



COMMODITY PRICE MECHANISMS

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COMMODITY DERIVATIVES BASICS



Basics

- “Derivative”=financial contract in which the payoff is derived from the value of some “underlying”
- EG, gold forward contract has a payoff that depends on the price of gold
- Also referred to as a “contingent claim” because payoff is contingent on something else
- “Something else” could be a price, or an event (e.g., default, temperature, government unemployment report, movie box office)



Forwards

- The forward contract is the most basic derivative
- Delivery settled: contractual *obligation* to buy or sell a specified underlying instrument at a specific date
- Cash Settled: contractual obligation to exchange cash flows per a formula
- Parties agree to price at initiation of agreement, but no money changes hands (under a standard forward) when deal is struck



Futures

- A futures contract is a type of forward contract
- Nomenclature is imprecise, but usually the term “futures” is used to refer to a contract that is traded on exchange (vice OTC) and cleared
- But . . . Especially in energy (and soon by regulatory fiat for most everything) OTC contracts are/will be cleared
- Also, the term “futures” pre-dates the introduction of clearing in the late-19th and early 20th centuries



Exchange Trading vs. OTC

- Main distinction is between exchange trading and OTC
- Exchanges standardize all relevant terms: parties need negotiate only price and quantity
- OTC permits customization
- That said, most OTC contracts (measured in volumes of trade) are highly standardized, and often mirror exchange traded contract terms (e.g., NYMEX lookalike swaps)



Swaps

- Swaps are essentially bundles of cash settled forward contracts in which parties exchange (“swap”) cash flows pursuant to a formula
- Example: Ap-Oct natural gas swap
- Contract sets: (a) notional size, (b) payment frequency, (c) payment formula (i.e., price or price index used to determine cash flows)
- Bullet swap is a swap where cash flows are exchanged on a single date—essentially a synonym for a cash settled forward



Uses of Forwards and Swaps

- Like all derivatives, forwards & swaps are *risk transfer mechanisms*
- Hedgers use contracts to reduce risk exposure (e.g., owner of a cargo of Nigerian crude sells WTI futures as a hedge)
- Speculators use them to increase risk exposure in anticipation of earning a profit
- That said, the line between speculation and hedging is hazy



The Economic Functions of Derivatives Markets

- Contrary to the impression given by the popular press (and the German, Greek, Spanish, etc. governments), derivatives are not the devil's evil spawn
- They perform valuable social functions
- Risk shifting
- Price discovery



Risk Shifting

- Derivatives facilitate the efficient transfer of risk from those who bear it at a high cost to those willing to bear it at a lower cost
- Speculators perform a socially valuable function of accepting risk from those who want to shed it: consenting adults engaged in a mutually beneficial transaction
- The ying-yang of derivatives
- Can they be used to gamble: Yes!
- Can they be used to hedge: Yes!
- These functions are complementary: can't have one without the other



Price Discovery

- Information about supply and demand fundamentals dispersed among millions of individuals
- Blind men and the elephant: markets facilitate assembling the entire image
- Individuals trade on their information. Trades affect prices, and as a result, prices aggregate the dispersed information
- Price can be used to guide resource allocation



Hedging Basics

- Hedging involves exchange of flat price risk for basis risk
- The basis is the difference between the price of the thing being hedged and the price of the hedging instrument



Example

- Hedging a cargo of Urals-Med using Brent
- 5/5: U-M \$79.34, Brent \$80.89, basis=-\$1.55
- 5/26 U-M \$68.78, Brent \$71.74, basis=-\$2.96
- Would have lost \$10.56/bbl with no hedge
- Lost only \$1.41 with hedge; lost because basis moved against you (long hedger would have made money as a result of this basis move)
- Can work the other way too: basis can move in your favor



Some Takeaways

- Face some risk when you hedge, but less
- Variability of the basis determines the risk of the hedged position
- Hedges are speculations on the basis
- No hedge is perfect: all hedges are dirty
- Foregoing example assumes 1-for-1 hedge. Can sometimes do better by choosing a different hedge ratio (statistical methods)



COMMODITY DERIVATIVES CONTRACT DESIGN



Delivery vs. Cash Settlement

- Most exchange-traded commodity contracts require delivery if held to expiration
- Most OTC contracts are cash settled
- Very few delivery-settled contracts actually result in delivery because most hedgers are “cross hedgers” and most speculators do not want to hold the phys
- Hedgers and specs liquidate/roll positions prior to expiration



Delivery is Still Important

- Delivery-settled contracts *can* be used to transfer ownership, but that's not the main role of the delivery mechanism
- Delivery ties together cash and futures prices at expiration: “convergence”
- In this way, delivery ensures that futures prices reflect physical market realities at expiration: the expectation that this convergence will occur ensures that futures prices reflect physical market realities prior to expiration



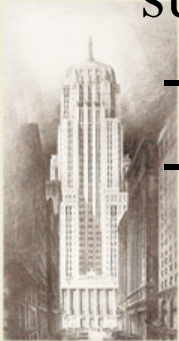
Cash Settlement

- Cash settlement is another way of tying forward and physical markets
- Many cash settled commodity forwards are settled based on prices of delivery settled futures (e.g., NYMEX LD NG swaps)
- Others are based on indices
- EG HSC forwards. Settled against average HSC prices reported during “bid week”



More on Cash Settlement

- Quality of index prices is highly uncertain: illiquidity/lack of trading, incomplete reporting, fraudulent reporting
- Index prices are best when they are based on transactions prices from transparent markets
 - Stock index futures
 - Live hogs in the US
- Index prices more problematic when they are based on surveys or indications
 - Platts prices
 - Libor



Some Common Cash Settled Contracts

- Monthly forwards
- Basis swaps (e.g., HSC-NYMEX HH)
- Gas daily swap (swap average of daily prices during flow month for monthly bid week price for that month)
- Many crude oil swaps (other than those based on Brent or WTI)



EFPs, EFRs, and EOOs

- Exchange for Physical (EFP, *ex pit*): privately negotiated and simultaneous exchange of a futures position for a corresponding position in the underlying physical
- Exchange for Risk (EFR): privately negotiated and simultaneous exchange of a futures position for a corresponding Over the Counter (OTC) swap or other OTC derivative in the same or related instrument (e.g., NYMEX CL for NYMEX CL lookalike)
- Exchange of Options for Options (EOO): exchange of an Exchange option position for a corresponding OTC option position or other OTC contract with similar characteristics in the same or a related instrument



Reporting EFPs

- Both parties to the trade must have an account at a Futures Clearing Member (Clearing Member or FCM). Subsequent to the negotiation of the EFRP, details must be provided to the relevant FCM for reporting to the Exchange.



Using EFPs

- Quite useful for hedgers as a way to reduce execution risk
- EG, grain merchant short SY futures, processor in Iowa long futures
- Merchant agrees to deliver 500m bu of beans to the processor's plant. They agree to a basis price (vs. front month CBT SY futures), and the merchant delivers the beans and the short futures in exchange for the processor's long futures position
- Parties can close out their futures positions at prevailing market price
- Exchanges require actual physical transfer: will scrutinize EFPs executed by those not typically in the physical market



TRADING MECHANISMS



Trading Mechanisms

- Organized Exchanges
- OTC



Organized Exchanges

- Centralized auction markets for standardized contracts
- Exchanges standardize all contract terms (quality, quantity, delivery location)
- Parties negotiate price and trade size (number of contracts)



Auction Markets

- Old School: floor trading in “pits”
- Some floors have closed (e.g., ICE), others a shadow of their former selves (e.g., NYMEX CL pit)
- Main floor activity today is in options
- Most trading is electronic: double sided electronic auctions



Double Sided Auctions

- Buyers submit bids to buy or offers (asks) to sell
- In a computerized market, computer has algorithm that matches orders based on priority rules
- Price priority—primary priority (orders sorted by price, best prices executed first)
- Secondary priority rules vary by market/product. Time priority, quantity priority, pro rata allocation, and hybrids are common



Centralized Markets

- Concentrate liquidity: some participants (“market makers” or “locals”) specialize in supplying liquidity by actively quoting prices
- Considerable pre-trade transparency especially in computerized markets (in floor markets, those on the floor have advantages in observing current prices)
- Post-trade transparency



Pit Images



Old School Pit Images



New School Centralization

NOB SPREAD		
Time	Account	Balance
12:29:51	A	
	+4,250	12,000
		11,750
		11,500
		11,250
		11,000
	1	10,750
	10	10,500
	50	10,250
	CLR	10,000
	1	9,750
		9,500
		9,250
	Del All	9,000
	Delete 0	8,750
	Delete 1	8,500
		8,250
		8,000
	Parent Pending	7,750
		7,500
		7,250

TTSIM ZN JUN02		
Time	Account	Balance
12:30:36	A	
	+115	107000
	-Dr Dis	106315
	108738	106310
	0	106305
	0	106300
	1	106295
	10	106290
	50	106285
	CLR	106280
	0	106275
	SL SM	106270
		106265
	Del All	106260
	Delete 0	106255
	Delete 10	106250
		106245
		106240
	Parent Pending	106235
		106230
		106225

TTSIM ZB JUN02		
Time	Account	Balance
12:30:52	A	
	+13	10217
	-Dr Dis	10215
	87819	10215
	0	10214
	1	10213
	5	10212
	10	10211
	20	10210
	50	10209
	CLR	10208
	0	10207
	SL SM	10205
		10205
	Del All	10204
	Delete 6	10203
	Delete 0	10202
		10201
		10200
		10131
		10130
		10129



Order Types

- Market order: buy or sell at best price (hit the bid, lift the offer, “sweep the book”) (liquidity demander)
- Limit order: buy or sell at a trader-specified price or better (liquidity supplier)
- Stop order: resting order that becomes a market order when the market trades at a pre-specified level (BE CAREFUL!)
- Stop limit: resting order that becomes a limit order when the market trades at a pre-specified level (BE CAREFUL, but not so careful as with a normal stop)



EXCHANGES



Major Commodity Exchanges: Energy

NYMEX (part of CME Group): crude oil, refined products, natural gas

CBOT (part of CME Group): ethanol

ICE Futures: crude oil, gas oil, UK nat gas



Major Exchanges: Grains & Oilseeds

- CBOT (part of CME group): corn, soybeans, soybeal oil and meal, wheat
- ICE Futures (formerly WCE): canola
- EuronextLiffe: corn, barley, rapeseed, feed wheat, milling wheat



Major Exchanges: Industrial Metals

- LME: aluminum, aluminum alloy, copper, lead, nickel, tin, zinc
- NYMEX: copper, platinum, palladium



Major Exchanges: Precious Metals

- NYMEX: gold, silver
- Dubai: gold, silver



Major Exchanges: Livestock

- CME: live cattle, feeder cattle, live hogs, pork bellies (once upon a time—not anymore!)



Major Exchanges: Industrials and Fibers

- CME: plywood
- ICE Futures: cotton



Major Exchanges: Softs

- ICE Futures: coffee (robusta, Arabica), sugar (world and domestic US), cocoa, orange juice
- EuronextLiffe: coffee, sugar, cocoa



OTC TRADING



OTC

- OTC markets are, for the most part, decentralized “search” markets
- Dealers typically dominate this structure
- Dealers make two sided markets for some products, negotiate prices on others
- Most end users (e.g., a hedge fund, an oil company) trade with a dealer, although end user-end user trades are possible
- Customized (“bespoke”) deals possible in OTC, but many OTC deals are highly standardized



Electronic Trading in OTC

- In energy in particular, there are electronic OTC dealing platforms
- ICE
- Sometimes referred to as an exchange, but really an electronic brokerage platform
- Parties specify counterparty credit limits
- Unlike in a true exchange, where every buyer can meet every seller, on ICE deals limited to pre-specified counterparties in pre-specified volumes



Swap Execution Facilities

- US has implemented a “SEF” mandate that requires certain swaps to be traded on centralized platforms
- Limit order book vs. RFQ
- RFQ requirements
- “Worst of Frankendodd”: one part of Dodd-Frank that is likely to be changed
- Early implementation in the US (vs. Europe) has fragmented liquidity



CLEARING



Clearing and Centralized Markets

- To facilitate anonymous trade in which only P & Q need be negotiated, it is necessary to standardize credit/performance risk
- Exchanges do this now through clearing
- Clearinghouse is the central counterparty—seller to every buyer, buyer to every seller
- This standardizes credit risk as everybody has the same counterparty—the CCP



Clearing

- Clearing is actually a little more complicated: CCP deals directly only with its members. Non-members must deal through members.
- Non-members do not benefit directly from CCP guarantee
- CCPs require initial margin and collect daily variation margin (marking to market)



Principles of Clearing

- “No credit/loser pays” system: margins supposed to reduce credit exposure to minimal levels
- Residual exposure remaining after margin cover is borne by CCP (usually in a minimal way) and clearing members *via* default/guarantee funds
- Risk is “mutualized”



Default “Waterfall”

- Initial margin
- Defaulter’s default fund contribution
- CCP capital (may fall behind default fund)
- CM default fund contributions
- ??? (VM haircutting? Tear-ups?)
- Note tranced structure, like a CDO or CLO. (This should make you nervous . . . More later)



Performance Risk and OTC

- Traditionally, performance risk remained with original counterparties on OTC deals—“bilateral” deals, no central clearing
- In energy in particular, many OTC deals are cleared
- ICE Clearing
- NYMEX Clearport (EFS)
- Deals negotiated bilaterally, then given up for clearing
- Post-Financial Crisis, major governments have implemented “clearing mandates” that require clearing of most transactions



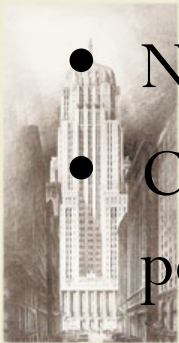
The Rationale for CCP and Collateral Mandates

- Widespread belief that OTC derivatives are a major source of systemic risk, and indeed contributed to the recent Financial Crisis
- OTC exposures too large and too leveraged (undercollateralized) and OTC markets too interconnected
- CCP mandate: reduce exposures through multilateral netting and collateral (IM and VM)
- Mandatory (and arguably punitive) margining of non-cleared trades to reduce exposures



The Reality

- This rationale is, ironically, profoundly un-systemic
- The primary effect of greater netting and collateral is to redistribute risk in the system
- CCP and collateral mandates transform counterparty risk into liquidity risk, which can be more systemically destabilizing
- Capital structures will adjust: level and fragility of leverage in the system may not change dramatically
- New market structure creates CDO-like wrong way risks
- CCPs don't have information or incentives to take systemic perspective



Netting and Collateral

- Increased netting of exposures and greater collateralization raise the payouts of derivatives counterparties in an insolvency (“defaulter pays”): but that means others get paid less
- These others may be systemically important (e.g., money market funds holding SIFI debt)



Transforming Credit Risk Into Liquidity Risk

- Collateralization-and especially VM-is very liquidity intensive
- During periods of stress, rigid VM/MTM mechanism can lead to substantial increases in need for short-term credit precisely when liquidity is in short supply
- Greater exposure to operational risks
- Increases the tightness of coupling in the financial system: this can increase systemic risk



More Focus on VM is Imperative

- Much of the policy debate has focused on the liquidity implications of greater IM: VM has been all but ignored. This is unsettling.
- Greater reliance on tightly sequenced VM mechanism increases “tight coupling”, which increases the potential for system failure (“normal accident”) (Operational risks—e.g., Fedwire on 19 October, 1987)



Compare and Contrast

- “Variation margin payments should not have a first-order effect on the demand for collateral, as variation margin is a one-way payment and hence does not affect the net demand for collateral assets”

BIS, 2013

- “The following discussion of CME cash flows emphasizes VM payments because . . .these payments put the greatest stress on the financial system in the week of October 19.”

Brady Report on the Crash of 1987



Mandates and Central Banks

- The liquidity and credit implications of CCPs and collateralization of non-cleared trades make central banks crucial to the ability of the system to operate in stress scenarios
- Liquidity support/LOLR: to CCPs and to market participants
- Review of 1987 Crash, and the Fed's response, is quite illuminating



Capital Structures Will Adjust

- Beware a fallacy of composition: reducing leverage/credit exposure in *derivatives* does not necessarily reduce leverage/credit in the *system*
- Market participants can & will substitute other forms of leverage/credit exposure
- Capital structures will adjust in response to changes in priorities resulting from netting/collateral, and to reduction in credit extended via derivatives
- These new structures will have different vulnerabilities



CCPs Pose CDO-like Tail Risks

- CCP default waterfalls eerily similar to CDO tranching
- Default funds concentrate systemic risk
- Acute wrong-way exposure
- Default fund connects SIFIs precisely when they are most vulnerable



CCP Incentives in a Tightly Coupled System

- Making one part of the financial system invulnerable doesn't make the system as a whole safer: the levee metaphor
- In a tightly coupled system (like a financial market) local efforts to protect one part of the system can destabilize the whole
- CCP managers (and regulators focused on CCPs) have an incentive to take actions in self-preservation that can be systemically destabilizing



The Equivocal Effects of CCP Mandates on Systemic Risk

- Derivatives-focused policies to reduce systemic risk are ironically not based on a truly systemic analysis
- CCP & collateral mandates redistribute some risks within the system and transform others
- Recognizing this, it is doubtful that these mandates reduce systemic risk: they transform how crises may occur and develop
- They also transform the challenges that regulators must manage



Practical Issues With Clearing

- Clearing means that you are not exposed to your original counterparty's credit
- CCPs are not immune to default, though (Hong Kong, 1987)
- Cash/working capital demands in clearing much greater: initial margin (whereas many bilateral deals extend credit), rigid variation margin (in cash)
- Mandated increases in clearing likely to lead financial institutions to increase commodity credit and to devise creative financing tools to allow cash poor end users to continue to use the markets

