FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Metallgesellschaft
case study

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

The background of MGRM

- **Metallgesellschaft AG (or MG) is a large industrial German conglomerate engaged in a wide range of activities ,from mining and engineering to trade and financial services.**
- **MG have several subsidiaries in its "Energy Group", with MG Refining and Marketing Inc. (MGRM) in charge of refining and marketing petroleum products in the U.S.**

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

What happened

What happened if oil prices fall? (in late 1993)

↓

Cause funding problems for MGRM

↓

Cancel its long-term contracts with its customers

↓

Terminate its hedging program

↓

Cause about $1.3 billion loss

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

MGRM's Marketing Program

- **MGRM provided their customers with a method that enabled the customer to shift or eliminate some of their oil price risk.**
  - This option would be attractive to a customer if they were in financial distress or simply no longer needed the oil.
- **MGRM believed their financial resources gave them the ability to wholesale and manage risk transference in the most efficient manner.**

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

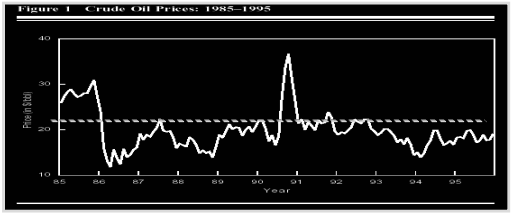
Hedging strategy

- **MGRM's hedge strategy to manage spot price risk was to use the front-end month futures contracts on the NYMEX.**
- **MGRM employed a "**Stack-and-roll" **hedging strategy.**
  - buying a bundle of short-dated futures contracts to hedge the long term exposure
  - roll over just before expiration

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Why MGRM needed to hedge

- MGRM's contract price reflected a premium of $3 to $5 per barrel



Oil prices ↑: the firm could suffer massive losses

Hedging strategy(con.)

- **The futures contracts MGRM used to hedge were the unleaded gasoline and the No. 2 heating oil.**
  - According to the NYMEX, MGRM held the futures position equivalent of 55 million barrels of gasoline and heating oil.
- **MGRM went long in the futures and entered into OTC energy swap agreements to receive floating and pay fixed energy prices.**
  - Their swap positions may have accounted for as much as 110 million barrels to completely hedge their forward contracts.

  (The swap positions introduced credit risk for MGRM.)

Stack and Roll Hedge

- **Independent oil refinery signs a contract with MGRM**
  - 10 year contract, 100,000 barrels of oil a month
  - MGRM hedges the delivery by purchasing 12,000 futures contracts near maturity
  - Each futures contract is for the purchase of 1,000 barrels
  - This equals the commitment to delivery 12 million barrels
  - What happens at the end of the month?

Stack and Roll Hedge

- **A short contract matures**
  - MGRM delivers 100,000 barrels of oil
- **The long stack expires**
  - Reverse the position
  - If prices rise, make money-but must be reinvested to create the new hedge
- **Create new hedge, less 100,000 barrels**
- **Question: Why not hedge over-longer periods, and the contracts that were going to expire?**

How is this profitable?

- **They were the market leaders**
  - Offering unique energy derivative products to their clients
  - Filled a liquidity demand. Offered long-term fixed rate oil contracts
  - By doing so, increased the sale of its derivative products. But were they priced correctly?
- **The hedge neutralize long-term exposures**
  - i.e, there is no long-term contracts, or there is poor liquidity (moves the market, wide bid-ask spreads)

From Backwardation to Contango

Forward Price =Spot price + Cost of Carry - Convenience yield

- **If Cost of Carry > Convenience yield**
  - → **Contango Market : F > S**
- **If Cost of Carry < Convenience yield**
  - → **Backwardation Market : F < S**

➢ **A stack-and-roll strategy appeared to offer a means of avoiding carrying costs because short-dated futures markets for oil product historically have tended to exhibit backwardation.**

To Contango

- **This was a result of market forces; like the end of the gulf war**
  - But in part was due to the size of the MGRM's position
  - 15,000 and 30,000 a day, versus 55,000
- **Marked-to-Market**
  - Margin calls approached 90 million
  - This resulted in liquidation
- **Accounting effects**
  - When do you report a loss.
- **Should not have sold the position.**

Who's to blame ?

- **Funding risk**
- **Operational risk**
- **Basis risk**

What went wrong

- **Taking bets on the relationship between spot and forward prices**
- **What of the size of the positions? Could they really be hedged?**
- **In 1991 the price of oil fell below the spot price (backwardation)**
  - The convergence to spot helped generate large profits
  - As did marking-to-market

Funding Problems

- **Marking-to-market forced firms to recognize future trading losses immediately**
- **Offsetting gains on forward delivery were deferred**
- **NYMEX raised margin requirements for MG putting further pressure on cash**
- **Rumors spread**

Funding Problems (cons.)

- **Some counterparties terminated their contracts**
- **MG's board fired CEO and orders cancellation of hedging program**
- **NYMEX withdrew hedging exemptions**
- **1.9 billion dollar bailout package**

Operational risk

- **Operational risk - inadequate control systems and management failure**
  - Poor execution and maintenance of a sound hedging strategy
- **MG reported DM 1.8 billion loss on operations in addition to 1.3 billion hedging loss**

Cash vs. Profits

- **Poor cash strategy versus a solid profit strategy.**
- **This is a liquidity issue**

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Cash Flow Implications

	Spot Prices Rising	*Spot Prices Falling*
Contango	Intermediate Case (Cash flows lower than best case scenario)	Worst Case (Largest negative cash flows)
Backwardation	Best Case (Largest positive cash flows)	Intermediate Case (Cash flows lower than best case scenario)

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Sell 10-year contracts with annual delivery

- **Assume oil is $19 a barrel**
- **Futures price is $18 a barrel**
- **Sell 1mm/year barrels future for next 10 years**
- **Buy a stack of 10,000 futures at $18**
- **What happens at year 1 if spot is $13**

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Scenario 1- Backwardation and Oil Prices Fall

Prices	*Year 0*	*Year 1*
Spot	$19	$13
Forward (each of the next 10 years)	$18	NA*
1-Year Futures	$18	NA
Backwardation or Contango?	*Backwardation: Forward < Spot*	

What happens?

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Scenario 2- Contango and Oil Prices Fall

Prices	*Year 0*	*Year 1*
Spot	$17	$11
Forward (each of the next 10 years)	$18	NA*
1-Year Futures	$18	NA
Backwardation or Contango?	*Contango: Forward > Spot*	

What happens?

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Cash Flow Examination Backwardation and Oil Prices Fall

- **MGRM offers 1 ($27) and 2 ($24) year forwards contracts at specified prices**
- **MGRM hedged for both contracts using 1 year futures contracts**

Prices/Rates	Year 0	Year 1	Year 2
Spot Prices	$30	$25	$20
Forward price in Year 0 for contracts expiring in Year 1	$27	NA	NA
Forward price in Year 0 for contracts expiring in Year 2	$24	NA	NA
Futures price in Year 0 for contracts expiring in Year 1	$27	NA	NA
Futures price in Year 1 for contracts expiring in Year 2	NA	$22	NA
Risk-free interest rate	10%	10%	10%

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

What happens at year 1

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

What happens at year 2

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Rolling Stack
Scenario A : Rising Price & Backwardation

	S_t	$F_{t,t+1}$	$F_{t,t+2}$	$F_{t,t+3}$
t=0	**17**	**17**	**16.992**	**16.982**
t=1	**18**	**17.892**	**17.832**	
t=2	**19**	**18.886**		
t=3	**20**			

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Rolling Stack
Scenario A : Rising Price & Backwardation

	Cash Flow			Income		
	A Spot (20-St)	B Futures (S_t-$F_{t-1,t}$)x (#)contract	C Net CF (=A+B)	D Gross Contract Income (20-17)x1000	E Net Cost of Carry (S_{t-1}-$F_{t-1,t}$)x (#)contract	F Net Income (=D+E)
t=1	**2000**	**3000**	**5000**	**3000**	**0**	**3000**
t=2	**1000**	**2216**	**3216**	**3000**	**216**	**3216**
t=3	**0**	**1114**	**1114**	**3000**	**114**	**3114**
total	3000	6330	9330	9000	330	9330

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Matched Strip Scenario A : Rising Price & Backwardation

	S_t	$F_{t,t+1}$	$F_{t,t+2}$	$F_{t,t+3}$
t=0	**17**	**17**	**16.992**	**16.982**
t=1	**18**	**17.892**	**17.832**	
t=2	**19**	**18.886**		
t=3	**20**			

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Matched Strip Scenario A : Rising Price & Backwardation

	Cash Flow			Income		
	A Spot (20-S_t)	B Futures	C Net CF (=A+B)	D Gross Contract Income (20-17)x1000	E Net Cost of Carry	F Net Income (=D+E)
t=1	**2000**	**2750**	**4750**	**3000**	**10**	**3010**
t=2	**1000**	**2162**	**3162**	**3000**	**10**	**3010**
t=3	**0**	**1114**	**1114**	**3000**	**7**	**3007**
total	3000	6026	9026	9000	26	9026

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Rolling Stack Scenario B : Falling Price & Contango

	S_t	$F_{t,t+1}$	$F_{t,t+2}$	$F_{t,t+3}$
t=0	**17**	**17**	**16.992**	**16.982**
t=1	**16**	**16.096**	**16.132**	
t=2	**15**	**15.090**		
t=3	**14**			

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Rolling Stack
Scenario B : Falling Price & Contango

	Cash Flow			Income		
	A Spot (20-S_t)	B Futures (S_t-$F_{t-1,t}$)x (#)contract	C Net CF (=A+B)	D Gross Contract Income (20-17)x1000	E Net Cost of Carry (S_{t-1}-$F_{t-1,t}$)x (#)contract	F Net Income (=D+E)
t=1	**4000**	**(3000)**	**1000**	**3000**	**0**	**3000**
t=2	**5000**	**(2192)**	**2808**	**3000**	**(192)**	**2808**
t=3	**6000**	**(1090)**	**4910**	**3000**	**(90)**	**2910**
total	15000	(6282)	8718	9000	(282)	8718

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Matched Strip
Scenario B : Falling Price & Contango

	S_t	$F_{t,t+1}$	$F_{t,t+2}$	$F_{t,t+3}$
t=0	**17**	**17**	**16.992**	**16.982**
t=1	**16**	**16.096**	**16.132**	
t=2	**15**	**15.090**		
t=3	**14**			

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Hedging with Matched Strip
Scenario B : Falling Price & Contango

	Cash Flow			Income		
	A Spot (20-S_t)	B Futures	C Net CF (=A+B)	D Gross Contract Income (20-17)x1000	E Net Cost of Carry	F Net Income (=D+E)
t=1	**4000**	**(2750)**	**1250**	**3000**	**10**	**3010**
t=2	**5000**	**(2133)**	**2867**	**3000**	**10**	**3010**
t=3	**6000**	**(1090)**	**4910**	**3000**	**7**	**3007**
total	3000	(5979)	9026	9000	26	9026

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Rolling Stack v.s. Matched Strip

Net Cash Flow	Rolling Stack		Matched Strip
Rising Price & Backwardation	9330	>	9026
Falling Price & Contango	8718	<	9026

FLORIDA STATE UNIVERSITY
The COLLEGE *of* BUSINESS

Defense of MGRM's Hedging Program

Consider losses from MGRM's hedging program to be sunk costs.

Culp & Miller find out the program had a net profit had it been continued by April 1995.

They find that the program had a positive expected net present value at the end of 1993.

The Deutsche Bank was not only a creditor to MG but also one of its largest shareholders, therefore it should have been willing to continue financing MGRM's hedge program.