

# Soya Saxa Manufacturing Firm

## Managing the Risk of a Defined Benefit Plan in a Volatile Market

FINC-556-10 Final Derivatives Project – Professor Jim Bodurtha

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# Company Plan Overview

Soya Saxa Manufacturing sponsors a defined benefit plan for its hourly and salaried employees. The plan assets (\$100 million) are invested in funds indexed to the S&P 500.

The company has promised to pay specific benefits to employees, so the investment risk is fully assumed by Soya Saxa.

The plan is currently fully funded, but only the funded status of the plan at the end of year is used for minimum contribution purposes.

# Business Problem and Risk

Recent market declines put Soya Saxa at risk of having an underfunded pension plan at the end of the year. In addition to the potential backlash of poor employee morale and increased scrutiny from regulators, an underfunded plan places Soya Saxa at risk of having to make a significant contribution in 2009.

Soya Saxa needs to hedge its financial exposure to the S&P to strengthen the funding of the pension plan and improve the predictability in annual contributions for business planning.

Pension risk guidelines require that Soya Saxa limit dollar losses at the end of the year to 10% of expected values – based on the future price of the S&P benchmark. The probability of a 10% or greater loss should not exceed 1%.

# Evaluation of Underlying Exposure

*Soya Saxa has a long position on the underlying S&P 500.*

- Current futures price (as of Oct. 10, 2008) for Dec. 19, 2008 S&P 500 contract (symbols SPZ8 - \$250 multiplier): \$891
- Units of underlying each contract represents: \$222,750
- The 100% futures equivalent is 449 contracts:  
$$\$100,000,000 / (\$250 * \$891)$$

# Mark-To-Market

- Current futures price (as of Oct. 13, 2008) for the Dec. 19, 2008 S&P 500 contract (symbols SPZ8 - \$250 multiplier): \$1,017
- Mark-to-Market Gain (from Oct. 10 to Oct. 13): +\$126

# Risk Guidelines

Pension risk guidelines require that the probability of a 10% or greater loss should not exceed 1% (2.33 standard deviations)

- Total exposure value: \$100 million
- Loss limit: \$10 million or 10%

# Expected Spot on S&P 500

The expected spot price on the S&P 500 on Dec. 19, 2008 is \$901.

- Current futures price = \$891
- Cost of funds (R) = 2%
- Risk premium (RP) = 6.09% (historical)
- Time horizon (T) = 0.19 (Oct. 10 – Dec. 19, 2008)

Expected spot price =  $\bar{S}_t^{\text{market}}$

$$\bar{S}_t^{\text{market}} = F_t \left[ \frac{1 + ({}_0R_t + {}_0\text{Risk Prem}_t) * t}{1 + {}_0R_t * t} \right]$$

# Value@Risk

A loss-limit critical price (down) level of \$256 represents an actual loss of 72%. Since Soya Saxa's target loss is only 10%, the exposure must be decreased by 86% to meet our target.

- Monthly volatility = 35.58% (Riskmetrics as of Oct. 10, 2008)  
→ annual volatility (s) = 123.25%
- Loss limit critical price (down) level =  $\$901 * e^{-2.33s v(.19)} = \$256$
- Keep = Target Loss/Actual Loss, or 62 synthetic long contracts
- Short 387 contracts

# Market View

Recent market losses do not deter Soya Saxa from being bullish on the market's long-term direction. This view agrees with our strategic decision to sponsor a defined benefit plan that represents long-term obligations.

However, Soya Saxa is very concerned about volatility. We believe that frozen credit markets will continue to keep volatility unstable.

**Market View – UP**

**Volatility View – UNSURE**

# Current Position +/- Hedge Strategy

		LEVEL OF CONFIDENCE			
		Current Position, +449F	Unsure	=Market	Sure
D I R E C T I O N	Up- Unsure	+449 P Syn. Long Call	+449 P <sub>otm</sub> -449 C <sub>otm</sub> Bull Spread		
	No Dir.- Unsure	+898 P Long Straddle			
	Down- Unsure				

# Pricing Analysis

Closest Maturity Futures Price → \$891 for contracts expiring  
Dec. 19, 2008

	Calls		Puts	
	Strike Price	Price Quote	Strike Price	Price Quote
More OTM	1000	36.80	800	49.70
OTM	950	55.90	850	67.60
ATM	900	79.90	900	88.90
ITM	850	108.40	950	114.70
More ITM	800	140.40	1000	145.40

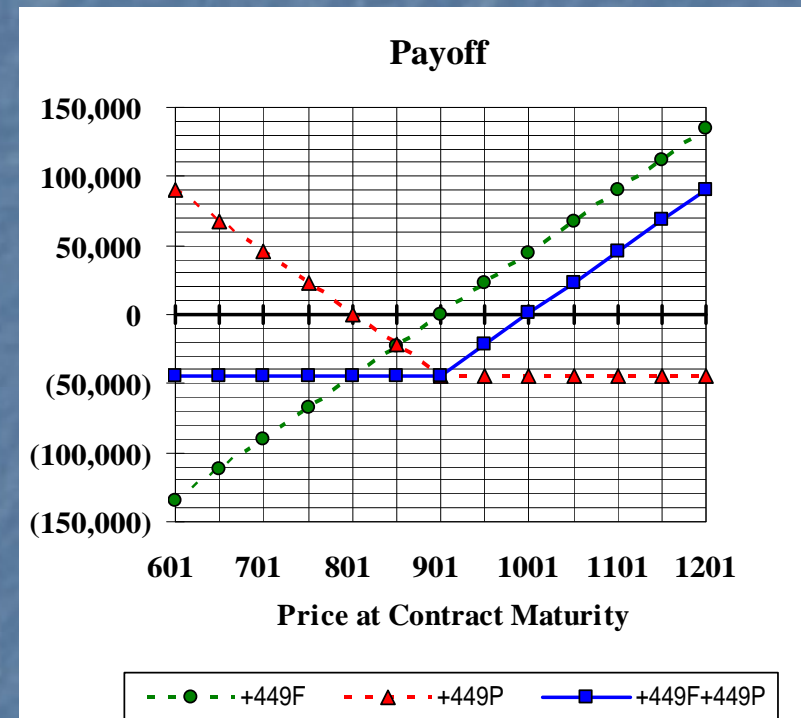
Source: Chicago Mercantile Exchange, as of Oct. 10, 2008.

# Option 1: Full Insurance

- Purchase 449 puts  
(synthetic long call)
  - Effect: Eliminates downside exposure; reduces upside gains
  - Pros: No downside risk
  - Cons: Reduces upside gains; complies (barely) with company risk management rules

Market View – UP

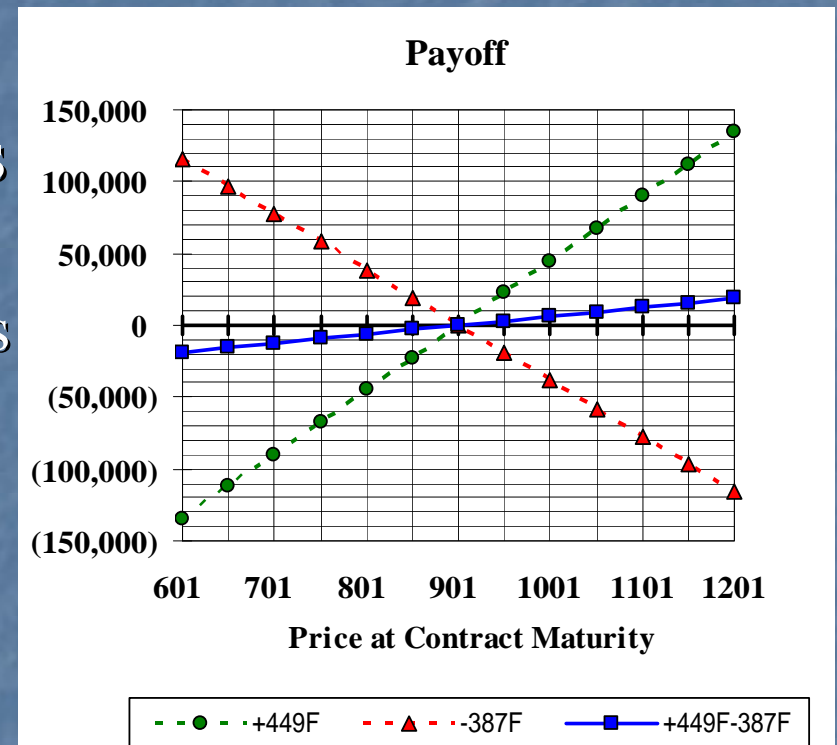
Volatility View – UNSURE



Position Maximum Loss:  
\$9.99 million  
(=  $\$89 * \$250 * 449$ )

# Option 2: Hedge with Futures

- Hedge 86% of position by shorting 387 futures contracts
  - Effect: Significantly reduces downside and upside exposures
  - Pros: Less downside risk; complies with company risk management rules
  - Cons: Significantly reduces upside gains



Market View – UP

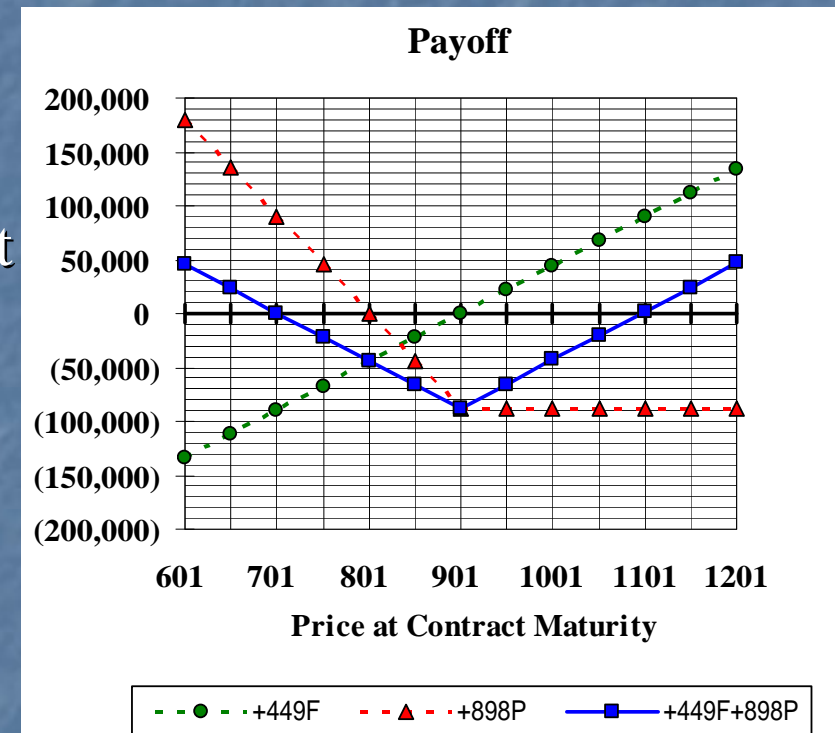
Volatility View – UNSURE

# Option 3: Trade Volatility

- Purchase 898 puts (long straddle)
  - Effect: Profits from big market downturns and upturns
  - Pros: No downside risk; protects company from high volatility
  - Cons: Very costly; not consistent with market up view; does not comply with company risk management rules

Market View – UNSURE

Volatility View – UP



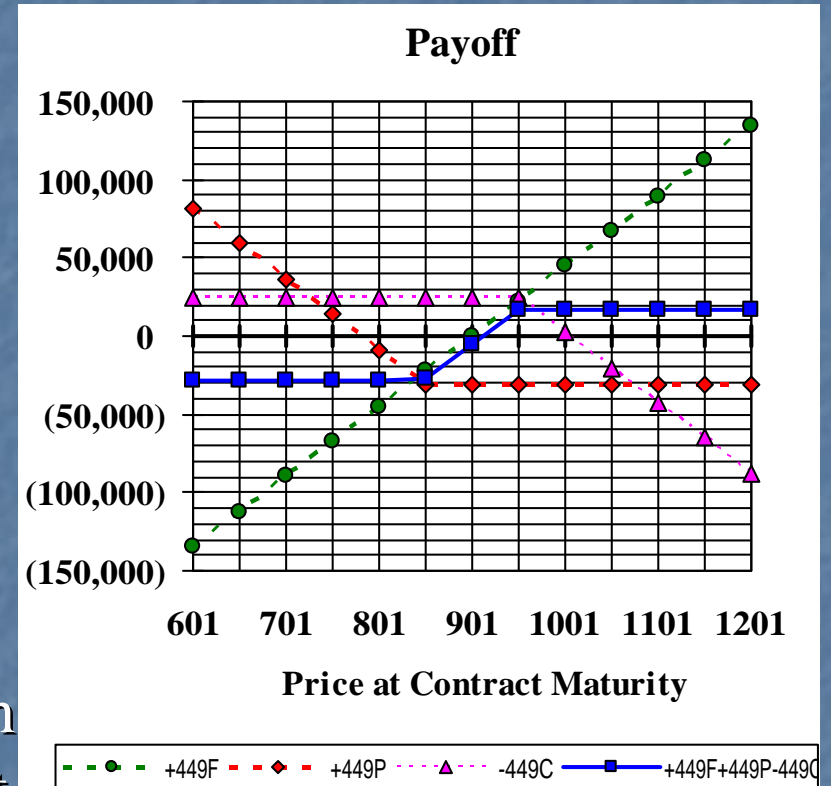
Position Maximum Loss:  
\$20.0 million

# Option 4: Bull Spread

- Purchase 449 puts<sub>otm</sub> and sell 449 calls<sub>otm</sub> (bull spread)
  - Effect: Significantly limits upside and downside
  - Pros: No downside risk; complies with company risk management rules
  - Cons: Limits upside gains; high market volatility would make it hard to find buyers of calls; not consistent with volatility view

Market View – UP

Volatility View – STABLE



Position Maximum Loss:  
\$7.0M

# Recommendation: Full Insurance

- Since we are bullish on the direction of the market, we do not want to significantly limit our upside potential. Investment gains strengthens the funding of our plan and could potentially reduce future contributions.
  - Options 2 and 4 significantly reduce potential upside gains.
- We are unsure on the volatility of the market. Given the nature of our pension liabilities, our fiduciary responsibility is to protect plan participants against downside risk.
  - Option 3 provides additional protection against volatility, but the strategy is not cost-efficient and inconsistent with our market view.
- Our strategy in Option 1 is to insure 100% of our exposure.
  - With Option 1, we would be able to hedge our exposure, add predictability to our funded status at the end of the year, and keep upside gains.