the last 90 years, the market portfolio has generated an average excess return of 0.62% and a volatility of 5.46% per month
- This implies a Sharpe ratio of $0.62/5.46 = 0.1143$ in monthly terms.
- Can we do much better?
- Let's put to work what we learned in the previous lecture
- Consider six portfolios sorted on size and book-to-market.

Beating the market

Portfolio	Mean	SE(mean)	Volatility	Correlations					
SG	1.00	0.25	7.81	1.00	0.95	0.90	0.85	0.82	0.81
S2	1.29	0.22	7.12	0.95	1.00	0.96	0.84	0.88	0.89
SV	1.50	0.26	8.36	0.90	0.96	1.00	0.79	0.88	0.92
LG	0.90	0.17	5.40	0.85	0.84	0.79	1.00	0.89	0.82
L2	0.96	0.18	5.82	0.82	0.88	0.88	0.89	1.00	0.94
LV	1.19	0.23	7.29	0.81	0.89	0.92	0.82	0.94	1.00

- Monthly data 1926-2010. Risk free rate has been 0.34% on average.
- How accurate are our estimates of historical returns?
- Assuming I believe this pattern is likely to hold in the future, what is the maximum Sharpe ratio I can achieve?

Beating the market

Number of securities: 6

No	Name	Fraction	Expected Return	Standard Deviation
1	SG	-364%	1.00%	7.81%
2	S2	381%	1.29%	7.12%
3	SV	138%	1.50%	8.36%
4	LG	193%	0.90%	5.40%
5	L2	-144%	0.96%	5.82%
6	LV	-104%	1.19%	7.29%
		1.00		

Correlations		2	3
1		0.951	0.900
2			0.963
3			
4			
5			
		YES	

Portfolio's Expected Return	0.0248
Portfolio's Standard Deviation	0.0963

Risk Free Rate	0.0034	**Risk Aversion Coefficient: A=**	2.00
Slope of CAL	0.2218	**Weight on optimal risky portfolio: x*=**	115.09%

- I can achieve a Sharpe ratio that is twice the sharpe ratio of the market.
- I can do better by diversifying across strategies

Portfolio Optimization with Constraints

- Previous solution involves rather extreme positions.
- Perhaps this is undesirable.
- One way is to use more conservative estimates for expected returns.
  - ↪ I could “shrink” the expected returns towards the historical return as we saw in Lecture 3.
- Alternatively, I could impose additional constraints into the problem.

Portfolio Optimization with Constraints

- Why constraints? Constraints naturally arise when applying the theory to real life situations:
  - ↪ No short sales.
  - ↪ Volatility cap.
  - ↪ Target CAPM beta.
  - ↪ Minimize benchmark tracking error.
  - ↪ Limit exposure to certain classes of assets. Why?
    - i) Transaction costs.
    - ii) Liquidity.
    - iii) Uncertainty about estimates.
- Constraints clearly shrink the set of feasible portfolios.
  - ↪ Hopefully it buys us some robustness instead.

Portfolio Optimization with Constraints

- Consider the following possibilities:
  - ↪ No short selling more than 50% in any security.
  - ↪ We want our portfolio to have a CAPM beta of 1.
- I can introduce these constraints into Markowitz.
- How do I compute the beta of a portfolio?

Portfolio Optimization with Constraints

Number of securities: 6

No	Name	Fraction	Expected Return	Standard Deviation
1	SG	-50%	1.00%	7.81%
2	S2	76%	1.29%	7.12%
3	SV	92%	1.50%	8.36%
4	LG	66%	0.90%	5.40%
5	L2	-50%	0.96%	5.82%
6	LV	-33%	1.19%	7.29%
		1.00		

Correlations		2	3
1		0.951	0.900
2			0.963
3			
4			
5			
		YES	

Portfolio's Expected Return	0.0157
Portfolio's Standard Deviation	0.0758

Risk Free Rate: 0.0034

Slope of CAL: 0.1619

Risk Aversion Coefficient: A= 2.00

Weight on optimal risky portfolio: x*= 106.77%

- Imposing short sales lowers our Sharpe ratio.
- Yet, we are still doing better than the market.

Portfolio Optimization with Constraints

Number of securities: 6

No	Name	Fraction	Expected Return	Standard Deviation	CAPM Beta	Correlations		2	3
1	SG	-50%	1.00%	7.81%	1.27				
2	S2	92%	1.29%	7.12%	1.18	1		0.951	0.900
3	SV	28%	1.50%	8.36%	1.33	2			0.963
4	LG	71%	0.90%	5.40%	0.97	3			
5	L2	9%	0.96%	5.82%	1.02	4			
6	LV	-50%	1.19%	7.29%	1.21	5			
		1.00			1.00			YES	

Portfolio's Expected Return	0.0124
Portfolio's Standard Deviation	0.0582

Risk Free Rate	0.0034	Risk Aversion Coefficient: A=	2.00
Slope of CAL	0.1546	Weight on optimal risky portfolio: x*=	132.91%

- Our Sharpe ratio drops if we also require our portfolio to have a beta of 1 with the market.
- Yet, we are still doing better than the market.
- Now, we can provide an “index” fund that provides investors with exposure to the market portfolio and pocket (almost all) the difference in fees.

Summary

- This lecture illustrates that if the CAPM does not hold, we can beat the market.
- Does this mean that this is free money?
- Only if we do not expose ourselves to additional systematic risks.
- Yet, it is possible that value and growth firms are differentially exposed to risks that are not fully captured by the market.
- To see this, notice that the 6 portfolios we saw earlier are not perfectly correlated, even though they are fully diversified.
- Also, their R^2s with the market are around 80%. What drives the other 20% of their variation?