15.997 Practice of Finance: Advanced Corporate Risk Management
Spring 2009

The Role of Risk Management

MIT Sloan School of Management
15. 997 Advanced Corporate Risk Management
John E. Parsons

Risk Management & the Revolution in Finance

- Risk management is a relatively new domain in finance. Why? What makes it new? Why is it considered its own domain?
- Risk is an age old problem, especially in finance. Think portfolio theory. And the management of risk isn't a new line of business. Think insurance.
- But there *is* new wine in an old bottle. The practice of risk management has been revolutionized; managers are forced to confront more choices and master more complex analyses of risk than ever before.
- This revolutionary practice follows the evolution of new types of financial markets and instruments and the development of modern asset pricing theory.
  - Practical roots in commodities futures exchanges and in options exchanges.
  - Black-Scholes-Merton pricing and progeny.
  - Advances in mathematics and computing.

2

Risk Management & the Revolution in Finance (cont.)

- Corporate finance used to operate along a single dimension:
  - Used to have a choice between debt or equity.
  - Low-risk capital or high-risk capital.
  - How much debt? End of story.
- Now, risks can be carved along many dimensions.
  - Highly leveraged transactions create debt that functions a lot like equity.
  - Warrants and stock options can provide highly concentrated doses of risk.
  - Creditors can ask for a repayment schedule denominated in gold, copper or oil.
  - Investors can participate in various tranches of mortgages, with interest rate risk parcelled out into safer or very risky packages.
  - Individual components of risk can be assigned to different parties – with the construction completion risk assigned to one lender, oil price risk to the bondholder, foreign exchange risk to the currency market and operating risk to the equity holder.
- Modern corporate finance has many more choices.

3

Risk Management & the Revolution in Finance (cont.)

- Old problems become more amenable to precision measurement and thoughtful design.
  - Debt covenants aren't just grabbed off the rack in standard sizes, but can be tailored to fit the features of the project or company.
  - Financial engineering.
- This is the revolution in corporate risk management.
  - Many different risks have a market.
  - Each risk can be separately measured and priced.
  - Companies can optimize their operations, their assets, their decisions and their financing based on a deeper understanding of risk and a greater facility in packaging and sharing the risk.
  - The company's interface with the capital markets is more complex.
  - Mastery of risk becomes a competitive necessity. With greater flexibility and increased capabilities, competition forces greater performance.

4

What is *Corporate* Risk Management?

- Risk management as a discipline has been developed and refined by the practice of financial institutions, whether commercial banks, investment banks, hedge funds, or other institutions.
- The tools they developed are useful. But the application to non-financial corporations demands a different focus and presentation.
- How? Why?
- First is the question, Where is value created?
  - Middlemen buy low and sell high. Value isn't really created. It's a zero-sum game.
  - Looking for *mis*pricing. The gain comes from exploiting a mispricing.
  - Non-financials buy inputs, process them, and deliver a product with a higher value.
  - How to make a better mousetrap, produce a product more cheaply. There is no zero-sum. Looking for positive NPVs.
  - The gain comes from finding an investment where the return more than compensates for the risk.

5

What is *Corporate* Risk Management?

- Second is the focus, which this class places on the strategic element of risk management, i.e. the "why" and less on the "how".
  - Less on the tactics.
  - No menagerie of derivatives. No greeks.
  - Tools are necessary. Practice with the tools brings insight. But the tools aren't the focus.
  - See why the tactics may be useful, why good tools are worth it.

6

Topic Outline

- THE ROLE OF RISK MANAGEMENT
  - How Companies Manage Risk
  - Why Companies Manage Risk
  - Where Companies Trade Risk
- THE TOOLS OF RISK MANAGEMENT
  - Measuring Risk
  - Packaging Risk
  - Pricing Risk
- THE BUSINESS OF RISK MANAGEMENT
  - Valuation & Pricing
  - Asset Management
  - Trading Operations
  - Transaction Hedging
  - Liability Management
  - Financial Policy & Strategic Hedging
  - Taxes
- THE RISK MANAGEMENT FUNCTION
  - Accounting
  - Organization, Governance & Control

7

Key Question

- Facing any problem in which the tools of this course are being applied, the question is,
  - "Can this problem be solved using traditional DCF or traditional finance tools, without all the distraction and unnecessary sophistication of so-called risk management?"
  - If the answer is "yes," then throw out the unnecessary complexity and stick with the tried, true and widely understood tools.
  - If the answer is "no," then we have found the right issue for which the tools of this course are necessary.

8

How Companies Manage Risk

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Everybody is a Risk Manager

- Traditionally, corporate risk management is viewed as a treasury function – for example, locking in the dollar value of foreign currency sales or managing fixed v. floating interest rate risk. Alternatively, risk management is viewed as a specialized line of financial business – securities and commodities trading.
- It's odd to think of risk management as a distinct compartment, set off and away from the rest of financial management.
- Risk is a central element of valuation and decision making.
  - DCF is an approach to valuing risk. No one thinks of DCF as a specialized tool appropriate for only one subset of financial managers.
  - Risk management is just turbo-charged DCF. It is a more sophisticated and more flexible tool for accomplishing the same tasks in more challenging and more demanding circumstances.
- A common toolkit applied in various circumstances.
  - Risk analysis, risk valuation and risk management is central to all business decisions.
  - DCF is applied very broadly. So, too, should turbo charged DCF. Every decision is evaluated in terms of the bottom line… the value captured. Risk matters for getting the value right.
  - But how this tool is employed varies according to the nature of the problem.
  - This course is about these different problems, the different parts of the firm, and how issues of risk arise differently and how the application of the toolkit varies to suit the purpose at hand.

10

Company Activities

Assets	Liabilities
Valuation of Real Assets	Cash Management
Operating Decisions	Tax Minimization
Investment Decisions	Debt Management
Pricing Decisions	Strategic Hedging
Performance Evaluation	Financial Accounting

11

Valuation and Asset Optimization

- Is the risk of a wildcat exploratory oil well the same as the risk of a long-developed property? Not if I look at stock market data for traded companies.

	Asset Beta	Asset Cost of Capital
Royalty Trusts	0.194	7.2%
Exploration & Production	0.873	12.2%
Integrated	0.684	10.8%

- How does this re-shape how an integrated company values a wildcat project?

12

Valuation and Asset Optimization (cont.)

Two-stage exploration and production project

Stage 1: Exploration requires a $500 investment

Stage 2: If exploration is successful, company goes into oil production which requires a further investment of $1000 but will generate future cash flows of $250 each year thereafter

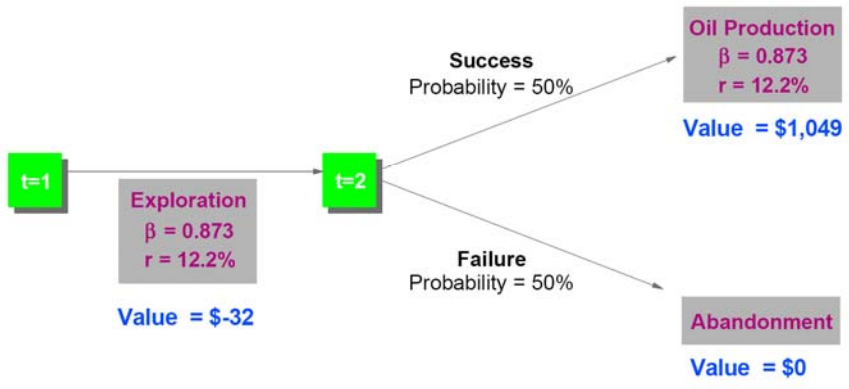
Assume that the probability of success is 50%

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	...
Exploration	-500						
Success		-1,000	250	250	250	250	250
Abandonment		0	0	0	0	0	0
Expected Cash Flows	-500	-500	125	125	125	125	125

13

Valuation and Asset Optimization (cont.)

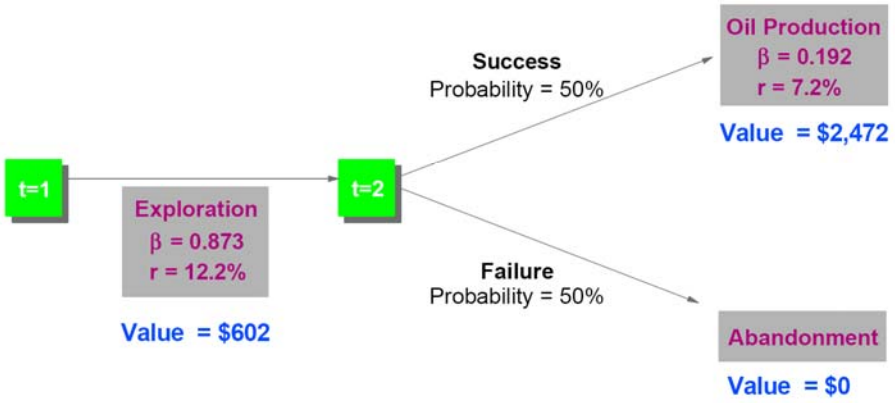
A constant discount rate?



14

Valuation and Asset Optimization (cont.)

Or different discount rates for the different stages:

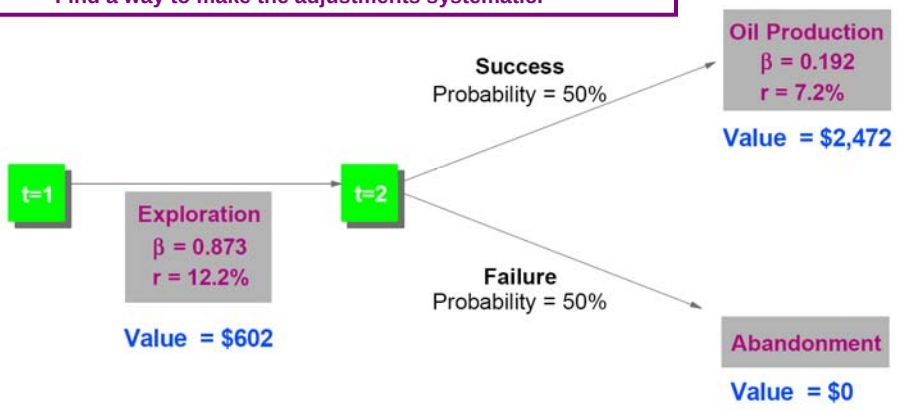


15

Valuation and Asset Optimization (cont.)

2 objectives…

- **Make this intuiton part of our automatic thinking process.**
- **Find a way to make the adjustments systematic.**



16

Pricing at Bombardier

- snowmobile manufacturer
- customer rebate offer:
  - $1,000 back if snowfall is less than x
- sales increase 38%
- hedged with weather derivative:
  $Y if snowfall is less than x

17

Weather Derivatives

- a bet on the weather
- traded on the Chicago Mercantile Exchange (CME) since 1999 and OTC
- typically HDD and CDD at various cities
- market prices reflect
  - market estimate of probability
  - market discount for risk

18

Pricing Issue

- underlying problem:
  - offer snowmobile with no guarantee; usefulness is risky and customer will pay less
  - offer snowmobile with a guarantee; customer will pay more
  - how much more? is it worth it?
- Bombardier could offer the guarantee w/o hedge
  - value of a sale equals the purchase price less the expected payout on guarantee
  - value is risky; estimation is difficult
- Marketing department is acting as a financial intermediary; lets the market price the guarantee
  - value of a sale equals the purchase price less the cost of the hedge

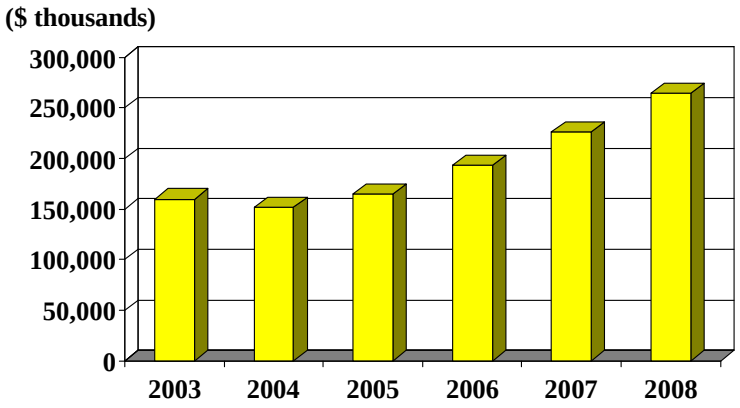
19

Mirant

- US power producer, trader
  - $6 billion in revenue
  - $19 billion in assets
  - $9 billion in own debt
- Filed Chapter 11 Bankruptcy in July 2003 and recently resurfaced
- Restructuring
  - what to keep
  - what to sell
  - what to shut down
- Major trading division (MAEM)

20

Trading Division Profit Forecast



21

Measurement of Capital at Risk

- Capital invested in trading is elusive
- Example of a futures contract:
  - an agreement today to buy 1 year from now at $F
  - a bet that $P_1 > F$
  - zero cost today
  - margin requirements complicate
- What is the rate of profit on a futures contract?
- One solution: measure profit and loss on a fully collateralized futures contract

22

Profitability of Trading at Mirant

- Need to attribute capital used by MAEM
- Not the same as collateral required by counterparties
  - investment grade = zero collateral but not zero capital
  - other assets are backing trading
- Measure V@R, value at risk
  - size of loss for a given confidence level
  - capital used is proportional to V@R
- Investment Bank solution

23

Hedging at Union Pacific Resources

- UPR was a major east Texas natural gas producer
- Hedged next few months of production using natural gas futures contracts traded on the NYMEX
- Company value is not tied to the short-term gas price
  - Performance should not be measured by short-term gains or losses on fixed production

24

Losses on a mismatched hedge

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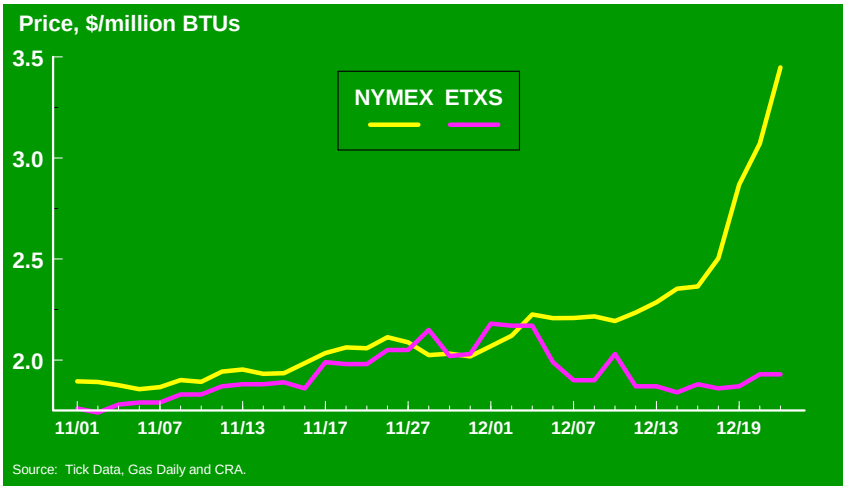
Basis blowout



26

Evaluation of Hedge & Market

- analyzed …
- history of spot gas prices @ various locations
- correlation of locational prices
- pipeline network
- history of futures gas prices
- history of futures trading & liquidation
- storage patterns
- weather patterns
- market price signals: convenience yields

27

Recommendation

- adjust hedge ratio
- make it conditional on the observed convenience yield and weather/storage patterns
- objective is to improve the correlation between futures profits and transaction value, I.e., improve the hedge

28

Why do they hedge?

- Most of the production decision has already been set
- Hedging is designed to lock in the value, once that value is already fixed in a plan – hedging doesn't change any operational decisions, atleast not directly
- Source of value: improved short-term cash management

29

Freeport-McMoran

- Gold and copper mining company.
- Heavy debt burden and low rating, large capital investment requirements, depressed stock price.
- Unable to issue any more traditional debt.
- Issues commodity-linked bond
  - free of covenants
  - lower cost
- A type of hedging
  - value hedging
  - avoid financial distress
- Lowers the cost of debt

30

Why Companies Manage Risk

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Which Side Are You On? A Balance Sheet Metaphor.

Assets	Liabilities
Valuation of New Assets	Cash Management
Optimization of Operations	Tax Management
Product Pricing	Foreign Operations Reporting
Supply Chain Management	Interest Rate Risk Management
R&D Strategy	Accounting
Third Party Contracts	Debt Funding
Management Incentives	Equity Issuances
	Financial Flexibility

Figure 3.1 from *Lecture Notes on Advanced Corporate Financial Risk Management.* Used with permission.

32

What's So Bad About Risk?

- Every major capital investment project is a case of the firm taking a risk, not hedging it.
- Taking risk is how companies make money.
- The idea of hedging risk as the objective or risk management comes from looking only at activities on the right-hand-side of the balance sheet.

33

Risk Management on the Left-Hand-Side

- What is the value of that risky asset?
- How much is this extra risk worth?
- What should I charge for a product or service line that involves more risk?
- What is the risk-reward tradeoff involved in delaying an investment or in developing a more flexible production scheme?
- How large of a premium do I pay to lock in a more reliable supply schedule?
- When do I pull the plug on a speculative R&D program?

34

Risk Management on the Left-Hand-Side (cont.)

- The task in all of these situations is to accurately assess, measure and price the risk,
- …so that management can then make the right decisions about what to pay, how much to invest, how to operate assets, organize production, price and market products and services, and so on.
- Risk management is an input to all elements of good business management, not a peculiar specialization of a subset.
- The task is not to reduce risk, but to face it wisely.

35

Some Hedging is Appropriate on the Left-Hand-Side

- Assign risk for incentive reasons, e.g., in a major construction project.
- Hedge risks that fall outside your core competency – Bombardier.
- Hedge to make performance evaluation sensible – HDG foreign currency hedging case.
- But hedging is not the objective. Hedging is an action taken to enable the company to execute its value creating risk endeavors more successfully.
- A matter of taking the right risks & layoff off the other risks.

36

The Right-Hand-Side

- Not a profit center.
- The task is to facilitate the activities on the left-hand-side.
- Risk management is not a source of profit. It is the sophisticated, higher-order management of the company's traditional engagement with capital markets… decreasing the frictions with the external capital markets.
- Typically, we do focus on hedging.
- Activities on the right-hand-side are diverse.
- The objectives of hedging are correspondingly diverse.
  - Reducing the cost of liquidity.
  - Increasing the company's debt capacity.
  - Lowering the equity required to support the business.
  - Lowering the effective cost of capital.

37

The MM Theorem of Hedging

- The original MM theorems:
  - The value of the firm is determined by the cash flow stream generated by its assets, i.e. on the left-hand-side of the balance sheet.
  - The value is unaffected by the amount of debt in its capital structure…
  - …nor by the amount of the cash flow paid out in dividends.
  - I.e. it is unaffected by actions on the right-hand-side of the balance sheet.
- The MM Theorem of Hedging
  - Hedging does not directly increase the value of the firm.
    - Risk is lower.
    - But so is return.
    - On net in value terms, a wash.
    - Unless there is some indirect effect.
  - Investors are risk-averse, and the company should price risks the way that investors do,
  - …but the company does not care which fairly priced risks pass through its balance sheet to investors,
  - The company only cares about those risks for which it can capture an above market return – and therefore belong on the left-hand-side of its balance sheet.

38

A Simple Example…

Table 3.1
The MM Theorem of Hedging

Unhedged Valuation	
Forecasted Production (000 bbls)	10,000
Forecasted Spot Price ($/bbl) -- current price $38	$35.00
Forecasted Spot Revenue ($ 000)	$350,000
Risk-adjusted Discount Rate, r	10.00%
PV ($ 000)	$318,182
Hedge Valuation	
Size of Position -- (000 bbls short, i.e., sold)	10,000
Futures Price	$33.09
Forecasted Hedge Inflow @ Futures Price	$330,909
Riskless Discount Rate, r_f	4.00%
PV ($ 000)	$318,182
Forecasted Hedge Outflow @ Expected Spot	$350,000
Risk-adjusted Discount Rate, r	10.00%
PV ($ 000)	$318,182
PV Net Hedge Inflows & Outflows ($000)	$0
Net Position Valuation	
Total PV Forecasted Spot Sales + Hedge ($000)	$318,182

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39