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Swing Options *Structure & Pricing*



RISK LIMITED CORPORATION

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What Is A “Swing Option”...?

- A swing option grants the option holder the right to take ...
 - a volume of some specified product
 - with a volume “swing” between some minimum and maximum volume
 - within some defined time period
 - at some pre-agreed price
- Generally considered an “exotic” option



What Is A “Swing Option”...?

- May be an outright option in the financial market or an option embedded in a physical transaction
- Also referred to as “Take-or-Pay” option
 - Flexibility of delivery options
- This option structure was developed in response to hedging and operational needs for unique exposures



What Is A “Swing Option”...?

- A multiple exercise option
- May be subject to daily as well as periodic (monthly, quarterly, or semi-annual) constraints
 - That permits the option holder to repeatedly exercise the right to receive greater or smaller amounts of energy
- Hence, implicit dependence through time



Basic Valuation Methods And Swing Option Pricing

- Volatility is assumed to be constant in the Black-Scholes Model
 - However, this is NOT a valid assumption
- The B-S model does not consider variable volumes in its valuation approach
- The B-S model does not have a provision for multiple exercise dates



Swing Option Applications

- Market price risk exposures that created a need for swing options were those with volumetric risks
- Swing options have found wide application in the US natural gas markets
 - Developing use in electric power markets
- Widely offered by market makers and used extensively by major energy companies



Swing Option Applications

- Given market use and interest, and the complexity of swing options...
- Considerable research has been conducted
- Information widely available
 - Courses on just swing options
 - Books, magazine articles, white papers
 - Off-the-shelf analytic models and plug-ins



Typical Structure - Background

- Assume a gas producer prefers to hedge their revenues on future natural gas sales
- Their production volume is not known precisely, but has been estimated to fall within some production volume range
- They are faced with a “volumetric risk”



Typical Structure - Background

- Alternatively, industrial natural gas consumers may prefer to hedge their costs on future natural gas use
- Their consumption volume is not known precisely, but has been estimated to fall within some volume range based on past usage patterns or operational capacities
- They are also faced with “volumetric risk”



Typical Structure - Example

- If current NG prices are \$6.00/MMBtu and implied volatility is 60 %
- A swing option could grant the option holder the right to take up to 10,000 MMBtu of NG each week in a month (presuming 4 weeks) at a price of \$6.00/MMBtu
- The total volume purchased during the month must be between 10,000 MMBtu and 30,000 MMBtu



Swing Option Pricing Concepts

- Quantitative dilemmas
 - Valuation of a swing option
 - Determining optimal exercise boundaries (exercise of an option today reduces or eliminates the ability to receive delivery in the future)
- Alternative stochastic processes for underlying prices



Swing Option Pricing Issues

- Anecdotal evidence from market participants suggests that buyers of swing options often exercise sub-optimally (from a financial/economic perspective) in order to meet their obligations as suppliers of gas or electricity
- Financial implications to sellers of swing options who optimally hedge their positions and buyers of swing options who sub-optimally exercise their contracts



Swing Option Pricing Issues

- Some counter-parties will execute their swing options out of need (consumption/demand), as opposed to economic profit taking
 - Also known as "non-ruthless" exercise
 - May be a provision of the option contract agreement, rather than sub-optimal exercise



Conclusions

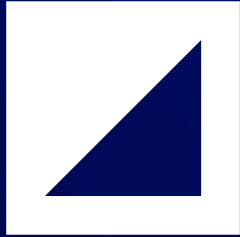
- A bit complex, but doable
- On most occasions, the delivery volume is taken based on the demand side of the equation, rather than to make profit/loss



Conclusions

- This pricing model takes into account the volume of the commodity that is being traded
- On most occasions, one needs to calculate the pricing for everyday





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