

**FUNDING INVESTMENTS**  
**FINANCE 238/738, Spring 2008, Prof. Musto**  
**Class 3 – Repo Market and Securities Lending**

**Today:**

- I. What's a Repo?
- II. Financing with Repos
- III. Shorting with Repos
- IV. Specialness and Supply Dynamics
- V. Securities Lending

**I. What's a Repo?**

First, three different terms are equivalent: Repurchase Agreement, Repo, and RP. We'll use Repo.

A Repo is an agreement to sell securities on one day, and then repurchase them on a later day, where the repurchase price is determined in advance

- A Reverse-Repo is just the other side of the transaction
- Nomenclature is more complicated than that, see the bulkpack article
- We'll stick to the term "Repo" here

A repo is simply this: two traders agree today to 1) exchange cash for securities today, and 2) exchange back on a later date, usually the next business day. There are two crucial details

- The terms of the later transaction are fixed today. That is, the traders agree today how much money will be exchanged for the securities on the later date.
  - Therefore, as long as each trader upholds his side of the bargain, the repo *does not* alter each trader's exposure to the value of the securities
- The relation between the cash transferred today and the cash transferred on the later date implies an interest rate
  - The trader who is delivering cash today and getting cash on the later date is effectively lending the cash he delivers, and the interest rate on this loan is the difference between what he delivers and what he gets back

*A Representative Transaction:*

Traders  $X$  and  $Y$  agree today that

- Today:
  - $Y$  pays  $\$F$  to  $X$
  - $X$  delivers security  $S$  to  $Y$
- $n$  days from now:
  - $X$  pays the  $\$F$  back to  $Y$
  - $X$  also pays  $n$  days of interest on  $\$F$ , at annual rate  $r$  to  $Y$ 
    - Interest is  $F(n/360)(r/100)$
  - $Y$  delivers security  $S$  back to  $X$

*What to notice:*

- From  $X$ 's point of view
  - Gets  $\$F$ , pays it back  $n$  days later with interest
  - Getting his security back is conditional on repaying
  - Almost like a collateralized loan, where  $S$  is the collateral
    - Difference is,  $X$  doesn't possess  $S$  while the loan is outstanding
    - Contrast with a home mortgage, or any other mortgage
- From  $Y$ 's point of view
  - Pays  $\$F$ , gets it back with interest
  - Possesses the collateral  $S$  while the loan is outstanding
  - Unaffected by changes in the market value of  $S$  *if* it is repurchased as scheduled
- No necessary relation between  $\$F$  and the value of  $S$

What connects  $F$  and the value of  $S$  is the concerns of  $X$  and  $Y$  about the possibility that the other side of the trade doesn't perform on the repurchase day. Consider the possible scenarios:

**$S$  worth less than  $\$F$ :**

$X$  is supposed to buy the security back for  $\$F$ . Suppose it doesn't.

- $Y$  still has  $S$ , and can sell it at the current bid price
- But  $S$  is worth less than the  $\$F$  that  $Y$  paid out in the first place, so  $Y$  takes a loss

Therefore,  $Y$  is exposed to  $X$ 's credit risk to the extent that the bid price for  $S$  could be less than  $\$F$  on the repurchase day

$Y$  can defend against this possibility by requiring  $F$  to be some amount less than the *initial* bid price of  $S$ . This amount is called the *margin*

- If the security's price has historically been very stable, then a small margin will do
  - If the price hardly ever changes more than  $x\%$  over  $n$  days, then  $Y$  is well-protected if  $F = (\text{bid price of } S)/(1+x)$
  - Bulkpack article shows the higher margins for riskier securities

**$S$  worth more than  $\$F$ :**

Suppose the repurchase day arrives, and  $X$  is somehow prevented from exchanging  $\$F$  for the security

- $X$  suffers a loss; instead of the value of  $S$ ,  $X$  has  $\$F$  which is lower
- $X$  can defend against the possibility of such a loss by requiring that  $F$  be *more* than the initial value of the security
  - *Undercollateralization*. This is called *reverse margin*.

The operative question is whether there is a meaningful possibility of this happening

- $Y$  could go into bankruptcy, and the bankruptcy judge could try to nullify the agreement
  - Views  $S$  as an asset that  $Y$ 's other creditors should get a piece of
- $Y$  could itself try to nullify the agreement, either legitimately or fraudulently, to get the profit

The actual likelihood of these scenarios is not clear from legal precedent. But reverse margin does occur in situations where the borrower of funds is nervous about the lender

EXAMPLE:

Repo rates on 1/7/08:

10:33 REPO/REVERSE RP O/N & TERM Index WX Page 1 / 3

SECURITY	TIME	LAST	CHANGE	OPEN	HIGH	LOW	CLOSE
GOVERNMENT							
Repo							
Dealer pays int							
4RPGT01D	10:21	3.90	--	3.98	3.98	3.90	3.90
5RPGT01W	10:21	3.95	--	3.95	3.95	3.95	3.95
6RPGT02W	10:21	3.95	--	4.00	4.00	3.95	3.95
7RPGT03W	10:21	3.90	-.05	4.00	4.00	3.90	3.95
8RPGT01M	10:21	3.90	--	3.95	3.95	3.90	3.90
9RPGT02M	10:21	3.75	--	3.75	3.75	3.75	3.75
10RPGT03M	10:21	3.60	-.10	3.75	3.75	3.60	3.70
Reverse Repo							
Dealer earns int							
13RVGT01D	10:21	4.05	-.05	4.01	4.05	4.01	4.10
14RVGT01W	10:21	4.10	+.05	4.05	4.10	4.05	4.05
15RVGT02W	10:21	4.10	+.05	4.10	4.10	4.10	4.05
16RVGT03W	10:21	4.05	--	4.10	4.10	4.05	4.05
17RVGT01M	10:21	4.00	--	4.05	4.05	4.00	4.00
18RVGT02M	10:21	3.85	--	3.85	3.85	3.85	3.85
19RVGT03M	10:21	3.75	-.05	3.85	3.85	3.75	3.80

PAGE FOR MTGE REPO

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000  
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.  
 6576-335-1 07-Jan-08 10:33:34

So if you want to do an overnight repo with a bond dealer where you are the one borrowing money (when you're financing a purchase of a bond) then you'll pay 4.05% interest to the dealer

- But if you are the one borrowing the security, and therefore lending money, you'll get less interest, 3.90%
- Note that the concurrent Fed Funds rate is 4.25%

Bloomberg Repo analysis for the current 10yr, as of 1/7/08:

```

<HELP> for explanation.                               Govt RRRRA
Enter <1><GO> to send screen via <MESSAGE> System.
REPO/REVERSE REPO ANALYSIS
ISIN: US912828HH67
US TREASURY N/B T 4 1/4 11/15/17 103-08 /103-08+ ( 3.85 /85) ML @10:25
CUSIP: 912828HH6

SETTLEMENT DATE 1/ 7/08 a RATE ( 360) 4.0500% g
<SETTLEMENT PRICE> <MARKET PRICE>
PRICE 101.2133565 103-8
YIELD 4.0985443 i 3.8500478 d COLLATERAL 102.0000% OF MONEY h
or HAIRCUT % OF MONEY
ACCRUED 0.6188187 0.6188187 b Y/N HOLD COLLATERAL/HAIRCUT Y
FOR 53 DAYS. Y/N BUMP ALL DATES Y
ROUNDING 1 1 = NOT ROUNDED
TOTAL 101.8321752 f 103.868819 c 2 = ROUND TO NEAREST 1/ 8

FACE AMT M 1000 e <OR> SETTLEMENT MONEY 1018321.75 j
<OR> To solve for PRICE: Enter NUMBER of BONDS, SETTLEMENT MONEY & COLLATERAL
TERMINATION DATE 1/ 8/08 f <OR> TERM (IN DAYS) 1
ACCRUED 0.630495 FOR 54 DAYS.

MONEY AT TERMINATION
WIRED AMOUNT 1,018,321.75
REPO INTEREST k 114.56
TERMINATION MONEY 1,018,436.31
NOTES:

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2008 Bloomberg Finance L.P.
6576-335-0 07-Jan-08 10:34:08
  
```

- Trading 103-08/08+
- Same-Day Settlement Assumed (a)
- Accrued Interest is  $(53/182)(4.25/2) = 0.6188$  (b)
- Invoice bid price is  $103 + (8/32) + 0.6188 = 103.8688$  (c)
- Yield to Maturity @ bid price = 3.85% (d)

Bloomberg calculates a repo of this note, assuming

- \$1M face value (e)
- Next business-day termination (f)
- 4.05% interest rate (g) from the screen above
- Sale/Repurchase amount =  $1/1.02$  of Security value at the bid (h)

So

- Sale/Repurchase amount (per \$100 face) =  $103.8688/1.02 = 101.8322$  (i)
- So for \$1M face value it is \$1,018,321.75 (j)
- Interest =  $(\$1,018,321.75)(1/360)(4.05/100) = \$114.56$  (k)

So if you had \$1M face value of this note, you could (at these terms) borrow \$1,018,321.75 for a day, paying \$114.56 interest.

Bloomberg does some calculation to help you think about the margin

- If the market bid price drops from 103:08 to 101.2134, i.e. about 101:07, then the margin is wiped out (security value = loan amount)
- Yield corresponding to 101:07 is 4.10 (1)
- So: *If* the bid yield rises from its current 3.85 up to 4.10, *then* the value of the bond will be just enough to make the money lender whole if the money borrower defaults. If the yield rises any *more* than that then the collateral cannot make the money-lender whole, so he is exposed to the borrower's default risk.

## II. Financing with Repos

Repos are how bond-market participants finance their portfolios. Let's stick with the same example to see how you could finance an investment in \$1M of the current 10yr

- Purchase price, at the ask of 103:08+, is
  - $103 + 8.5 / 32 + 0.6188 = 103.8844$  per \$100 face value, so \$1M face value costs \$1,038,844. Where to get it?
- Repoing out the bond, as we just illustrated, brings in \$1,018,322
  - You only need  $\$1,038,844 - 1,018,322 = \$20,522$  in cash
  - Remember all that talk about hedge funds like LTCM engaging in 50:1 leverage? This is where that's coming from.
  - Daily cost of the loan is the \$114.56 interest on the borrowed money, plus any capital charge on the \$20K you're paying in

So to buy \$1M FV of this note from Z by means of a repo with Y, X could (simultaneously)

- Get \$1,018,322 from Y, and add \$20,522 from his own account
- Deliver the \$1,038,844 to Z
- Get the note from Z and deliver it to Y
  - Z is now out of the picture

On the following day

- X gets the note back from Y, and sells it at the current bid price
  - *Note that there will be 1 more day of accrued interest*
- X pays \$1,018,322 plus \$114.56 interest to Y
  - *So if quoted bond prices do not move (i.e. the quoted prices are still 103-08/08+ the next day) then X's net profit is one day of accrued interest, minus the bid/ask spread, minus the interest paid on the repo (and also minus any opportunity cost on the \$20K capital)*
    - *1 day of accrued interest =  $(1/182)(4.25/2)(1000000/100) = 116.76$*
    - *Bid/Ask Spread =  $(0.5/32)(1000000/100) = 156.25$*
    - *Repo Interest = 114.56*
    - *Net profit =  $116.76 - 156.25 - 114.56 = -154.05$*

Y's total profit/loss is just the \$114.56 interest income

So, using the Repo market, you can take a position in a \$1M bond with just \$20K cash

As the security in question becomes riskier, you need more cash

- The 2% here reflects the 2% margin assumption, which is common
- If you needed 10% margin, it would require \$100K

Two categories of repo

- Overnight repo, repurchase is the next business day
- Term repo, longer

### III. Shorting with Repos

In the above example, the repo was *X*'s idea, to finance his long position in \$1M face value of the note. But the repo could instead have been *Y*'s idea, to facilitate a *short* position in the note, i.e. to

- Sell the note at the current bid
- Buy the note at a later ask

*Here's how it works:*

*Y* agrees to sell \$1M FV of the bond to *W* for the bid price of \$1,038,688, and arranges to get the note, for delivery to *W*, by means of a repo with *X*. So (simultaneously)

- *W* delivers \$1,038,688 to *Y*
- *Y* delivers \$1,018,322 to *X*
  - I'm assuming here the same 2% margin as in the previous case. In practice the short-seller might expect less margin (and therefore have to deliver more cash) since the originator of a transaction generally has to make some concession to get the trade done, and less margin means less protection for the lender of cash
- *X* delivers the note to *Y*, and *Y* passes it on to *W*
  - *W* is now out of the picture

The next day,

- *Y* buys the note at the current ask, and delivers it to *X*
- *X* pays *Y* \$1,018,322 plus 1 day of interest @ 3.90% (from the screen above), which is \$110.32

So *Y*'s total profit/loss is

- Pays the bid/ask spread, **\$156.25**
- Also pays 1 day of accrued interest, **\$116.76**
- Gets the interest on the collateral, **\$110.32**
- Plus any price change that occurs

*X*'s total profit/loss is just the \$110.32 interest expense

- Just borrowed \$1,018,322 for a day, using his bond as collateral

*Y* could facilitate a longer-term trade with either a term repo, or by a sequence of overnight repos

Motive could be speculation, but often it is hedging

- Investment bank commits on Thursday to the price it will pay for a bond issue on Friday, so they lose money if bond prices tank in-between
- Lay off the risk with a short position
- Ten-year and Five-year notes are especially popular for that purpose
  - Especially for mortgage-backed securities, which have a similar duration
- Maybe you would go short in the futures market rather than the spot market, but the trader on the long side of the futures contract will want to lay off *his* exposure, so *he* would go to the spot market

#### IV. Specialness and Supply Dynamics

One way to look at the shorting example is that *Y* offers to lend to *X*, provided that *X* uses the 10-year note as collateral

- Other bonds won't do; *Y* needs *that* bond to deliver to *W*

Now suppose *lots* of traders want to short the 10-year note, and they're all trying to lend to *X* for that purpose. *X* can tell them

- I've got something you need, so you'll have to pay up
- Since you're lending, the way to pay up is to lower the interest rate

When the interest rate on repos of a specific bond drops below the general repo rate, that bond is said to be *on special*, and the difference between its repo rate and the general rate is called its' *specialness*.

## On 1/7/08, Bloomberg reports the following:

### **U.S. Repo Open: Old Five-Year Note Is at Lowest Rate of 2.6%**

By Ye Xie

Jan. 7 (Bloomberg) -- The following is a summary of early trading in the market for U.S. repurchase agreements, or repos, in New York. All repo rates are for overnight transactions based on trading at nine repo brokers, as reported to GovPX Inc., a unit of ICAP Plc, the world's largest interdealer broker.

#### **Lowest Repo Rate as of 8 a.m. New York time:**

The old five-year note, a 3 3/8 percent coupon maturing in November 2012, opened with the lowest repo rate: 2.6 percent.

#### **Other Rates:**

Current two-year note: 4.05 percent  
Old two-year note: 3.75 percent.  
Current three-year note: 3.45 percent.  
Old three-year note: 3.90 percent.  
Current five-year note: 3.80 percent  
Current 10-year note: 3.35 percent  
Old 10-year note: 4.05 percent.  
Current 30-year bond: 4.05 percent.  
Old 30-year bond: 4 percent.

Current issues are the most recently issued securities, and old issues are those sold previously with the same maturity.

Specific Treasury securities in the greatest demand are considered to be "special." Firms that want to borrow them are willing to lend money overnight at rates below those on general collateral or other Treasuries in exchange for them.

#### **Behind the Numbers**

Securities firms use repos to borrow money to finance positions in Treasury, corporate and mortgage-backed securities. They also borrow securities on reverse repos to make deliveries of sales of securities the dealers don't own, and engage in speculative repo trading based on expectations for the future direction of interest rates.

Current five- and 10-year notes often trade at the lowest repo rates because they are widely used as hedges against positions in corporate, mortgage and global debt.

#### **General Collateral**

Delivery repos: 4.15 percent. The collateral is sent to an investor's bank against receipt of funds.

Triparty repos: 4.18 percent. A clearing bank acts as a third party to make sure there's adequate collateral behind the repo and that it conforms throughout the life of the transaction to the investor's requirements, providing the customer with an additional layer of safety.

Securities firms are willing to pay higher rates to borrow money through triparty repos because they can allocate leftover collateral at their clearing bank late in the day as backing for the transactions, saving on delivery costs

Rates on general repos, or those backed by non-specific collateral, are usually set slightly below federal funds levels.

#### **Treasury Bills**

The three- and six-month Treasury bills opened at 4.15 percent.

#### **Federal Funds**

Federal funds, the overnight inter-bank lending rate, traded at 4¼ percent, matching the Federal Reserve's target rate, according to ICAP.

So the general repo rate on 1/7/08 was 4.15%, but the rate for repos of the current 10-year note was 3.35%, 80bp lower. This 80bp is its specialness.

- Increases the cost of shorting the bond
- Decreases the cost of financing a long position in the bond

The article Repo Rate Patterns for New Treasury Notes observes that a bond's specialness is concentrated early in its life, when it is on-the-run

- Starts near zero in the first weeks after issuance
- Grows steadily over the ensuing weeks, reaching a peak around the time when the next auction for that maturity is announced
- Plummet to zero
- The bulkpack article looks at a time when 5-year auctions were 3 months, rather than 1 month, apart.

Rationale for this pattern is related to our discussion last time:

- Major investment houses are big bidders in the auctions, but are not long-term investors
- Long-term bond investors, such as pension funds and insurance companies, accumulate their positions while spreads are low
- So the supply of the on-the-run issue in the hands of repo-market participants decreases over time
- Once it is scarce enough, specialness sets in and remains as long as shorting demand is strong

## V. Securities Lending

Whenever you make a short sale, not just of Treasuries, you are selling securities you don't have so you need to get them somehow, to deliver them. In the equity market, you would go to a securities lender and the transaction would be similar to a repo.

### *EXAMPLE:*

You short 40,000 shares of GE, which is selling for \$35 bid, \$35.1 asked. Now you need the 40,000 shares to deliver to the guy you sold to. The securities lender tells you

- The shares are currently worth  $40,000(35) = \$1.4\text{M}$ . I'll lend you 40,000 shares this way
  - You give me  $\$1.4\text{M}(1.02) = \$1.428\text{M}$  cash collateral
    - Note, reverse margin
  - I give you 40,000 shares
  - Tomorrow,
    - I'll give you interest on the  $\$1.428\text{M}$  at the general repo rate *minus*  $n$  basis points (called the interest *rebate*)
    - If GE went up, you'll give me more collateral. If it went down, I'll return some collateral, keeping the reverse margin at 2%
  - We'll keep going like that until one of us wants out, at which point
    - You return the shares
    - We return the cash collateral

### *What's going on here:*

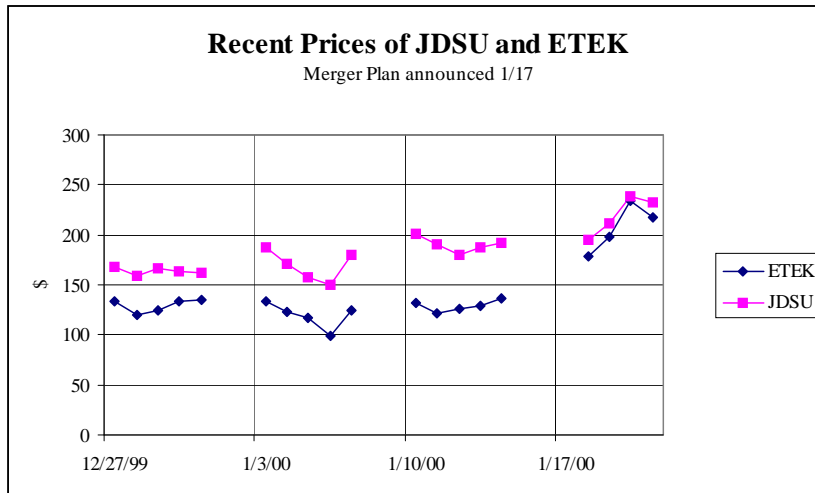
- The securities lender needs the collateral to protect against you not returning the shares
- Your proceeds from the short sale are invested at the short rate, minus  $n$  basis points
- The  $n$  basis points is essentially the securities-lending fee
  - The lender invests the collateral at the general repo rate, keeps  $n$  basis points of this interest income for itself, and gives you the rest

When stocks go on special, the rebate goes down, or in other words  $n$  goes up.

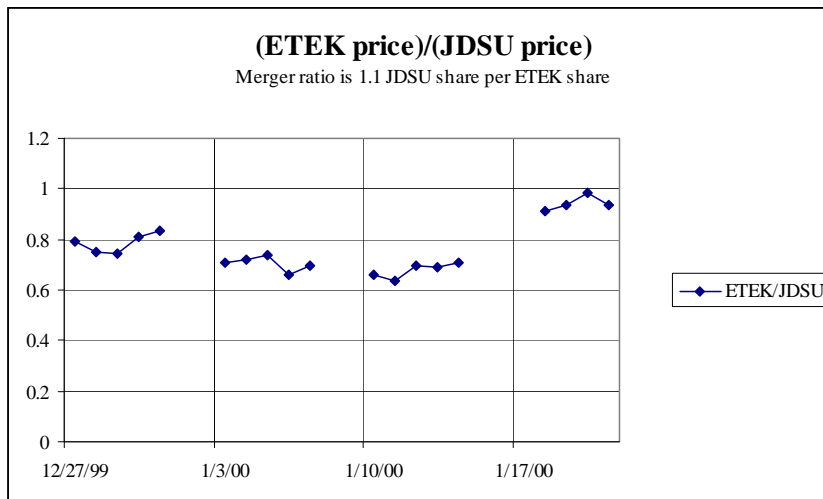
*EXAMPLE from Internet days: JDSU and ETEK:*

On 1/17/00, JDS Uniphase (**JDSU**) announced plans to merge with E-TEK Dynamics (**ETEK**). If this plan goes through, each share of **ETEK** will be exchanged for 1.1 shares of **JDSU**.

- On the final date, price of **ETEK** should be at least 1.1 times the price of **JDSU**, or else there's an arbitrage
  - Buy 1 ETEK, exchange for 1.1 JDSU, and sell that



**ETEK** rallied on the announcement, but remained below (1.1)**JDSU**:



On Friday 1/21/00, **JDSU** was 233 1/8, **ETEK** was 218. Suppose you

- Bought 10,000 **ETEK**, payout is \$2,180,000
- Shorted 11,000 **JDSU**, brings in \$2,564,375, so net = \$384,375
  - Have to borrow the **JDSU**, that's also going to cost

*Merger goes through:*

- Exchange your 10,000 **ETEK** for 11,000 **JDSU**
- Return the 11,000 **JDSU** to the lender, you're all done
- Net profit is the \$384,375 *minus* the cost of the borrow
- Cost of the borrow depends on
  - How many days until the merger
  - Specialness between now and then

*Merger doesn't go through:*

- **ETEK** would drop relative to **JDSU**, and you'd have to buy **JDSU** to return to the lender. You could lose a lot of money.

### ***ON SPECIAL***

This arb appears to be popular, because **JDSU** is getting expensive to borrow

- General rebate rate was 5¼%
- For **JDSU**, 3%
  - Extra daily cost of the trade above is
    - $(\$2,564,375)(1.02)(1/360)(.0225) = \$163.48$
    - This cost goes up as the rebate goes down

During the Staples/Office Depot merger speculation, rebate rate dropped to *minus 20%*

- Then, the merger didn't go through

***(The JDSU/ETEK merger went through on 6/30/00, so this trade made money.)***

Securities lending can be a meaningful source of income for an institutional account like a pension or mutual fund, particularly if it is:

- Indexed, since this means it holds stocks for long periods, and therefore can lend without needing the shares back anytime soon, and
- Small-cap focused, since these are more likely to be hard to borrow, and therefore on special

For example, the Vanguard Small Cap Index Fund reports \$13.7MM of security-lending income for 2006

- Offsets 66% of the fund's total expenses of \$20.8MM