Basis Basics

• Remember: Basis is the difference between the cash (spot) price of a commodity and a futures price
• Cash price rises relative to futures = strengthening basis
• Basis is driven by differences (law of one price)
• Two basic differences drive the basis
  • Time (difference between delivery dates)
  • Location (or quality) (difference in location/quality)
Basis Is Hard: The Space-Time Continuum

• For deliverables, the calendar spread is the basis: only time matters
• For non-deliverables, space (or quality) and time matter
• Understanding the economics of transformation in both space & time necessary to understanding the basis
• Bottlenecks, transformation costs, etc., are extremely important
Simple Case

- Simplest case, constant cost of transportation $t$ between market 2 and the delivery location (market 1)
- Commodity in abundant supply: full carry

\[ B = P_2 - F = P_1 - t - (1 + RT)P_1 = -t - RTP \]
Basis Behavior in Simple Case

• Demand increase in the delivery market raises $P_1$
• Basis weakens
• Basis strengthens due to passage of time (convergence)
The Simple Case is Boring

• Now for something more interesting: more complex (but still pretty simple) spatial structure of the commodity market
• Market 1 and Market 2 are at the endpoints of a line segment
• Commodity produced/stored along the segment
• Some of the commodity flows to Market 1, some flows to Market 2
Some Basic Features of the Model

• The two markets compete for shipments of the commodity
• Demand in Market 1 goes up, it draws supplies from a larger fraction of the line segment
• This causes $P_1$ to rise relative to $P_2$: cash basis weakens
• What happens to the futures basis is more complicated: depends on market conditions
Futures Basis When Supplies Abundant

• When supplies are abundant, delivery market in full carry

\[ B = P_2 - F = P_2 - (1 + RT)P_1 = P_2 - P_1 - RTP_1 \]

• Rise in demand in Market 1 causes the basis to weaken because the cash basis weakens and because of the time (carrying-cost) effect: costlier to carry more expensive inventory
Futures Basis in Less Than Fully Carry Markets

• Analysis more complicated when market is at less than full carry

• Again consider a positive demand shock in Market 1

• Cash basis weakens, but $P_2$ rises because supplies fall there (more of the commodity flows to Market 1)

• Futures price rises, but by less than spot price: Contango falls/backwardation increases
Indeterminate Effect of the Demand Shock

• Since both $P_2$ and $F$ go up as a result of the demand increase, we don’t know what will happen to the basis: don’t know how much $F$ will rise, relative to $P_2$ because can’t use full-carry equation

• Basis strengthens if the impact of the demand shock on $P_2$ is bigger than the effect on $F$, and this is possible

• Basis weakens if the reverse is true
An Edge Case

• Supplies extremely short: stockout almost certain before expiration of future
• Demand shock is temporary: expected to go away by futures expiry
• Example, Market 1 is an export point for a processed commodity (e.g., soybean oil) and there is a temporary shutdown of a processor in a location Market 1 exports to
Basis Movements in the Edge Case

• Due to near certainty of stockout and temporary nature of demand shock, $F$ doesn’t change
• Both cash prices rise, and the Market 1 price rises more. Even though the cash basis weakens, the futures basis strengthens
• Basic result: basis more likely to strengthen in tight supply conditions than in abundant supply conditions
Numerical Analysis of Another Market Structure

• Simpler economy. Demand in one market (“terminal market”). Commodity produced and stored in tributary market

• Delivery against futures in terminal market

• Temporary demand shocks

• Use simplified version of the numerical analysis to solve how basis depends on demand shocks and stocks
An Easier Case

• Demand in Market 2 rises
• Both prices rise, but $p_2$ rises more than $p_1$
• $p_1$ rises more than $F$ (theory of storage)
• Therefore, both cash basis and futures basis strengthen
Basis Effects of a Demand Shock

• Demand increase causes cash basis in tributary market to weaken to attract supplies to the terminal market
• Market moves towards backwardation: this tends to strengthen cash-futures basis
• When demand is above average the latter effect dominates: cash-futures basis strengthens
• Effect is stronger, the lower are stocks
Example of the Easy Case

- Propane in 2014 as discussed before
- Demand shock in Midwest due to cold weather
- Cold snap temporary (thankfully!)
- Price in the Midwest (Conway, KS) spiked relative to main pricing benchmark in Texas
- Transportation bottleneck prevented shock from being communicated fully to TX
- Conway basis (vs. Mont Belvieu) spiked dramatically
Propane & the Polar Vortex

Conway-Mt. Belview TET Propane Spread
Some Basic Takewaways

• Basis movements depend on supply/demand conditions
• Where does the supply/demand shock take place?
• Are supplies abundant or scarce? Is the market in backwardation or contango?
More Takeaways

• Basis more volatile under tight supply/demand conditions
• Basis movements can be in same direction or opposite direction of price movements
• Economic frictions (e.g., transportation bottlenecks) make basis more volatile, and more dependent on supply/demand conditions
MANIPULATION
Manipulation—Important & Controversial

• The subject of “manipulation” has been important since the dawn of commodity futures (and securities) trading
• Frequent allegations of manipulation by market participants
• Regulation of futures markets has been largely driven by desire to prevent manipulation
• Shaped popular perceptions of markets
Popular Perception: Serious Literature

FRANK NORRIS

THE PIT
A STORY OF CHICAGO

STREETWISEPROFESSOR.COM

CRAIG PIRRONG
Popular Perception: Games
Popular Perception: Film

A Corner in Wheat

Trading Places
What Is Manipulation?

• This question is more easily posed than answered
• “the word ‘manipulation’... in its use is so broad as to include any operation of the cotton market that does not suit the gentleman who is speaking at the moment.”
• “The methods and techniques of manipulation are limited only by the ingenuity of man.”
My Working Definition

• Intentional conduct that causes market prices to diverge from their competitive level (or, in the case of imperfectly competitive markets, exacerbates divergences between market prices and their competitive level).
Key Aspects of the Definition

• *Intentional*: legitimate trading can move prices, but legitimate traders attempt to mitigate price impact, whereas manipulators specifically intend to cause prices to move.

• *Prices must be distorted* ("artificial" in US legal lingo)
  • This is a legal issue in the US right now: CFTC vs. Wilson *et al*
  • Manipulation causes prices to diverge from competitive values
  • Price distortions cause welfare losses
An Aside on Intent

• In the US, there must be “specific” intent to prove manipulation legally

• What about conduct that has the foreseeable effect of distorting prices, even though that is not the specific intent?
  – Example: Aluminum warehousing. Banks owning warehouses constrained loadout to increase storage revenues, and this foreseeably caused price distortions
Types of Manipulation

• Allen & Gale (1992):
  – Action Based
  – Information Based
  – Trade Based

• Market Power Manipulation (“MPM”): specific type of action-based manipulation, or a separate category
MARKET POWER

MANIPULATION
Market Power Manipulation

• Most important form of manipulation in terms of frequency and economic harm: “Corners,” “squeezes,” “hugs”

• Ostensibly the focus of US futures market regulation (though in practice matters are much more confused and confusing)

• Economically straightforward: exercise of monopoly power as a futures contract moves towards expiry
Price Theory of a Long MPM

- Marginal cost of delivery determines price shorts are willing to pay to repurchase contracts
- Marginal cost of delivery must be increasing for quantities less than and equal to the size of a long’s position: creates downward sloping demand curve
- Long demands excessive deliveries in order to inflate price at which remaining shorts liquidate
- Too many deliveries, too few liquidations
Non-Competitive Pricing: Manipulation

• The foregoing analysis is predicated on the assumption that the market is competitive
• But there is no guarantee that will be the case
• Indeed, futures and forward markets create the potential for the exercise of market power
• Market power can distort forward curves (and basis relations)
Corners, Squeezes, Hugs

• A large trader can sometimes accumulate a futures/forward position that is larger than the supply of the commodity in the delivery market at the competitive price

• Additional supplies can be brought into the market, but only by distorting flows, and distortions are costly

• Upward sloping supply curve in the delivery market due to transformation costs
Exploiting Transformation Costs/Frictions

• By demanding delivery of more than the competitive quantity, a large long can force the market up the supply curve, thereby driving up prices.

• The large long can liquidate his remaining positions at this elevated price.

• If his position is sufficiently larger than the competitive quantity in the delivery market, the profit on the contracts liquidated at the inflated price is larger than the loss he takes on the units delivered to him, making this profitable.
Economic Frictions & the MC of Delivery

- Transportation costs in a spatial market
  - Need to go to progressively more distant locations to secure supplies
  - Due to transportation costs, not all commodities shipped to delivery point will return to origin. Therefore, necessary to bid supplies away from consumers in non-delivery markets
MC Function in a Spatial Market

Fig. 4.—Marginal cost of delivery function

Parameter Values

\[ \phi_0 = 0.2 \]
\[ \phi_1 = \phi_2 = \phi_3 = 0.1 \]
\[ \theta_0 = 3.2 \]
\[ \theta_1 = 4.25 \]
\[ \theta_2 = 4.5 \]
\[ \theta_3 = 4.75 \]
Demand Curve in a Spatial Market

Fig. 5.—Manipulative equilibrium, II
Other Frictions

- Storage Capacity
- Inspection capacity (e.g., Warren Buffett & silver, February 1998)
- Quality differences
Price Effects of a Corner

• Artificial demand for the commodity elevates the price of the manipulated contract (and the spot price) until the manipulation ends

• Anticipation of the corpse being dumped on the market depresses forward price for expiries later than cornered contract

• These effects mean that corners can cause backwardations

• Price of deliverable rises relative to prices of related commodities, or of the same commodity at other locations (i.e., basis effects)

• Spot price crashes when “corpse is buried”
Price Effects of MPM

• Expiring futures & spot prices (which converge) artificially inflated

• Deferred futures price depressed because excess supplies attracted to delivery market

• Thus, calendar spread widens

• Delivery market price rises relative to out-of-position prices: i.e., basis falls

• These price effects reverse suddenly when corner is over
Cocoa Corner

NU Spread, March-July 2010
Burying the Corpse

• A corner works by demanding excessive deliveries
• The cornerer has to dispose of this stuff after the corner is over: it is said that this is the “corpse he has to bury”
• Lose money on burying the corpse
Quantity Effects of a Corner

- Excessive flows of the commodity to the delivery point before the corner ends, excessive flows away from the delivery point after it ends
- Atypical directions of commodity flows (“water flowing uphill”)
- Inventories in delivery market elevated
- Level of inventories high even though market is in backwardation (or less than full carry): completely contrary to what you’d expect if the market were competitive
How Do You Know Somebody Wants to Corner?

• Cornerers make transactions that would otherwise be uneconomic

• They take delivery of the commodity at a higher price than they could obtain it in the markets where they actually want to consume it (example to follow)

• Hold inventories of the commodity even though spreads say that is very costly

• “Sharp pencil tests”
Corner Examples

• Ferruzzi soybeans, 1989
• Sumitomo copper, 1995
• BP propane, 2004
• Cocoa, 2010
• Cotton, 2011
An Example: Ferruzzi Soybean Corner

• In 1989 Ferruzzi accumulated ~20mm bu futures position when deliverable supplies were ~8mm bu, of which Ferruzzi owned half

• There were soybeans in western Iowa, but it was economical to process those locally or to ship them to the Mississippi River to load for shipment to NOLA—shipment to Chicago inefficient
Economic Geography
Ferruzzi’s Impact

• July futures price (and Chicago cash price) rose relative to deferred futures prices, and cash prices outside Chicago

• NOLA basis went from about +35 to -1, and then post-manipulation rose to +40

• Increase in shipments to Chicago, including movements up-river, with barges loaded with beans passing one another along the Illinois River, some going to Chicago, others from Chicago
Event Study Results

Fig. 1. July Soybean futures cumulative residuals.
Ferruzzi’s Intent

• Ferruzzi claimed it needed soybeans to satisfy export contracts “to the Russians” and for domestic processing

• But, taking into account loadout (.06/bu), barge freight (.225/bu), grade differentials (.075/bu #2 delivered vs. #1 export quality), it was $.365/bu to export delivered SY than buy at NOLA for export

• Similar calculation for domestic processing
Welfare Effects

• Distortions in quantities cause deadweight losses
• Distortions in basis and spreads harm hedgers and undermine value of futures contracts as risk transfer mechanisms
• Distortions in price undermine value of futures contracts as price discovery mechanisms
How Can A Long Obtain Market Power?

• A corner is odd because (unlike in conventional settings) long obtains market power from those victimized by it through voluntary transactions with them. How can that happen?

• Pirrong (1995): noise traders provide camouflage. By engaging in a mixed strategy, a trader can accumulate market power with positive probability without being detected.
Short MPM

- Short MPM is possible, but rare
- Short MPM exploits the burying the corpse effect
- Ability to store mitigates this effect, so short MPM is typically profitable only for highly perishable commodities, e.g., onions in Chicago in 1955-1956
- This is why onion futures trading is outlawed in the US!
MPM of Cash-Settled Contracts

• Since MPM relies on long demanding excessive deliveries, couldn’t this problem be fixed by cash settlement?

• No: long can drive up price in the market(s) whose prices are used to determine settlement price by buying excessive quantities there

• Pirrong (2000) shows that delivery contracts that give shorts delivery options are less vulnerable to long MPM than cash-settled contracts
MPM of Electricity

• MPM for a storable commodity involves long holding what is delivered to him off the market while he is liquidating futures

• This is not possible in electricity, because quantity consumed and produced must be equal at every instant of time

• Therefore, manipulation of electricity market requires manipulator have control over generation assets so he can distort output to enhance value of derivatives positions
Implications for Trading

• Don’t do it—it’s illegal (both in the US & the EU)
• Try not to get caught short in a corner
• Commercial intelligence is important: want to know about positions being accumulated in the market, because they might be used to run a corner
• Keep an eye out for anomalous pricing relations, and anomalous commodity flows
TRADE-BASED MANIPULATION
Trade-Based Manipulation: Theory

• Much of the academic literature on manipulation has focused on TBM, primarily because it is the most common type of manipulation in securities markets.

• Jarrow (1992) pointed out a fundamental issue: if buying drives prices up, selling should drive prices down, so how can a manipulator profit?

• Must be some sort of asymmetry.
Sources of Asymmetry

• Trades move prices due to asymmetric information
• Asymmetry in informativeness of trades, e.g., purchases more likely to be informed than sales: manipulator mimics informed buyer (Allen & Gorton)
• Difference in informativeness of trades in derivatives vs. underlying (e.g., Kumar-Seppi) due to differences in information environment
TBM in Commodity Futures

• TBM in commodity futures most likely to involve use of multiple, related instruments (e.g., cash-settled derivative and the underlying, swaps and futures used to settle the prices of OTC swaps)

• Amaranth, 2006

• Optiver, 2008
Optiver: TAS Contracts

• Trade-at-Settle (TAS) contracts unappealing to informed traders with short-lived information, or when competition between informed traders is intense

• Therefore, price impact of TAS trades likely smaller than price impact of market orders in futures (which informed traders more likely to use)

• Optiver exploited this asymmetry
The Optiver Strategy

• Buy (sell) TAS contracts, then trade in large quantity in the opposite direction during the 2 minute settlement window & a few minutes before

• Trading in settlement window largely determined the settlement price: these trades hedged by portion of TAS trades

• Trades prior to the window at a higher (lower) price than settle: remainder of TAS trades covered these trades at a profit
Optiver’s Impact

- Optiver traded in nearby RB, HO, and CL contracts
- Had permanent impact on these prices, and the prices of deferred contracts: also spillovers between RB, HO, CL
- Optiver pocketed about $1 million, but caused price impacts that resulted in the transfer of $100s of millions between those holding positions in the manipulated contracts
Optiver RB “Bully Trades”
US Law

• It has been a crime to manipulate or corner commodities traded in interstate commerce since 1922

• Grain Futures Act (1922)

• Commodity Exchange Act (1936 and subsequent amendments, as late as DFA in 2010)

• Manipulation prevention was the basis for finding the GFA constitutional (legitimate exercise of commerce clause powers)
“Now Let Them Enforce It”

• Enforcement of the anti-manipulation provisions of the CEA has proved very problematic, even in pretty clear-cut corner cases

• With a few exceptions (Cargill v. Hardin, Great Western) decisions have been totally contrary to basic economics

• Egregious cases: Volkart, Cox & Frey, Indiana Farm Bureau
Cox & Frey

• Substantial evidence of a classic MPMBut CFTC determined that respondents couldn’t have caused an artificial price because deliverable supply too large

• To reach this result, Commission included wheat in KC, even though it was highly inefficient to bring that to the delivery point

• Earlier analysis shows that cornerer exploits such inefficiencies to extract supercompetitive price
Indiana Farm Bureau

• Commission found no manipulative intent
• Evaluated intent at time respondents entered position, not when they would have exercised market power
• Requires a trader to exacerbate deliverable supply short to be found guilty of manipulation: but MPM can readily occur without such exacerbating conduct
Self-Inflicted Wounds: Radley

• In a case (US v. Radley et al) arising from a propane corner in 2004, US DOJ argued that BP had manipulated through fraud: did not allege a corner
• Judge found this argument incomprehensible, and threw out the case, because BP did not engage in concealment or fraud
• Pounding a market power peg into a fraud hole
Other Anti-Manipulation Regs

- FTC Anti-Manipulation Rule
- New CFTC Anti-Manipulation Rule (DFA)
- All of these deeply flawed ways at attacking MPM because all are fraud-based: taken directly from securities laws
- Again, the MPM peg and fraud hole problem
European Law

- MAD (2002) and MAR (2014, effective 7/2016) ban manipulation
- Contrary to US practice, these include a detailed list of proscribed actions (including “smoking”)
- MAR too recent to evaluate
- Few cases under MAD. In the UK, sole case involved a drunken trader buying a lot of Brent contracts
- Egregious manipulations (e.g., cocoa in 2010) not prosecuted
Who Should Regulate?

- Should the government be the primary enforcer, or should exchanges be the first line of defense?
- Exchanges can’t handle off-exchange actions
- Many prominent academic have advocated self-regulation, claiming that exchanges internalize costs and benefits of reducing manipulation
Problematic Nature of Self-Regulation

- Exchanges care about volume, but volume doesn’t reflect manipulative costs imposed on inframarginal traders (e.g., hedgers).
- Exchanges face little competition due to liquidity effects, so competition doesn’t force them to adopt efficient rules.
- Historically, exchanges did not adopt anti-corner rules: CBT repeatedly refused to adopt such rules 1867-1922.