

Hedging Strategies Using Futures (Part I)

- Introduction and Exmples

- What is hedging? Why hedge? Examples. Should firms hedge?

- Hedging and Basis Risk

- mismatch between contract termination and hedge horizon.

Mismatch between contract specification and commodity being hedged.

- Hedging with stock index futures

- Example with mismatch in hedge horizon.
- Hedging “beta risk” (end of part I)
- Cross hedge – mismatch with contract specification.
 - Minimum Variance (optimal) Hedge Ratio
 - Example with Stock Index Futures

- Other issues

- Creating synthetic positions.
- Rolling the hedge forward

• See also <http://www.hedgestreet.com>

–Allows trading of variety of hedgelets with payoff \$10

2 Terminology and Introduction

- Terminology
 - Hedge – a trade designed to reduce a type of risk.
 - Perfect hedge – a trade that completely eliminates a type of risk
 - Long (futures) hedge –
 - Short (futures) hedge –
- What might firms hedge?
 - Interest rate – hedging can reduce borrowing costs and increase capacity.
 - Exchange rates – hedging can reduce volatility of foreign earnings
 - Commodity prices – hedging can reduce volatility for firms using commodities as interm/final goods. E.g, gas retailers, jewelry retailers, oil refineries, auto manufacturers; builders.
- Evidence - Disney states policies and procedures on risk mgt in annual report.
 - Manages exposure to interest rates, FX, and fair mkt value of investments.
 - Derivative securities are used only for hedging, not speculation.
 - Half of all non-financial firms use derivatives, with large firms most active.
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3 Commodity Hedging - Examples

- Miller sells flour forward – hedge short wheat position (~2.3 bushels/100lbs flr)
 - low protein flours (cakes) hedged with CBOT soft red wheat contracts.
 - low to mid protein flours (breads) hedged with KCBT wheat contracts.
 - high protein flour (non-pan breads (bagels)) hedged with MPLS wheat.
 - sells wheat feed by-product forward – hedges with wheat/corn futures.
 - Miller wants benefit if price of wheat (input) falls – add long put position.
- Processor sells corn syrup forward – hedge short corn (input) position.
 - Hedge with corn futures (~3 bushels /100lbs syrup).
 - Sunflower processors sells oil forward – hedge short seed position
hedge with soybean oil futures plus bean meal futures.
- Farmer sells corn to elevator flat price but wants exposure to rising prices.
 - Elevator buys calls for benefit of farmer, deducts premium from proceeds.
- Baxter Int'l – manufactures medical products (intravenous soln's, vaccines etc..)
 - Hedged Euro revenues at \$0.95/€ for 2002-06. $XR_{2004}=\$1.326/\text{€}$ (up 40% !)
 - Most currency hedges 6-12 mo; Analysts investors upset. CEO resigns.

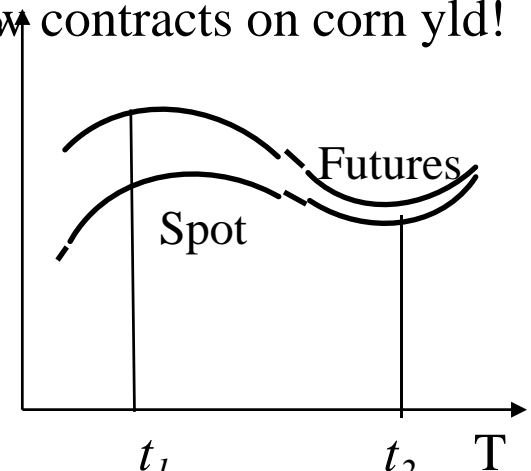
4 Should firms hedge?

- Should firms hedge?
 - Yes: Focus on core business. Minimize risks from interest rates, FX, etc..
 - No: Shareholders make their own hedging decisions with diversification.
 - No: Hedging may add risk in vertically integrated industries/firms.
 - No:

- Will hedges be profitable?
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- Imperfect hedges –
 - Hedge termination date uncertain or different than futures (basis risk).
 - Asset being hedged may not have futures (another source of basis risk).
 - Exact quantity not known (e.g. farmer's yield). Now contracts on corn yld!

- Basis – spot price of asset minus futures price.
 - Basis risk (at expiration): $S_2 - F_2$
 - Change in spot and futures prices appear different. but investment in spot also earns dividend yld and investment in futures earns risk-free rate.



5 Basis Risk 1

- Hedging Commodity risk – (all prices are \$/bbl)
 - On Jun 8, WJE INC identifies needs 20k bbl of West Texas crude in future.
 - WJE INC takes long position in 20 Dec oil futures, priced at $F_1 = \$18/\text{bbl}$.
- Suppose firm closes hedge on Dec 20
 - WJE INC purchases oil on spot mkt ($S_2 = \$20$); closes futures ($F_2 = \20).
 - Cash flow to get oil at $t_2 = [F_2 - F_1 - S_2] =$
 - What if Dec spot price is \$30/bbl? or \$10/bbl?
 - Gain/loss on futures
- Suppose firm closes hedge on Nov 10
 - WJE INC purchases oil on spot mkt ($S_2 = \$20$) and closes futures ($F_2 = \19.10).
 - Cash flow to get oil at $t_2 = [F_2 - F_1 - S_2] =$
 - Gain/loss on futures
- Cash Flow when hedge is closed at t_2 is $[F_2 - F_1 - S_2]$ or $-(F_1 + b_2)$.
 - If $F_2 = S_2$, there is no basis risk. Net cash flow will be $-F_1$.
 - Price paid matches futures price at time hedge placed only if hedge terminates on same date as futures contract.

6 Hedging with Equity Index Futures 1

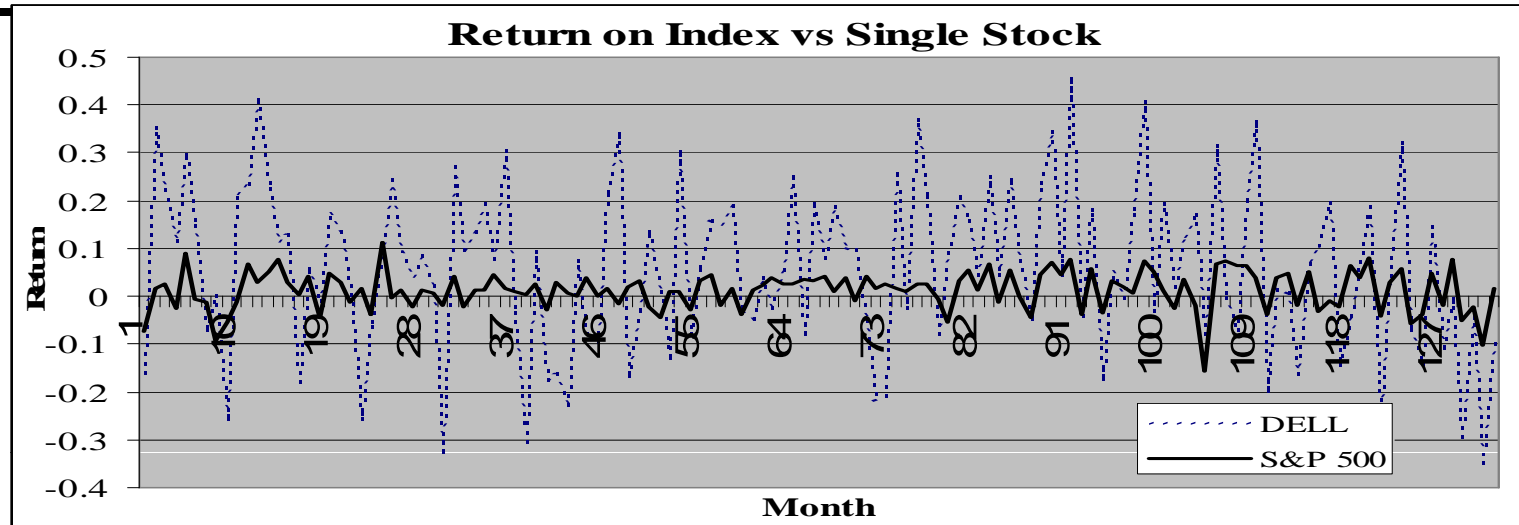
- Consider a portfolio mgr that may want to hedge an equity portfolio. Why?
 - Immunize portfolio for short period of time (cheaper than temp liquidation)
 - Hedge systematic risk (believe stock picks will out-perform broad market).
- Q: Suppose the portfolio's objective is to track the SP500. Currently, the portfolio beta is 1.0, with \$5M in assets and SP500 futures price is 1,010. The SP500 futures contract on CME is settled in cash at 250 times the index.
 - What position in futures contracts on SP500 hedges the portfolio?
 - Will portfolio be perfectly hedged?
- A1: Number of (short) contracts =
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- Q: Suppose the risk-free rate is 4%; Div yield is 0%; SP500 index is 1,000; futures price is 1010 and matures in 4 months; and hedge is unwound in 3 mo.
 - Find the value of hedged portfolio under different outcomes for the SP500, given the associated futures price.

7 Hedging with Equity Index Futures 2

		Annual	Period				
	R_f	4.00%	1.00%		$T_2 - T_1$	0.25	
	Div Yld	0.00%	0.00%		Maturity F_0	0.33	
	S_1	1,000			$F_1 = S_1 e^{(r-q)T}$	1,013.42	
	Portfolio	\$5,000,000			Multiplier	250	
	β_p	1			Contracts	20	
S_2	F_2	Cash Flow on Short Hedge $N*Q(F_1 - F_2)$	Return on Mkt (CAPM) Incl Div R_m	Return on Portfolio Incl Div R_p	Cash Flow on Equity Portfolio	Cash Flow on Hedged Portfolio	Return on Hedged Portfolio
800	802.67	1,053,758	-20.00%	-20.00%	-1,000,000	53,758	1.08%
900	903.01	552,088	-10.00%	-10.00%	-500,000	52,088	1.04%
1,000	1,003.34	50,419	0.00%	0.00%	0	50,419	1.01%
1,100	1,103.67	-451,251	10.00%	10.00%	500,000	48,749	0.97%
1,200	1,204.01	-952,920	20.00%	20.00%	1,000,000	47,080	0.94%
1,300	1,304.34	-1,454,590	30.00%	30.00%	1,500,000	45,410	0.91%

- Will hedge actually this work this well? Will cash flows be as predicted?
- CF portfolio:
- CF hedge:

8 Hedging with Index Futures: Role of Beta



- CAPM: $E(r_i) = r_f + \beta_i \times [E(r_M) - r_f]$
 - risk-free rate r_f - the pure time value of money ($\beta_{rf}=0$)
 - market risk premium $[E(r_M) - r_f]$ - reward for bearing systematic risk ($\beta_m=1$)
 - beta coefficient - measure of systematic risk $\beta_i = \text{cov}(r_i, r_M) / \text{var}(r_M)$
 - Beta of portfolio is linear combination of asset betas.
- What does it mean to hedge a portfolio with index options?
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- How will we know if index options/futures will track portfolio?
 - Look at the

9 Hedging: Estimating “beta” from actual data

- CAPM: $E(r_i) - r_f = \beta_i \times [E(r_M) - r_f]$
- Market Model: $(r_i - r_f) = \alpha_i + \beta_i(r_M - r_f) + e_i$
 - e_i = unsystematic risk and α_i = return in excess of CAPM prediction.
- Decompose assets’ variance: $\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma^2(e_i)$
 - total variance = systematic variance + unsystematic variance
 - Market explains about 25%-90% of variance of diversified stock portfolio.
- Consider following regression for Ford Motor Corp from 5/00-4/05
 - Load Analysis Toolpack in Excel 07: Start button; Excel Options; Add-ins; Manage Excel Add-ins, Go. Select “Analysis Toolpack”.
 - Run regression: Select “Data” then “Data Analysis” then “Regression”

Regression Statistics	
Multiple R	0.526
R Square	0.277
Adjusted R Square	0.265
Standard Error	10.428
Observations	60.000

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.785	1.355	-0.579	0.565
X Variable 1	1.410	0.299	4.714	0.000

