

# Capital Budgeting: CoC Averaging

(Welch, Chapter 13-2)

Ivo Welch

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# Averaging (Opportunity) CoC

# Value Creation by Diversification

- ▶ Does combining two unrelated projects creates a lower-risk firm?
- ▶ Can firms create value by reducing risk through diversification?

# 10% vs 20% Rate of Return

- ▶ A firm has an average (opportunity) cost of capital of 10%.
- ▶ It has been offered a project that offers an expected RoR of 20% over the same time interval.
- ▶ Does this project add value?
  
- ▶ Let's work through a perfect-market example.

# Acquirer (ACQ)

- ▶ Assume a PCM. (Big deal!)
- ▶ The ACQ conglomerate is thinking about taking over the TGT corporation.
- ▶ For example simplicity sake, ACQ and TGT both will last only one more year.
- ▶ ACQ expects cash flows of \$500 million.
- ▶ Companies with (beta?) characteristics like ACQ offer an expected RoR of 5% per year.

# Target (TGT)

- ▶ TGT expects cash flows of \$300 million.
- ▶ Companies with (beta?) characteristics like TGT offer an expected RoR of 8% per year.

# Value of TGT

- ▶ ACQ's executives evaluate potential takeover targets by using their *own* cost of capital, not the target's cost of capital.
- ▶ They do however assess the correct  $E(CF)$ .
- ▶ What do they think the value of TGT is?

# ACQ (Mis-)Calculation

- ▶ TGT True Worth:  $\$300/[1 + 8\%] = \$277.78$ .
- ▶ ACQ imagines TGT to be Worth:  
 $\$300/[1 + 5\%] = \$285.71$ .
- ▶ ACQ would believe that TGT at \$277.78 is undervalued by \$7.94.

# What is the True Opportunity CoC?

- ▶ Recall: the (opportunity) cost of capital is what investors can earn elsewhere in *similar* projects.
- ▶ Investors would be willing to give capital to firms at appropriate expected RoRs.
- ▶ Firms should take projects until the marginal project has the same CoC.
- ▶ In a PCM, the CoC should be the  $E(R)$ .

# What Is The Correct CoC?

- ▶ **Firms should take projects *AS LONG AS* the opportunity cost of capital of a project is lower than its return.**
- ▶ Let me demonstrate working through an equity offer.
  - ▶ (A cash offer would come to the same conclusions.)

# Value Gain/Loss

- ▶ ACQ executives make a takeover offer for \$280, which is accepted.
- ▶ What is the value gain/loss to the shareholders?

# CoC Calculation Problem?

- ▶ Does it matter whether ACQ executives believe the cost of capital is 1%, 3%, or 6%, etc., given their offer of \$280?

# Share Exchange Calculation

- ▶ ACQ executives finance this takeover offer by issuing \$280 million to the new shareholders.
- ▶ What percentage do they have to promise to the TGT shareholders, given that they will also own combined ACQTGT stock?

# True Joint Value

- ▶ ACQ is truly worth  $\$500/1.05 \approx \$476.19$ .
- ▶ TGT is truly worth  $\$300/1.08 \approx \$277.78$ .
- ▶ The net firm value will truly be:

$$\$476.19 + \$277.78 = \$753.97.$$

# Fair Share Exchange

- ▶ In a fair transaction, ACQ and TGT should have truly represented  $\$476.19/\$753.97 \approx 63.16\%$  and  $36.84\%$  of the firm's  $\$753.97$ , respectively.
- ▶ The true merged ACQTGT cost of capital will be

$$0.6316 \times 0.05 + 0.3684 \cdot 0.08 \approx 6.1\%.$$

# Unfair Ownership Share: TGT

- ▶ What share of the overall new firm ACQTGT needs to be given to TGT shareholders to raise the equivalent (raising of) \$280 million?
  - ▶ The total  $E(CF)$  will be  $\$500 + \$300 = \$800$ .
  - ▶ The new TGT shareholders need to be promised  $\$280/\$753.97 \approx 37.14\%$  of the new firm.
  - ▶ This is more than the appropriate 36.84%.
  - ▶ Therefore, ACQ will own only 62.86% of ACQTGT.

# Unfair Ownership Share: ACQ

- ▶ Now ACQ own  $62.85\% \cdot \$753.97 = \$473.97$ .
- ▶ Before, ACQ owned \$476.19.
- ▶ Where is the difference going?

# Announcement Response

- ▶ Upon announcement of the \$280 deal:
  - ▶ What happens to the value of shares of ACQ corporation?
  - ▶ What happens to the value of shares of TGT corporation?

# Passing Up Good Projects?

- ▶ ACQ lost value because it overpaid
  - ▶ Simply put, it took a bad project.
  - ▶ We could also construct examples in which a non-acquirer loses value because it passes up on a good project.

# What did ACQ Calculate Wrong?

- ▶ Because TGT had higher CoC due to term or risk (not due to a less perfect capital market).
- ▶ Acquiring the target increases the cost of capital for the whole firm from 5% to 6.1%.
- ▶ Buying a more risky (higher beta) firm with a higher expected RoR is almost like a “negative externality” that the acquiring shareholders need to take into account.
- ▶ ACQTGT can no longer raise capital at 5%!

# Observations and Implications

- ▶ Cost of Capital averaging has many implications.

# Cost of Holding Treasuries

- ▶ If a firm raises capital for a construction project that is to-be-built over the next 5 years, and invests the unused cash in Treasuries, how does the fact that the Treasuries offer a lower  $E(R)$  hurt the company?
- ▶ When a highly levered bank holds Treasuries, does this destroy value?

# Cost of Capital vs Hurdle Rate?

- ▶ The 8% is called the “cost of capital.”
- ▶ This is somewhat misleading but conventional.
  - ▶ A better name would have been the *opportunity cost of capital*.
- ▶ This emphasizes that, instead of investing in this project, the CEO could have spent existing cash on better projects.
  - ▶ An even better name would have been *opportunity RoR elsewhere*.

# Dumb CEO?

- ▶ If this CEO is so stupid that investors can convince him to pay 25% cost of capital,
  - ▶ the cost of capital would be 25%.
  - ▶ But the correct project hurdle rate / discount factor would not go to 25%; it would still be 6%!
  - ▶ A better name for the 6% would have been “appropriate project discount rate.”
  - ▶ And who knows what a dumb CEO actually uses as the hurdle rate? Maybe 25%, too?
  - ▶ Or maybe (s)he is not dumb, but conflicted?

# When is CoC The Hurdle Rate?

- ▶ In a PCM with smart managers and investors:
  - ▶ Nowadays, many people uses the names *hurdle rate* and *cost of capital* interchangeably,
  - ▶ because every project *of the same risk class* has the same CoC, hurdle rate, and  $E(r)$ .
- ▶ Yes, then the three take on the same value.
- ▶ This is badly confusing. Sorry, not my fault.

# PCM + Smart Management

- ▶ In a PCM, smart (unconflicted) management should use:
  1. the CoC unique to each project (component), here 8%; or
  2. the overall CoC at which you last raised capital, here 5%,  
or
  3. the post-acquisition average CoC (6.1%)?

**Only 8% is correct!**

# General Motors Example

- ▶ Should all General Motors projects have the same hurdle rate?

# Correct CoC Rule

- ▶ **You must use each a cost of capital specific to each project.**
- ▶ This can be very tedious.
- ▶ If it does not matter too much, then do what most corporations do—fudge numbers.

# Really?

- ▶ What about
  - ▶ the CoC of the manager's desk, vs
  - ▶ the CoC of the secretary, vs
  - ▶ the CoC of staples, vs
  - ▶ ...

# Imperfect Capital Market (ICM)?

- ▶ If TGT operated in an ICM, and if ACQ could improve capital access, could an acquisition add value?
- ▶ We will cover positive and negative externalities later in this chapter.

## A Different Example Now

- ▶ **but again all about different costs of capital.**

# The Expedition

- ▶ In the year of our Lord, 1675 AD.
- ▶ Spices are worth more than their weight in gold.

# Nutmeg, Cloves, Cinnamon, +

map

more maps

Not This



**Figure 1:** spices

The Spice Must Flow



But This

**JUAL BELI KOMODITI MALUKU**



**CINNAMON**



**NUTMEG**



**CARDAMOM**



**ALLSPICE**



**GINGER**



**CLOVES**

- ▶ You can buy a ship for a 1-year expedition.
- ▶ If you do, there is a 60% chance the ship will sink before it can return.
- ▶ If the ship does not sink, you can sell the spices (and the ship).





# The Spice Expedition

- ▶ You must invest
  - ▶ \$100,000 to purchase the spices in the Moluccas,
  - ▶ and \$1,000,000 here to buy the ship.
- ▶ If the ship makes it back,
  - ▶ you can expect to sell the spices for \$3,000,000 (uncertain, depends on market conditions),
  - ▶ and you can expect to resell the ship for \$1,000,000.

# Cost of Capital

- ▶ The spice business has a CoC of 25%.
- ▶ The ship business has a CoC of 5%.
  - ▶ You could work this as a CAPM example with different market-betas.
- ▶ Should you risk it?

# Different Types of Risks

- ▶ Note that there are two components of uncertainty, the idiosyncratic risk of sinking and the systematic risk of the spice trade.
- ▶ They are taken care off differently.
- ▶ You have the default risk in the numerator, and the risk premium in the denominator.

# Adding?

- ▶ Conditional on the ship returning (or not returning), the underlying cash flows are *independent*.
  - ▶ This is why you can add them.
  - ▶ There are no synergies from ship+spices.

## Nerd: Derived Spice Beta

- ▶ In a CAPM framework, the expected amount of money on the spice trade would covary:
  - ▶ That is, you would get more than \$30,000 in a good stock market, less in a bad one.
  - ▶ But, together, they create one beta today, cited in the example. In fact, because there is no covariance if the ship sinks, conditional on the ship not sinking, the beta must be even higher:

$$0.6 \times 0 + 0.4 \times \beta = 2 \Rightarrow \beta = 5$$

- ▶ In a PCM, the cost of capital for a zero-systematic-risk but risky project could still be the risk-free rate. -This is not a mistake.
  - ▶ It is because such a project is infinitely parcel-able among many investors.
  - ▶ Each investor diversifies the risk away.
  - ▶ You better be a billionaire with thousands of projects to be in this situation.

# More Realistic Spice Ships

What kinds of contemporary projects have spice-ship like investment profiles?

SPACEX

FALCON 9

FALCON HEAVY

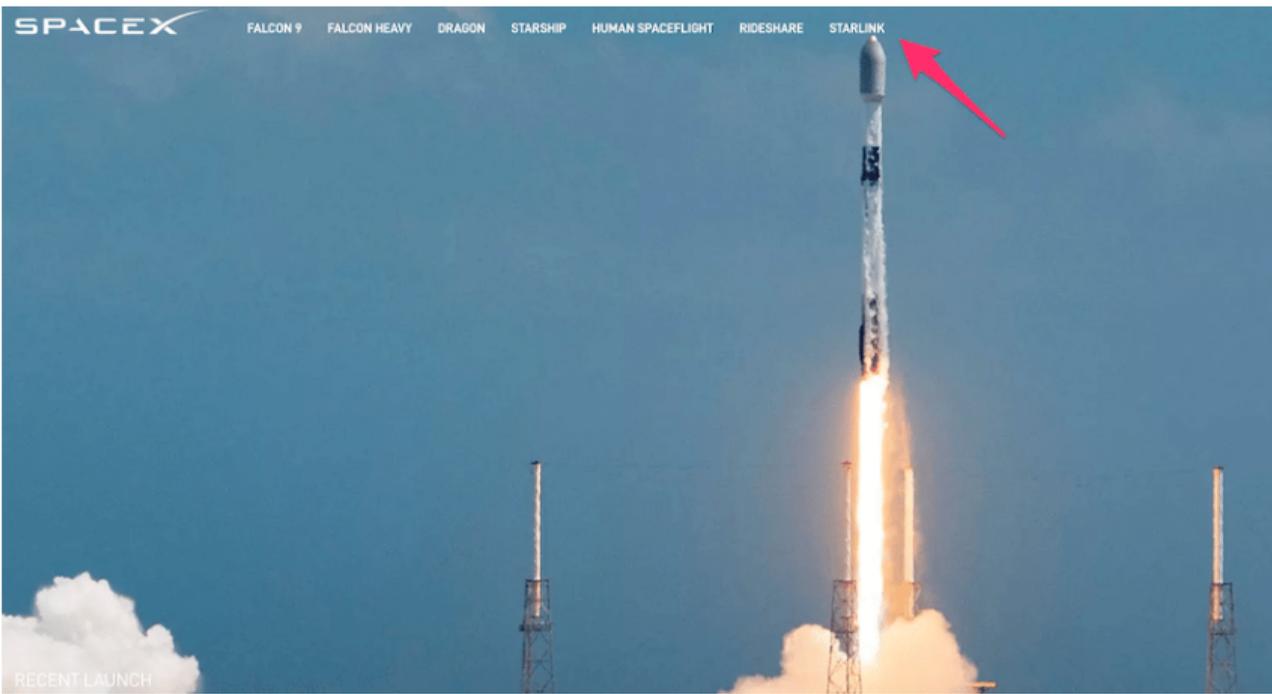
DRAGON

STARSHIP

HUMAN SPACEFLIGHT

RIDESHARE

STARLINK



RECENT LAUNCH