Event-Driven Finance

IEOR – Fall 2017

Mike Lipkin, Sacha Stanton
Today I want to discuss a difficult, and often very lucrative but scary group of stocks. These are called: \textit{hard-to-borrow}.

Before I do that, I want to spend some time on the projects. I want to deal with subjects, approach, requirements and presentations.
• Remember what you are attempting to do:
  – Thinking about volatilities and how they expand and contract and change under differing circumstances, or
  – Thinking about prices and how they couple amongst stocks in time, or
  – Thinking about relationships between volatilities or prices across strikes or series.

• Almost certainly you will be doing something involving these points.
• If you are looking at values (for a trade) across time, you should be honest and work in the *risk-neutral* metric.

• **How?**
  • By hedging positions daily and keeping track of the P+L in the hedging instrument as well as via the options.

• Keep a careful eye on time scales – a frequent theme in this class – so that you do not mix apples and oranges.

• Be honest about your selection methods for prices. If you use mbbo, how accurate are your results (as opposed to buying the bid, selling the offer)?
• **Format suggestions for the Presentations**

  • Identify your group
  • Motivation for your project
  • What IVY experiment you performed
  • How the data was utilized and analyzed
  • What the numerical results were
  • What conclusions you could draw

  • Remember you don’t need to have found a tradable result, negative results are acceptable; be honest and thorough

• **Clarity is very important**

• Only 30 minutes per presentation so be succinct.
• The PP presentations, the coding, an outline of the steps taken to analyze the data, and anything else needed to reproduce your work, should all be sent to Sacha and Hal, zipped if necessary.

GOOD LUCK!!
• Certain stocks have limited *floats*.

• Because of current [misguided, *in my opinion*] regulations, stocks may only be shorted if the seller *finds* a lender.

• Clearing firms act as clearing houses for supplies of long stock.

• If a clearing firm cannot borrow stock to cover short holdings, then traders with short positions are subject to **buy-ins**, where the clearing firm acts to force a covering purchase on the trader’s account.

• There are several consequences of these *hard-to-borrow* situations.
  – How the stock trades
  – How the options are priced
• When buy-ins take place, the stock, even in strongly down markets can have extreme, spiky, up days.
• Basically, the stock is artificially taken up and then (around 3:40 ET, typically) purchased for the shorts.
• Imagine you have a delta-neutral position, long 100 calls, short 100 puts and short 10000 shares of stock.
  – \( S_0 = 20.00 \), at 9:30. By 3:40 \( S = 21.80 \) and you are bought in. Although the clearing firm has said you will be bought-in on up to 6400 shares, you don’t know if or how much they have purchased for your account.
  – Scenario A: do nothing
  – Scenario B: sell 3000 shares
  – \( S_{\text{fin}} = 21.00 \)
• Suppose the eventual buy-in was 1426 shares!
  – Case A: you are long 1426 deltas down 80 cents
  – Case B: lucky, you come in the next day short 1574 deltas, but you made $1250.
If you look at hard to borrow stocks, you often see a great deal of spiky behavior.

Hard-to-Borrows are extremely manipulated stocks. Someone who is aware of the potential buy-ins can make large +delta purchases (stock or options or both) early in the day and then sell later at an almost certainly higher price.

- That is why I am personally opposed to restrictions on shorting stocks.
- Holders of long stock can demand the return of their long stock, by refusing to lend it, thus producing a short-squeeze.

Let’s look at a few graphs of hard-to-borrows:
- MIPS and KNOT

And a recent spectacular short-squeeze (VW)
Lecture 7f

Hard-To-Borrow
Volkswagen AG
Porsche’s Short Squeeze

Lecture 7f
Hard-To-Borrows
• Unlike ordinary stocks, h-t-b’s appear to have almost no daily correlation with market indices. (But do they? -a possible project idea-)

• Instead, the presence or absence of a buy-in will often determine the price movement.

• Let’s look at options.
• Calls and puts function differently in h-t-b’s.
• They must have very different value functions.
  – WHY?

• Ordinary Put-Call parity must fail.
  – WHY?
IOC buy-in
3:56 PM Jun 19
427,000 shares
average daily volume ca. 900K
• In normal circumstances, a clearing firm will permit you to short stock and pay you a short rate. Why?

• In a hard-to-borrow situation, they may reduce this rate, or even assess you a negative rate. Sometimes they will forbid a short sale (although this is waived for market-makers hedging a long delta position).

• So the net result of all these factors is that puts and calls are not replacements for long and short stock in the traditional sense.
  – Owning calls makes you long in a way unhedgeable with a stock sale.
  – Puts are invaluable sources of short deltas.
  – Even without a negative interest rate imposed by the clearing firm, put-call parity may imply a negative interest rate.

• Problem Set VI explores hard-to-borrow put-call parity. Let’s work through a simple example:
### MicroHedge [ACTIV] v91.4.0.576 MIKE.3153 - (Google Inc-GOOG) GDOD.G47

*File Edit View Format Parameters AutoQuote Recall! Trade Risk Sheets Tools Help LogOff LiNK!*

**GOOG. =519.35** $40.96 b+619.31 a619.51 l x 2 b625.60 b617.18 cc18.60 c618.39b y2156055 14:30 Divs: None

**Trade Date:** 02/23/12  **Model:** Microhedge  **Type:** Equity  **Exercise:** American

**Volatility:** Using Volatility Skew  **Interest:** 0.4 0.4 0.4 0.4 0.4 0.4

| Net GOOG. | Delta: 0 Ganna: 0 Theta: 0 Vega: 0 Rho: 0 ThdG: 0 Delta: 0 Ganna: 0 Alpha: 0 WtVega: 0 PP: 0 OpenPos: 0 DayTrades: 0 Net: 0 |

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**Jan 620 reverse conversion...**

**call 63.16; put 60.50**

**Copp = 63.16; P copp = 60.25**

**T=324.35=0.9 --- (Copp-P Copp)/20=0.9= 0.605=0.5%**

**Mike Lipkin, Alexander Stanton**

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### Lecture 7f

**Hard-To-Borrows**

![Option Display screenshot](image)

#### Table: Option Prices

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• KKD (Krispy Kreme Donuts) was a typical hard-to-borrow (HTB-ness changes with time. There is a term structure of HTB-ness.)

• Let’s do a quick calculation on the apparent negative interest rate.

• The previous slide shows KKD at the close on expiration, Fri May 19, 2005.
  – \( S_{\text{close}} = 10.20 \).
  – Jan 10C = $1.65; Jan 10P = $1.95. (mbbo)
  – 246 days to Jan expiration = 246/360 = 0.683 y
  – \( C_{\text{pop}} = 1.45; P_{\text{pop}} = 1.95 \)

  – \( C_{\text{pop}} - P_{\text{pop}} = -0.5 \approx R(10)(.683) \)
  – \( R = -0.0732 \)

• So KKD has an implied negative interest rate of 7.3%. 
From 2001 to 2004, Krispy Kreme was extremely hard to borrow, with frequent buy-ins. The candlesticks show the stock was very volatile and high-priced reaching $200 (unadjusted).
The six-month negative rate does not imply that the stock is hard-to-borrow in the near term.

Let’s repeat the analysis for June 10’s:
- Jun 10C = $0.80; Jun 10P = $0.675
- June expiration in 29 days = 29/360 = 0.0806 y
- $C_{pop} = .60; P_{pop} = .675$
- $-0.075 = R(10)(0.0806)$
- $R_{jun} = -9.3\%$

But it still was!

In fact, typically a ter-structure of HTB-ness is declining in intensity.

Problem Set VI looks at KKD over a 2-year period.
- Some of the time it is not hard-to-borrow.
  - What would that mean numerically?
• The negative interest rate your clearing firm charges you (if it charges you one) is not necessarily the same rate you back out from enforced put-call parity.

• Why?

• The fact that you may find put-call parity violated in a given product does not mean that the float is necessarily small or that the stock is hard to borrow.

• What might make put-call parity fail?

• Biotechs awaiting events are one class of stock which frequently sees h-t-b conditions. Here are some examples:
**Lecture 7f**

**Hard-To-Borrows**

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Jan'03 2.50/5.00 put spread (11 months out; 2/20/08).

Midpoint "rule": worth < 1.25

Extremely hard-to-borrow: c(pop)-p(pop) = -0.45
5xRx(331/360) = -0.45, R = -9.8%
Let’s try to calculate a representative lending rate for NRMX. The stock is at $16.32. We’ll look at the Apr 15’s and the Aug 17.5’s.

Days to expiration → Apr 53
→ Aug 173

- $C_{pop} = 1.93; 5.75$
- $P_{pop} = 3.1; 8.67$

- $C_{pop} - P_{pop} = -1.17; -2.92 = Krt = 15(53/360)r_{apr}; 17.5(173/360)r_{aug}$

- $r_{apr} = -53\%; r_{aug} = -34\% !!!!!!!! $
• What does an actual buy-in look like in terms of the time scales involved?

• The following slide shows an actual buy-in in the biotech stock AGIX in early February. Look at the time of day when the buy-in occurred. This is typical of buy-ins.

• What strategies do you think might be successful for putting on short plays in any of these stocks?
Lecture 7f

Hard-To-Borrows

AGIX....Note end of day buy-in
Feb6
Lecture 7f  

Hard-To-Borrows

- A second way to “fix” the put-call parity problem is to “impose” a series of phony dividends.

- Why would this bring puts and calls into line?

- The “cost-of-carry”, cc, is:
  
  \[ cc = e^{rKt} - 1 - d = rKt \text{ (linear approx)} - d \]
  
  \[ cc = rKt - \delta St \]

- So we can replace an negative interest rate with a positive dividend stream.

- Why might this be preferable to using a negative rate?

- In fact, work by Lipkin and Avellaneda:
  

  A Dynamic Model of Hard-to-Borrow Stocks, shows that implied dividend rate is the “correct” way to address HTBs.
• A naïve dividend approach will fail at very high or low strikes because the carry on deep puts competes with their extra value as short deltas…and the early exercise premium exerts itself.

• How does this happen?

• Suppose that $S_0=25$, the 35 and 40 puts in the near month are both –100 delta. Which will be cheaper?

• Note: for normal stocks both these puts will trade at parity, but as hard-to-borrows, the puts may trade may trade above parity. Then the 35 puts will be fatter than the 40’s even if the corresponding calls are both worthless.

• For very low strikes, the calls can become an exercise- even when there is no real dividend! Let’s look again at a previous slide:
Hard-To-Borrows

Jan'03 2.50/5.00 put spread (11 months out; 2/20/08).

Midpoint "rule": worth < 1.25

Extremely hard-to-borrow: c(pop)-p(pop) = -0.45
5×Rx(331/360)=-0.45, R= -9.8%
• In addition to h-t-b, the issue of put-call parity appears frequently and is a very important potential source of profit and loss.

• It figures prominently in several situations.
  – Can you guess any?

• The following page shows a chart of MOT when an event happened.
  • Was this event expected or unexpected?
  • What was the consequence of this event for the price?
  • Someone who was flat with the following position:
    – Jan 09 20: +100C, -100P, -10K shares
    lost a lot of money, while the reverse position made a lot of money:
    – Jan 09 20: -100C, +100P, -10K shares
    – WHY?????
Motorola, Inc. (Public, NYSE:MOT) - Add to Portfolio - Discuss MOT

18.83
Open: N/A
High: N/A
Low: N/A
Vol: 0.00

Pre-Market: 18.75 -0.08 (-0.42%) Mar 2, 8:42AM ET

Tip: You can drag the chart.
NYSE data delayed by 20 min. - Disclaimer

Event-Driven Finance
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Here is a slide from the last lecture. VMW before the Jan 2008 earnings announcement:
Before the earnings announcement, the at-the-money, 2009 conversion traded for -$9.00. After it traded for -$1.80. So the hard-to-borrowness was enormously reduced by the crash. What is the consequence of this?

Suppose you owned 100 puts, 10000 shares of stock and were short 100 calls on the 90-line in Jan 2009.

- What is your naïve delta?
- What is your P/L?
- What was your apparent delta?
• The dividend rate is an *inferred* quantity.
• Companies give guidance but the general rule for successful companies is that the pay-out gradually increases over time.

• When GM was in difficulties, the market priced in a 50% cut in dividends. **How?**

• In the MOT case, the market expected Icahn to force MOT to *increase* its payout.

• Another place where put-call parity is critical is when a two-tier deal is a possibility. This is a complicated subject in its own right but I may discuss it briefly next week when we consider take-overs.
• Why are HTBs part of this course?
• In the pinning case, we seemed to have obvious temporal boundaries of
  – a LARGE trade
  – Expiration
• Here we also have boundaries:
  – “regime of hard-to-borrowness”
  – “regime of easy-to-borrowness”
• In actuality, both pinning and HTB involve feedback
  – Pinning: change in delta $\rightarrow$ impulse on stock price
  – Frequency of buy-ins $\rightarrow$ intermittency/bursting of stock price
• In representing analytically the HTB case we write coupled SDEs whereas in Pinning, the feedback was directly inserted into the form of $dS$
The “simplified” details of this feedback mechanism can be found in the talk “short_3princeton” in Courseworks.

There is a link there to the (harder) paper.

In pinning, we see that the realized vol, $\text{vol}$, is depressed after the large trade until expiration- and the implied vol, $\sigma$, also- until the large OI disappears.

- See JDEC price evolution in lecture 3

In HTB, we see a very similar detail, VMW (p. 32). The realized intraday vol declines after a crash resulting in decreased HTB, and the implied vol also declines.

- The latter is because the theoretical vol of a HTB is a sum of “bare” vol + a term increasing with the buy-in rate
VMW before the Jan 2008 earnings announcement:
(note the lengths of the candlesticks before and after crash)

JDEC in March 2001

Large sale of options on this day
• The moral of the story regarding h-t-b’s is this:

Know Put-Call parity thoroughly!

Next time: take-overs. (Damn exciting stuff!!!!!!)