ECON 136: Week 10, Friday
Investment

Sit anywhere, open up your spreadsheet program.

Concepts

Income – a flow of claims on resources.

Consumption – Whatever you choose to do with the resources available to you. Goods and services purchased to address immediate needs, wants or values.

Saving – Reducing consumption today to make possible increased consumption in the future.

Investment – Foregoing current consumption to create an asset.

Assets – Resources that enhance the productivity of inputs or the value of consumption

Financial Investment – Directing savings at a project that yields future income

∴

Net Present Value Again:

If the goal is to maximize income over time, then investment makes sense if NPV > 0, where present value is calculated using an interest rate r:

$$PV = \frac{FV_t}{(1+r)^t}$$

The size of r determines PV, hence NPV

From Wednesday's class

Problem 2 Solution		Interest rate =	10.0%
		Contemporaneous	Present
	Year	Value	Value
	Now	-$2,000	-$2,000.00
	1	$0	$0.00
	2	$300	$247.93
	3	$300	$225.39
	4	$300	$204.90
	5	$300	$186.28
	6	$2,000	$1,128.95
		NPV=	**-$6.54**

Suppose we lower the interest rate to 9%

Problem 2 Solution		Interest rate =	9.0%
		Contemporaneous	Present
	Year	Value	Value
	Now	-$2,000	-$2,000.00
	1	$0	$0.00
	2	$300	$252.50
	3	$300	$231.66
	4	$300	$212.53
	5	$300	$194.98
	6	$2,000	$1,192.53
		NPV=	**$84.20**

$\frac{2000}{(1.09)^6}$

In this problem, there exists some interest rate between 9 and 10% at which NPV=0. That interest rate is called the **internal rate of return** (IRR).

$$0 = NPV = -2000 + \frac{300}{(1+IRR)^2} + \frac{300}{(1+IRR)^3} + \frac{300}{(1+IRR)^4}$$

$$+ \frac{300}{(1+IRR)^5} + \frac{2000}{(1+IRR)^6}$$

$+\frac{}{(1+IRR)^5} \quad (1+IRR)^6$

Internal Rate of Return and Investment:

If NPV > 0, then IRR > r

So, to maximize income over time, one would invest so long as IRR > r,

where r is "the" interest rate. In the Wednesday's Problem 2, one would invest in the proposition for r = 9%, but not for r = 10%

Perpetual income flows:

Imagine that I had access to an investment that yielded FV in every future year forever.

$$PV = \frac{FV}{(1+r)} + \frac{FV}{(1+r)^2} \ldots + \frac{FV}{(1+r)^t} \ldots$$

$$PV = \sum_{t=1}^{\infty} \frac{FV}{(1+r)^t} = \frac{FV}{r}$$

$NPV = -1000 + \frac{100}{.10} = 0$

So, the present value of an investment that yields \$100 each year forever with a 10% interest rate would be

100/.10 = \$1000 $\frac{100}{\frac{1}{10}} = 100 \cdot 10 = 1000$

Confirm that 900/.05 yields a present value of \$18,000. $\frac{900}{\frac{5}{100}} = 900 \cdot 20 = 18{,}000$

In contrast to most investment propositions, perpetual flows make it easy to calculate the IRR for an investment. Given PV and FV, I know that IRR solves

$$PV = \frac{FV}{IRR} \quad \text{or} \quad IRR = \frac{FV}{PV}$$

So an investment that costs \$1000 and yields \$100 each year forever as an IRR of 10% = (100/1000)

Confirm that the IRR for an investment that costs \$4500, but yields \$900 each year forever is 20%.

If the interest rate at which I can borrow or invest savings with certainty is 12%, then I would make the second financial investment, but not the first. If the interest rate were 9%. I'd make both.

Adding Risk:

But, we live in a world of uncertainty.

Suppose there is 20% chance that the $1000 investment that yields $100 forever will fail.

My expected future value is now (0.8)(100) = $80, so the expected IRR is now 80/100 = ~~0.8~~ .08

Since 8% < 9%, I would decline to invest.

We can solve the same problem using the NPV approach:

If I knew with certainty that I could get $100 each year, then my calculation would be

Current cost	-$1000.00
Present Value of Future Income 100/.09 =	$1111.11
NPV	$111.11

But, since I know there is only an 80% that the investment will pay off, I'm going to use a risk adjusted interest rate = .9/.8 = 1.125 or 11.25%

With uncertainty

Current cost	-$1000.00
Present Value of Future Income 100/0.1125 =	$888.89
NPV	$-111.11

I won't invest.

To compare risky with riskless investments, we need to adjust the interest rate to discount future income flows not only for the rate of interest, but for the riskiness of the investment.

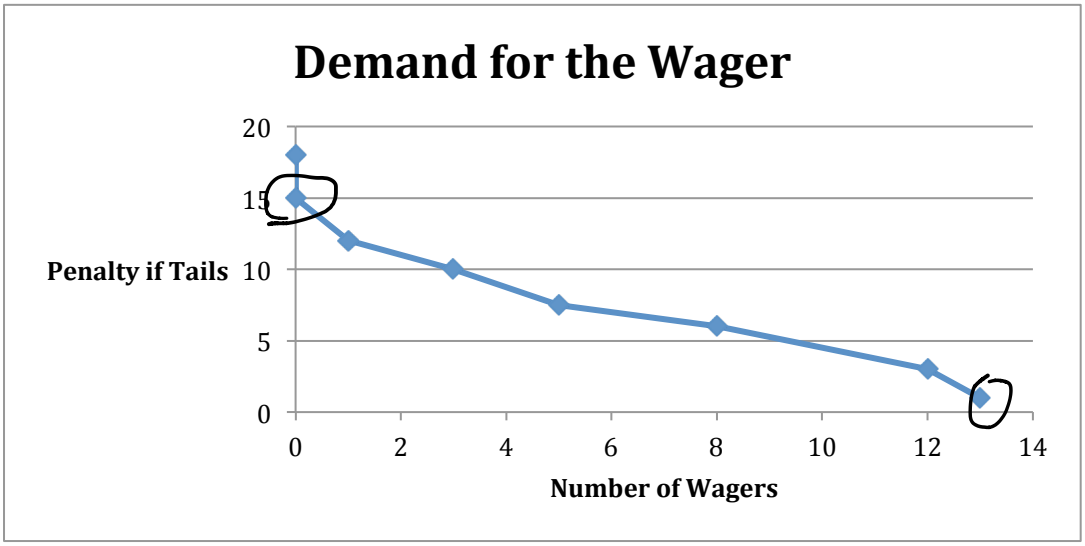
Risk Aversion:

But, that's not the end of the story.

We've seen that people prefer a sure thing to an equivalent proposition with risk.

Recall the risk survey I asked you to complete:

You are visiting the city for the day with $30 in your pocket. You have no credit card nor access to an ATM machine. Suppose I offer you the following wager: "I'm going to flip a fair coin (equal chance of heads of tails). If it comes up heads I pay you $15; if it comes up tails you pay me $1. Will you take that bet?"



All 13 who completed the survey were willing to take the original wager, but no one was willing to take the fair bet. All of you are risk averse.

Hence, in doing the NPV calculation for proposed investment with risk, each of you would choose a risk-adjusted interest rate (called the discount rate – because we use it to discount future returns) that is higher than the rate that at risk neutral individual would choose.