Risk management

(Berk & DeMarzo, Ch. 30.1-30.2)

Study Shows Risk Management Boosts Corporate Valuations

Companies showing "mature risk management practices" may have valuations of up to 25 percent more as a result.

David M. Katz

DENVER — Risk managers attending the annual Risk and Insurance Management Society conference here are all abuzz about the need to "speak in the language of the CFO." One of the difficulties to date for risk managers is that they have long been speaking in too much detail about such things as preventing insurable losses or keeping premiums down, while CFOs want the information boiled down into financial metrics.

A related struggle for corporate risk managers has been the battle to justify the value of what they do so that finance chiefs will be convinced of the need to spend money on risk

Question:
Can good risk management increase firm value?

Motivation

- Firms can choose to avoid some risks through insurance or hedging

- Examples:
  - Airlines can hedge against changes in the price of jet fuel by buying futures
  - An oil company can protect itself against an oil platform blowing up by buying insurance

- Question:
  - How do you know what risks to insure/hedge and which ones to live with?
  - Can risk management add value?
    - If so, how?

- Common intuition: Firm should hedge or insure **all** risks
  - That is **definitely not** the right answer!

- Should Chipotle insure against business disruption from e-coli?

- Should Chipotle insure against fires?

- Should a McDonald's franchisor insure against fires?

Two Main Types of Risk Management

- Insurance
  - Property
  - Business Liability
  - Business interruption
  - Key Personnel

- Hedging
  - Commodity prices, currencies, interest rates…
  - Instruments:
    - Non-financial: Long-term purchase/supply contracts
    - Financial: Futures/forward/options/swap contracts
  - For example, the risk from jet fuel prices is one of the most important risks that faces an airline
    - Airline can enter a hedging contract to counteract the risk of changes in fuel prices

MM & Risk Management

- In MM, risk management cannot add any value

- Why?

1. The firm pays for the insurance/hedge
   — The cost is usually more than the actuarially fair value; *i.e.*, a negative-NPV project! (or, at best, zero NPV)

2. Investors are diversified and can manage risks themselves!
   — For example, idiosyncratic property or liability risk is completely irrelevant to diversified investors
   — If investors are concerned about some systematic risk; e.g., oil prices, they can often manage those risks themselves ("homemade risk management")

Actuarially fair insurance

Actuarially Fair Insurance Premium = Present Value of Expected Loss;
- e.g., if a one-time risk (loss could happen next year):

$$Fair\ Premium = \frac{\Pr(Loss) * E[Payment\ if\ loss]}{1 + r}$$

- r depends on the risk being insured
  - Depends on the systematic risk (beta) of the insured event
  - Beta is often zero (if idiosyncratic risk), or negative (e.g., September 11)
- Buying actuarially fair insurance is a zero-NPV investment for the insured

Example 1: Price of actuarially fair insurance

- Suppose a company has a 0.02% risk that its factory will burn down, and if so, incurring a $150m loss
  - 99.98% chance of no fire and no loss
  - 0.02% risk of a $150m loss
  - Expected loss is $30,000

- The risk-free interest rate is 5%

- If we are the insurer, what is the fair premium for a policy that pays $150m in case of a fire?

Solution

- Every period, expected cash flow is $30,000. The risk is idiosyncratic, so $r = r_f$

- If recurring premium every year, the fair price is 30,000/(1+r)=28,581
  - If one-time premium, the fair price is $30,000 / r = $600,000

- An insurance company will usually charge more than this to cover administrative costs, overhead, make a profit, etc...

Example 2: Price of actuarially fair insurance

- You own a concession booth in a major airport, and want to purchase insurance that will pay $2 million if the airport terminal is destroyed by terrorists.

- Suppose the likelihood of such an event is 0.05%, the risk-free interest rate is 3%, and the market excess return is 8%.

- If the risk has a beta of zero, what is the actuarially fair insurance premium?
  What is the premium if the beta of terrorism insurance is −3?

Solution

- The expected loss is 0.05% × $2 million = $1,000.
  If the risk has a beta of zero, we can use the risk-free rate: ($1,000)/1.03 = $970.87.

- If the beta of the risk is not zero, we can use the CAPM to estimate the appropriate discount rate.
  Given a beta for the loss, β_L, of −3, and an expected market return, r_{mkt}, of 8%:

$$r_L = r_f + \beta_L \left(r_{mkt} - r_f\right) = 3\% - 3\,(8\% - 3\%) = -12\%$$

- In this case, the actuarially fair premium is ($1,000)/(1 + (-0.12)) = $1,136.36.
  This premium is higher than the expected loss, but is a fair price given the negative beta of the risk that's being insured (it pays out in particularly bad times for the entire economy).

Insurance (almost always) costs more than the actuarially fair price

Three reasons why insurance is more expensive than its actuarially fair price:

1. Insurance companies have administrative and overhead costs they need to cover

2. Adverse selection: "Bad" types (*i.e.*, high risks) are more likely to purchase insurance
   — So premium will reflect the high-risk types' risk and not the average person's/company's risk

3. Moral Hazard: Insurance reduces the insured's incentive to avoid risk
   — e.g., after you buy fire insurance, you may be less diligent about fire prevention (regularly servicing fire extinguishers, etc…)

- Consequence: Buying insurance is almost always a negative NPV investment!
   — Paying actuarially fairly priced insurance is zero-NPV decision for the insured, and paying more than that means it's negative-NPV
   — Unless you know that you're a really high risk and the insurance company does not know that (i.e., insurance is priced too low for you)!

Ways for insurance companies to mitigate adverse selection and moral hazard

- Mitigate adverse selection:
  - Screen applicants and apply individual risk-based pricing
  - Set policy maximum limits

- Mitigate moral hazard:
  - Set high deductible
  - Investigate losses to look for evidence of fraud (e.g., deliberate intent)

- These strategies can limit the extent of adverse selection/moral hazard, but typically not eliminate them
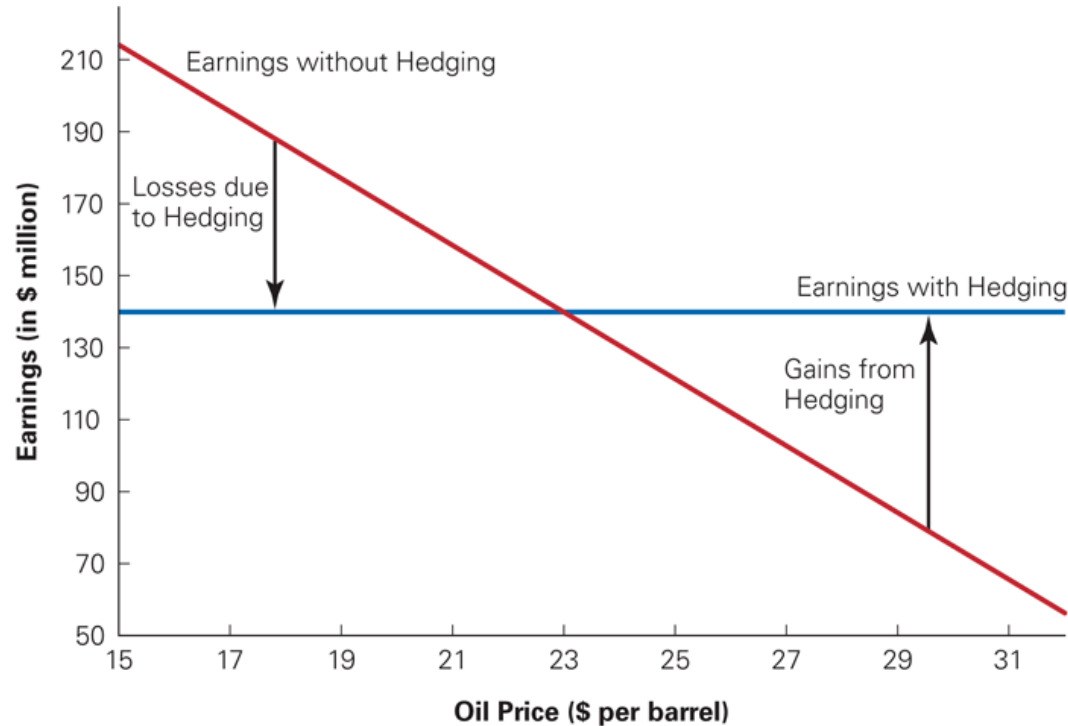
Hedging: An example

- The Kashi cereal company expects it will that will need 20 million bushels of corn next year to produce its cereal

- The current market price of corn is $3 per bushel

- At $3 per bushel, the firm expects an EBIT of $50 million next year

- What will the firm's EBIT be if the price of corn rises to $3.50 per bushel?

- What if the price of corn falls to $2.25 per bushel?

- What if the firm enters into a futures contract to buy corn for a price of $3.25 per bushel?

Solution

- At $3.50 per bushel:
  - EBIT = $50,000,000 − [($3.50 − $3.00) × 20,000,000]
    = $40,000,000

- At $2.25 per bushel:
  - EBIT = $50,000,000 − [($2.25 − $3.00) × 20,000,000]
    = $65,000,000

- At $3.25 per bushel:
  - EBIT = $50,000,000 − [($3.25 − $3.00) × 20,000,000]
    = $45,000,000

- As long as the futures contract is fairly priced (no arbitrage condition holds, etc), and other MM conditions hold, hedging is a zero-NPV decision

Example: Effect of hedging oil prices on earnings for an airline

Large losses – A possible exception?

- So is there ever a reason to manage risk through insurance or hedging?

- If there is, it must come from breaking some of the MM assumptions

Let's consider the $150m fire loss example

- If the $150m loss represents most of our assets, insurance may create value!
  — Reduces expected costs of financial distress and firm thus can increase its optimal debt level (→increase Interest Tax Shield)
  — Reduces risk for undiversified investors (e.g., undiversified family firms)

- Conversely, if $150m is peanuts for the company, there is no reason to insure against the fire
  — Large companies usually self-insure all smaller loses
  — E.g., no reason for Exxon to carry comprehensive insurance on their company cars

- In a publicly traded company (*i.e.*, diversified investors), the baseline rule should be that the only risks worth insuring are the ones that could take down the entire company!

Why could risk management add value?

We need to break some assumptions behind M&M…

- Bankruptcy and Financial Distress Costs
  - By managing risks that could lead to distress, the firm can reduce expected CDF
- Debt Capacity
  - Managing risks enables firm to increase leverage and keep less cash around
- Issuance Costs
  - When a firm experiences losses, it may need to raise additional financing from outside investors to survive or invest → Firm has to pay issuance costs that could be avoided with proper risk management
- Matching cash flows to investment opportunities
  - Famous model: Froot, Scharfstein, and Stein (Journal of Finance, 1993)
  - (The underlying driver behind this model is also issuance costs)

Example: Insurance and distress

- Suppose the risk of a major accident for a railroad company is 1.2% per year. The expected loss would be $100 million with a beta of zero (the risk-free rate is 6%)
- If there's an accident and the company is uninsured, it would experience $25 million in financial distress costs and $15 million in issuance costs in addition to the loss
- What is the actuarially fair premium for a policy that pays $100 million in the event of a loss?
  What's the NPV to the railroad from buying the policy at the fair price?

Solution
- The expected loss is:
  - 1.2% × $100 million = $1,200,000
- So the actuarially fair premium is:
  - $1,200,000 ÷ 1.06 = $1,132,075
- The total benefit of the insurance to the railroad is $100 million plus an additional $40 million in distress and issuance costs that it can avoid if it has insurance
- The NPV from purchasing the insurance at the actuarially fair price is:

$$-1,132,075 + 1.2\% * \frac{\$100m + \$40m}{1.06} = \$566,038$$

- The insurance company can charge more than the fair premium (e.g., $1.5 million), and it would still be a positive-NPV investment for the firm to buy the policy

The Froot, Scharfstein, Stein model: Examples

Oil Companies and Oil Prices

- Oil companies naturally tend to make a lot of money when oil prices are high, and vice versa when oil prices are low

- Oil companies can use hedging to *smooth* earnings

- Hedging results in:
  - higher-than-otherwise earnings when oil prices are low, and
  - lower-than-otherwise earnings when oil prices are high

- The key question: When do oil companies **need** more money—when oil prices are high, or when oil prices are low?

The Froot, Scharfstein, Stein model: Examples

Oil Companies and Oil Prices (cont.)

- When oil prices are low, there are fewer profitable (positive-NPV) projects in drilling and looking for more oil!

- Conversely, when oil prices are high, oil companies need more cash to pay for investments to drill etc.

- The unhedged cash flows of oil companies match these needs quite well!
  - Low oil prices→low EBIT but also low capex needs
  - High oil prices→high EBIT but also high capex needs
  - If oil companies hedged (and didn't get higher profits when prices are high), they may need to issue more debt/equity to pay for investments, and thus pay issuance costs they could avoid by not hedging

- Takeaway: Oil-producing companies should not hedge oil prices!

The Froot, Scharfstein, Stein model: Examples (cont.)

Marriott Hotels and Real Estate Prices

- Marriott owns a lot of real estate in the form of their hotels

- When real-estate prices drop, cheap real estate creates profitable investment opportunities to buy/build new hotels
  — But at the same time Marriott's market value has dropped, and may not be able to issue new financing

- Hence, Marriott would benefit from hedging real estate prices

What should airlines do about fuel costs?

- Are investment opportunities correlated with fuel prices?
  - E.g., need to buy more planes and expand in times with rising fuel costs?
  - If so, fuel cost hedges are useful

- Revenues: Can airlines pass on fuel costs and raise prices when fuel costs are high?
  - If so, "natural hedge"; hedging fuel costs is less important

- Correlation with other costs: Do higher fuel costs tend to correlate positively with higher costs of other airline expenses (e.g., salaries)?
  - If so; hedging fuel costs can be useful

- You may not want to be the only one in industry who hedges
  - More expensive than others when oil prices are low, less expensive when oil prices high→you may confuse your customers if you're a low-price airline

Different airlines follow different strategies

- Nov. 11 2007 (Bloomberg): Rising jet-fuel prices are forcing airlines to curtail expansion plans. Chicago-based UAL Corp.'s United Airlines said it may cut capacity in 2008 to make up for higher fuel costs.

- Oct. 26 2007 (Reuters): While rising oil prices typically mean soaring jet fuel costs, Dallas-based Southwest's fuel hedges give it a unique edge over competitors […] Over the last nine months, the value of Southwest's fuel hedging contracts […] has risen about 50 percent to $1.5 billion as of the end of September.

American Airlines dumps its fuel hedges — and saves

By TERRY MAXON 🐦 ✉

Staff Writer

In 2008, as fuel prices were making a historic rise, executives at US Airways Inc. made a gutsy decision.

Just about every airline had embraced hedges — specialized investments based on energy prices — to protect itself against a sharp rise in the price of crude oil and, more particularly, jet fuel. US Airways had done so, too.

Debt vs. Equity conflicts and risk management

- Is there a conflict between debt and equity in managing risk (insurance/hedging)?

- Risk management can protect against extreme downside; in those cases, debtholders could benefit more from insurance (shareholders may not care between "really-bad" and "catastrophically-bad")
  - Debtholders sometimes **require** insurance/hedging in covenants
  - Example from personal finance: My mortgage bank requires home insurance; if I pay back the mortgage, I no longer have to insure it

- But, debt-holders know this, so shareholders know they could pay lower debt cost of capital if they contractually agree to insure/hedge certain catastrophic risks

Takeaways

- Risk management is about moving cash between different "states of the world" (between loss/no-loss)
  - In MM world, this does not benefit the firm or investors

- In Froot, Scharfstein, Stein's model, hedging helps companies match cash flows and capital expenditures, thereby minimizing issuance costs

- Risk management could also add value by:
  - Reducing CFD
  - Allow for higher leverage and DTS