**Test 2, Lecture 5-6 Review**

**Corporate Finance**

Capital Budgeting

* Goal: make decisions that add value to the firm
* Capital budgeting: the process of planning for purchases of assets whose returns are expected to continue beyond 1 year
	+ Firms undertake capital budgeting decisions for the purchase of machinery, plant construction or expansion, new product development, merger decisions, and many other projects
		- Capital budgeting involves any project where investment funds (debt or shareholder money) is used
* The purpose of capital budgeting is to plot a course of action for the firm
	+ The firm should only take on projects that expand shareholder value (we only want to spend money if it will benefit shareholders aka increase stock prices)

$$Gain in Stock Price= \frac{NPV}{\# of shares}$$

* The key component to capital budgeting is to estimate the cash flows associated with a project
	+ Once we have the cash flows, we can build on our required return idea from CAPM to apply the same principle to evaluating a project

$r\_{e}$ = Required return (CAPM) 🡪 shareholders

$r\_{D}$ = Debt required return

r = avg. investor return (return that the avg. investor wants) = cost of capital

Evaluating Capital Budgeting Projects Using NPV

* Net Present Value (NPV) represents the value of a project today
	+ We want to compare value today to cost today

$$NPV=\sum\_{t=1}^{n}\frac{FCF\_{t}}{(1+r)^{t}}+FCF\_{0}$$

$FCF\_{t}$ = Free cash flow at time t

$r$ = cost of capital

* To make a decision today, we want to put all cash flows at one point in time
	+ We can discount all cash flows back to time zero and compare with the start up costs
* NPV Decision Rule:
	+ If NPV $\geq $ $0, accept the project (this adds shareholder wealth)
		- \*\*\*Positive NPV projects add value to the firm
	+ If NPV $<$ $0, reject the project
		- An increased r causes NPV to fall
			* Increased risk leads to increased returns but a lower NPV
		- It’s harder to accept riskier projects
		- At some r, the NPV becomes negative, so there are limits, but the question is how far can we go before it becomes a bad project?

Building an NPV Profile

* If we are uncertain about our cost of capital, we can form an NPV Profile, which is a graph that shows the NPV for a variety of discount rates (or cost of capital)
* Steps in Building an NPV Profile:
1. Enter the CF into the calc
2. Pick an r
	1. If r $\leq $ IRR, NPV $\geq $ $0
	2. If r $\geq $ IRR, NPV $\leq $ $0
* Decision Rules:
	+ Accept the project if r $\leq $ IRR
	+ Reject the project if r $>$ IRR
* Advantages of NPV calculations:
	+ Uses cost of capital
	+ Direct measure of shareholder gain
* Disadvantage of NPV calculations:
	+ Can be hard to explain

The Internal Rate of Return

* While NPV gives you a dollar measure of a project, the IRR gives you a percentage return
* Internal Rate of Return (IRR): the IRR sets the NPV of a project equal to zero
	+ IRR is like the break-even rate
	+ Profit Rate: the percentage earned in each dollar invested
	+ IRR = maximum cost of capital
* To solve for IRR, enter the cash flows into the calc and hit the IRR and compute keys
* Advantage of IRR calculations:
	+ Very easy to explain
* Disadvantage of IRR calculations:
	+ Assumes all cash flows are reinvested at the IRR percentage
	+ Can conflict with NPV for several projects

Types of Projects Firms Face

* There are 3 basic types of projects firms face
1. Independent projects: if you invest in one project, you can invest in another (no constraints)
2. Mutually Exclusive projects: if you invest in one project, you can’t invest in another
	1. Have to pick the best one, but NPV and IRR may disagree, so then you choose the project with the highest NPV
3. Contingent projects: invest in all projects or invest in none; if you take one you have to take another
	1. May have a winner and a loser but you have to invest in both to get the winner

Project Selection Rules for NPV and IRR

* One Project
	+ Accept if NPV $\geq $ 0 or if r $\leq $ IRR
* Independent Projects
	+ When projects are independent, take any good project
	+ Take all projects with NPV $\geq $ 0
	+ Take all projects with r $<$ IRR
* Mutually Exclusive Projects
	+ Take the best project if it adds value
	+ Take the project with the largest NPV $\geq $ 0
	+ Take the project with the largest IRR if r $<$ IRR
* Contingent Projects
	+ Take all projects or none
	+ Take all projects if the combined NPV $\geq $ 0
		- Add up NPV and if its positive, then do it
	+ Take all projects if r $<$ IRR of all the projects combined

Reasons for the NPV Rule and IRR Rule to Differ

* IRR and NPV can lead you to a different project choice when projects are mutually exclusive
	+ This is because NPV uses the cost of capital for r while IRR is its own separate rate
1. Timing of Cash Flows
2. Sometimes we can have multiple IRR’s
	1. For every negative cash flow, there is one IRR
3. Scale: size of project
	1. Ex: Project A has CF0 = -1, CF1 = 2, and r = 0%. Project B has CF0 = 100, CF1 = 150, and r = 0%.
		1. NPV of project A = 1 and IRR of project A = 100%
		2. NPV of project B = 50 and IRR of project B = 50%

Other Measures We Can Use to Evaluate Projects

1. Payback Method
2. Profitability Index
3. Modified Internal Rate of Return

Payback Method

* Payback: how long does it take to recover your initial investment?
	+ Units = time
	+ The payback approach is a liquidity measure, so it asks how long is cash held up?
* There are 2 ways to calculate the Payback Method:
1. Constant annual cash flow payments

$$\frac{\left|Initial Investment\right|}{Annual Cash Flow}$$

1. Uneven cash flows
* Weaknesses:
	+ Ignores TVM
	+ There’s no clear decision rule
		- Each firm has their own rule
	+ Ignores time after payback
* Never use the payback method as a dominant rule, payback is only useful as a secondary rule

Profitability Index

* The Profitability Index allows projects to be ranked by efficiency
	+ Choose the project that’s the most efficient, even if it doesn’t have the highest NPV
		- The higher the PI the greater the efficiency (you’re getting more for what you give)

$$PI=\frac{NPV}{resources used}=\frac{NPV}{initial cost}$$

* The PI is a ratio
* Use this rule when the firm is constrained (not enough budget, not enough employees, not enough …)
	+ Firm may be constrained money wise or with another resource
* Approach:
1. Calculate the PI for all projects
2. Rank the projects from high to low (most efficient to least efficient)

Modified Internal Rate of Return

* The MIRR addresses the weaknesses of the IRR rule
* Assume that all project cash flows are reinvented at the cost of capital
* Solving for MIR:
1. Find the FV of the project cash flows at time N using the cost of capital (r)

$$FV=PV\*(1+r)^{n}$$

1. Solve for MIRR
	1. Add up the FV from the previous step and plug those into the FV key on the calc. Use TVM and solve for I.
* Decision Rule:
	+ Accept the project if r $\leq $ MIRR
	+ Reject the project if r $>$ MIRR

Repeatable Projects

* When we are faced with deciding between repeatable projects, the NPV rule is biased towards the longer project because the NPV will be higher from the extra years, so don’t use NPV
	+ Goal: compare on a yearly basis
* The standard way of comparing repeatable projects of unequal length is to determine the Effective Annual Annuity (EAA) of the projects
* Steps in deciding between repeatable projects:
1. Find the NPV for one cycle of each project
	1. Solve using CF on calc
2. Convert the cycle NPV into a series of equal PMT’s

$$NPV of 1 Cycle=\frac{EAA}{r}\*[1-\left(\frac{1}{1+r}\right)^{n}]$$

 Solve for PMT using TVM on calc (N = #, I = #, PV = # found in step 1, PMT = ?)

1. Compare the EAA of each project and take the project with the highest EAA