
Under Construction Right Now. Do Not Use!

-0809(Cntd)

INSTRUCTOR

I did not use these notes in my classes, due to lack of time. Therefore, they are not polished. As I have refined the notes and textbook, I hope I have gained some extra time, so I hope to cover this

CAPM: Random Thoughts

▪ **Q1:** As CFO, you must consider alternative ways to raise capital. You can issue C, B+ or A- rated bonds. (*How?*) How would you evaluate which one to offer?

The point is: you are not creating much value here. Spend your time on more important points.

▪ **Q2:** Does the CAPM require a perfect market ?

Yes!

▪ **Q3:** Theoretically, are NPV and the CAPM consistent?

Yes, and they are often used together. The CAPM only tells us about the $\mathcal{E}(\tilde{r})$ in the denominator. Use the expected cash flow in the numerator, rather than the known cash flow.

▪ **Q4:** Does the CAPM ignore taxes ?

Yes. it may be that there are enough tax-sheltered investment accounts, though, to drive pricing in the economy.

▪ **Q5:** As a firm, do you care about corporate taxes? personal taxes?

Yes, but you can think of whatever we see as being in after-taxes. Not perfectly correct, but workable.

▪ **Q6:** Does the CAPM rely on other assumptions?

Yes. + risk-aversion in only 2 dimensions. + knowledge of parameters
+ no untraded assets.

▪ **Q7:** Is the CAPM right?

NO! It is convenient, and can give reasonable estimates, but it is almost
surely wrong. Unfortunately, we have nothing better.

▪ **Q8:** What is the difference between the CAPM with a risk-free security and one without a risk-free security?

Replace the $r_{\mathcal{F}}$ with a number. Now, this makes the CAPM much more
difficult to use, but in principle no different. It still says that the graph
of expected return against beta is linear, with a slope greater than 0.

The CAPM gives some nice intuition. For example, terrorism/asteroidal insurance is likely to require a higher expected rate of return than car theft insurance, because it would hit the economy overall, and thus be difficult to diversify away.

The Logic Behind CAPM/SML

Why the connection between the fact that you are choosing a best portfolio (in overall portfolio mean-variance space) and the securities markets line (in individual securities mean-beta space)?

- The SML arises from the fact that in order to be a “best” portfolio, you must purchase the optimal amount in each investment opportunity. You must not purchase too much or too little of a new security.
- If a portfolio is not a best portfolio (in the mean-variance sense), then some of its components are underweighted or overweighted.
- If some are overweighted or underweighted, you could improve your portfolio by purchasing more or less of this security.
- This one security would offer too little or too much expected rate of return for its market beta.

The Variance of Sums

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	Pfio A	Pfio B	Pfio C (0.25 A, 0.75 B)
1	4	-2	-0.5
2	12	4	6.0
3	-7	-1	-2.5
4	-2	2	1.0
\mathcal{E}	1.75	0.75	1.0
$\mathcal{V}ar$	50.19	5.688	9.875
$\mathcal{S}dv$	7.084	3.142	3.142

If your class has time, eliminate the answers for $\mathcal{V}ar$ and $\mathcal{S}dv$, and ask the students to compute it.

You can think of 1–4 as representative time periods, or as the set of possible outcomes (states).

- **Q9:** What is the expected rate of return of the C pfios?
1.0%
- **Q10:** What is the risk of the C pfio?

$$\begin{aligned}\mathcal{V}ar_C &= \frac{(-1.5)^2 + 5.0^2 + (-3.5)^2 + 0^2}{4} \\ &= \frac{2.25 + 25 + 12.25}{4} = 39.5/4 = 9.875\end{aligned}$$

$$\mathcal{S}dv_C = \sqrt{9.875} = 3.142$$

- **Q11:** What is the covariance of A and B?

$$\text{Cov}_{A,B} = \frac{-6.19+33.31+15.31-4.69}{4} = 9.438$$

- **Q12:** What kind of covariance would you prefer as a risk-averse investor?

Negative, of course.

- **Q13:** If you know the variance and covariances of A and B, can you tell me the variance of C?

Yes:

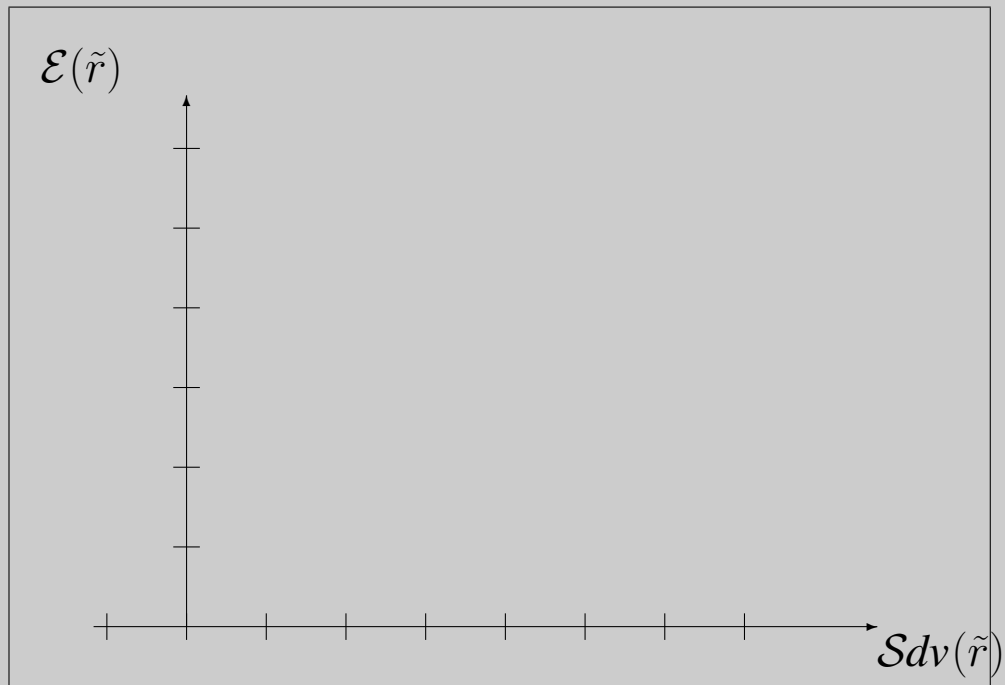
$$\begin{aligned} 0.25^2 \cdot \text{Var}_A + 0.75^2 \cdot \text{Var}_B + 2 \cdot 0.25 \cdot 0.75 \cdot \text{Cov}_{A,B} \\ = 9.875 \end{aligned}$$

The formula is helpful if we have many observations, and we want to think about how to vary investment weights.

- **Q14:** A stock's rate of return has a risk of 10% per month. What is its annual risk?

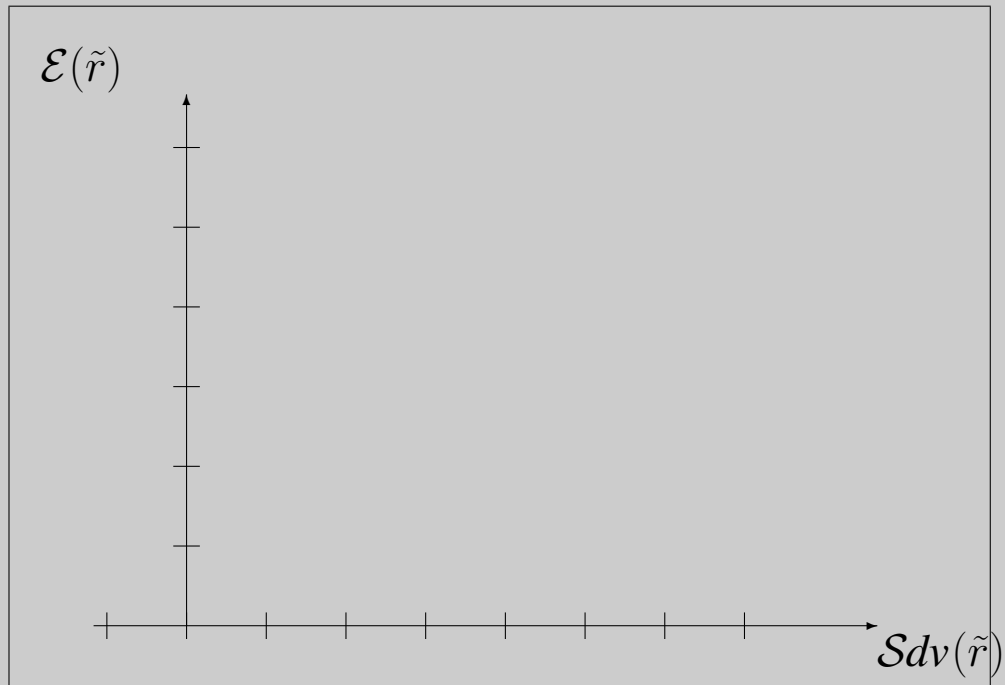
About three times!

- **Q15:** Graph the possible risk-reward combinations of A and B!



- **Q16:** What is the risk of a portfolio combined with a risk-free security?

- **Q17:** Graph the possible risk-reward combinations of A and B and the risk-free security!



- **Q18:** What kind of portfolios would investors choose?

the tangency!

- **Q19:** What kind of portfolios would CAPM investors choose?

the tangency!

- **Q20:** Where is the market portfolio

the tangency!

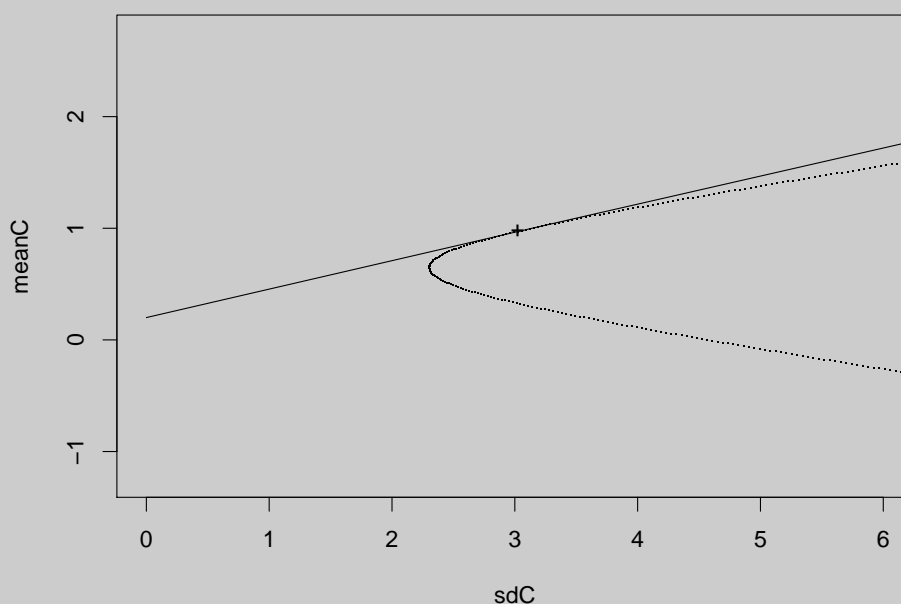
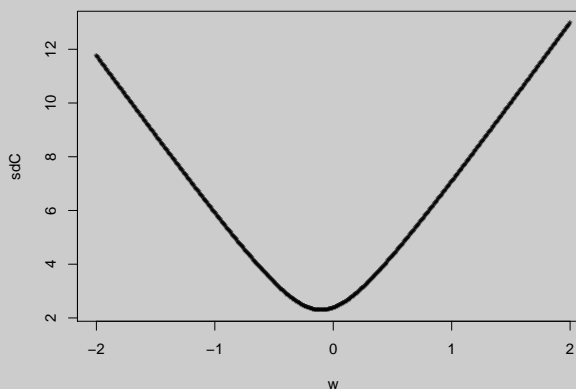
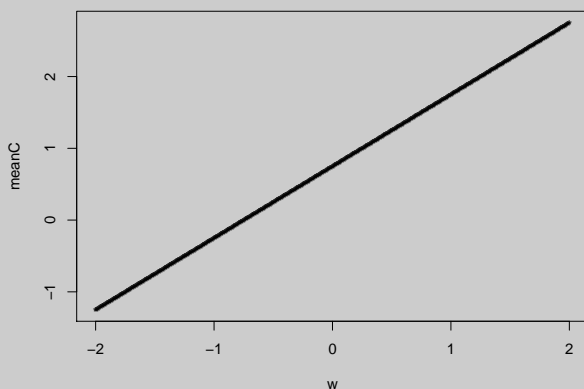
Tangency Portfolio and Computations

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Optional: The program in c13.pdf is a listing that shows what you can compute here. It is written in R, a statistical language. You do not need to know R, but you do need to know how to follow a programming language—any programming language. This program shows how to find the best pfo. It creates 3 graphs: w-m.pdf, w-s.pdf and s-m.pdf.

	Pfio A	Pfio B	Pfio T
1	4	-2	-1.36
2	12	4	4.854
3	-7	-1	-1.64
4	-2	2	1.573

Note: The tangency portfolio is 10.67% in A and 89.33% in B.



Why Use the CAPM

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1. The CAPM makes internal sense. It does not generate internal contradictions and/or arbitrage opportunities that someone can use to “game you.” (There are some, but they are obscure.)
2. It provides great intuition of what matters: the required hurdle rate, i.e., the opportunity cost of capital for our owners, depends on the extent to which you can provide your investors with diversifying assets. It is only common risk that matters to them.
3. Everybody who is anybody uses the CAPM in the real world: investment banks, CFOs, regulators, recruiters.
4. For corporations, most of the time, it yields reasonably good and usable cost-of-capital estimates.
5. There is no better alternative most of the time. When there is, it is usually far more complex and demands the mathematical skills of a finance ph.d.—or blind faith.

IMPORTANT:

- **The CAPM is not great for portfolio choice.**
- **IMHO, it is often good enough for capital budgeting.**

If it is not, then we do not have a better alternative.

Approx End of Class Tuesday, Sep 7, 2006