

Repurchase Agreements

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Outline

- Introduction
- Definition and details
- General collateral repos
- Special collateral repos
- Settlement fails, securities lending, and squeezes
- Asset pricing effects of repo specialness

Introduction

- **Repurchase agreements (repos or RPs)** are short-term (often overnight) loans secured by collateral.
- Repos enable the financing of short positions as well as long positions.
- Repos thereby facilitate market making, hedging, and speculative activities.
- Repos are fundamental to the smooth functioning of the Treasury securities market in particular, and fixed income markets more generally.

Definition

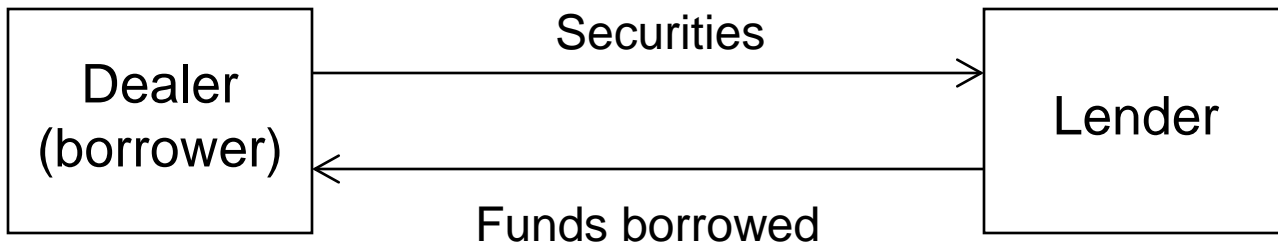
- A repo is a sale of securities coupled with a commitment to rebuy the securities at a specified price on a future date.
- Future price is usually slightly higher than the sale price, with the increase in price the interest paid on the loan.
- Repos are thus similar to collateralized loans.

How Repos Work

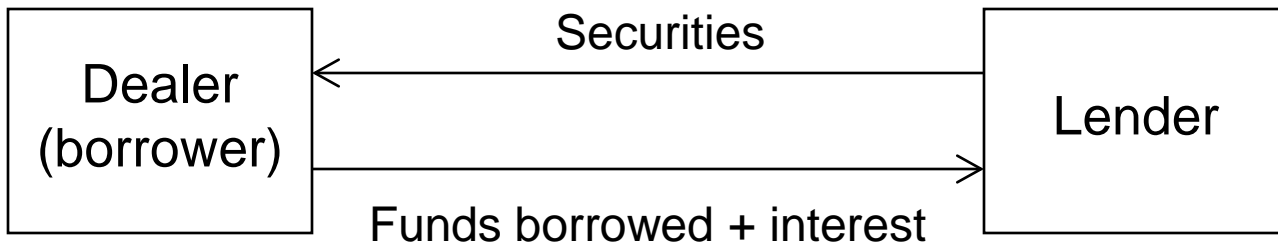
- At **starting leg**, borrower of funds delivers securities and receives cash, and lender of funds receives securities and delivers cash.
- At **closing leg**, borrower of funds returns cash plus interest and receives securities back, and lender of funds receives cash plus interest and returns securities.
- If borrower of funds defaults on repurchase obligation, lender of funds can sell the borrower's securities.

Repo Diagram

Starting leg:



Closing leg:



Terms of Repos

- **Overnight repo** (one business day) is most common.
 - Roughly half the market.
- Otherwise, agreement is a **term repo**.
 - Terms up to three months are common.
- **Open repo** is an overnight repo that rolls over automatically.

Settlement of Repos

- Starting legs of repos typically settle the same day.
- In contrast, **outright** Treasury and other fixed income security trades typically settle the next business day.
 - Outright terminology is used to identify regular transactions of securities as opposed to repo transactions involving securities.

Repo Market

- Over-the-counter market (like outright market).
- In interdealer market, brokers arrange transactions on a blind, or undisclosed basis (like outright market).
 - Recent growth in electronic trading (like outright market).
- Trading begins about 7 am, remains active until about 10 am, and activity is then light until market closes at 3 pm.
 - Differs from outright market because of same-day settlement (securities wire closes at 3 pm).

Reverse Repos

- A **reverse repo** is just the other side of a repo transaction. That is, a purchase of securities coupled with a commitment to resell them on a future date.
- Securities obtained as collateral in a reverse repo are said to be **reversed in**.
- Repo and reverse repo terms are based on the dealer's perspective.
 - If a dealer borrows cash, it's a repo.
 - If a dealer lends cash, it's a reverse repo.

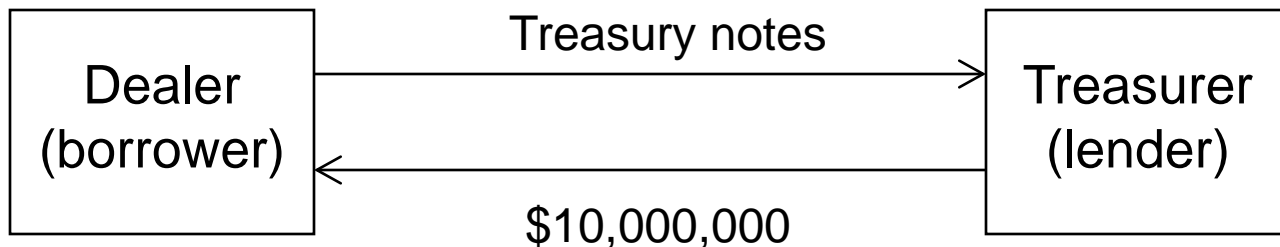
Repo Interest Calculations

- Interest is calculated on an actual/360 day basis.
- Simple interest is used (no compounding).
- For example, the overnight interest on \$10 million (principal amount) borrowed through an overnight repo at an interest rate of 3% is \$833.
- $\$833 = \$10,000,000 \times 3\% \times 1/360$

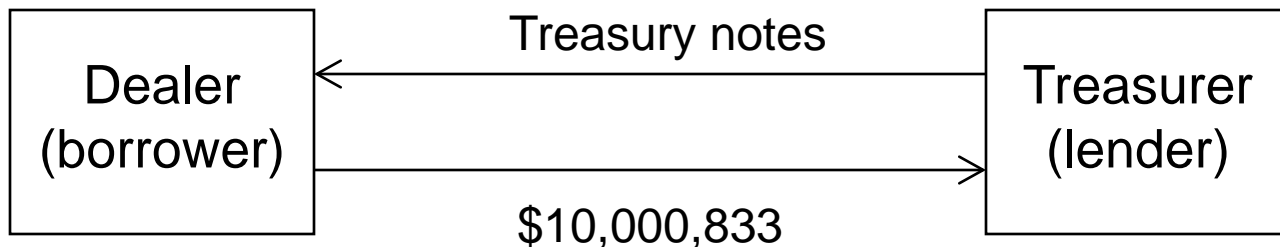
Example

- A dealer borrows \$10 million from a corporate Treasurer on an overnight repo at an interest rate of 3% and pledges Treasury notes as collateral.

Starting leg (day t):



Closing leg (day t+1):



Credit Risk

- There is credit risk in repos because collateral value can change and because counterparties can default.
- Suppose a mutual fund lends a dealer cash and takes in Treasury notes as collateral. Then suppose the dealer defaults and cannot buy the notes back. If the value of the notes has fallen, then the fund suffers a loss.
- Credit risk concerns can also go the other way, so that the lender of cash defaults and cannot return the securities.

Mitigating Credit Risk

- Requiring margin (or a **haircut**) on collateral.
 - Lenders of cash often require a margin, or overcollateralization, to limit credit exposure.
- Marking to market on a regular basis.
 - If the collateral value changes too much, collateral levels or loan balances are adjusted.

Note: Federal Reserve Discount Window margins table gives some sense as to how margins vary by security type and maturity (although discount window loans are not repos):

<http://www.frbdiscountwindow.org/discountmargins.cfm>.

Haircut Example

- In our earlier example, a dealer borrowed \$10 million from a corporate treasurer while pledging Treasury notes as collateral.
- Suppose the treasurer imposed a 1% haircut.
- The dealer then needs to pledge enough collateral so that \$10 million remains after the haircut.
- That is,

Collateral pledged \times 99% = \$10 million, or

Collateral pledged = \$10,101,010

General Collateral Repos

- A **general collateral** (GC) repo is a repo in which the lender of funds is willing to accept any of a variety of securities as collateral.
- Acceptable collateral might be limited to Treasuries, or Treasuries maturing in less than 10 years, or it might include other securities, such as agency debt or MBS.
- Lender is mostly concerned with earning interest on money and having possession of assets that can be sold quickly and with low transaction costs in the event that the borrower defaults.
- GC repo is thus a device for borrowing and lending money.

Uses of General Collateral Repos

- Dealers and other levered accounts (such as hedge funds) use as an inexpensive way to finance positions.
- That is, dealer can buy security and use security as collateral to finance (that is, pay for) the purchase.
 - This amounts to a forward purchase of the security (that is, establishing a long position with no cash upfront).
 - Financing is inexpensive because collateral is provided.
- Money market funds, corporate treasurers, and others with cash to invest use as safe money market instrument.

Note: For information on repo use by primary dealers, see the *Weekly Release of Primary Dealer Transactions*:

<http://www.newyorkfed.org/markets/primarydealers.html>.

Example

- Suppose dealer buys \$1 million par of June 30, 2009 2-year note (4.875% coupon) on Thursday, August 14, 2007 for regular settlement at bid price of 101-12.
 - Quoted price = \$101.375/\$100 par
 - Accrued interest = $\$100 \times 46/184 \times 4.875\%/2 = \$0.609375/\$100$ par
 - Invoice price = \$101.984375/\$100 par
 - Invoice price = \$1,019,843.75/\$1,000,000 par
- Suppose dealer finances August 15 payment by repoing out security at overnight GC Treasury repo rate of 4.3%.
 - That is, dealer borrows \$1,019,843.75 against the note (assuming no haircut).

Example (Continued)

- Repo is closed when dealer gets security back on August 18 and makes payment of principal plus interest.
 - Dealer pays \$1,020,209.19 ($\$1,019,843.75 + \365.44 , where $\$365.44 = \$1,019,843.75 \times 4.3\% \times 3/360$)
- Suppose dealer sold note August 15 for August 18 settlement at new ask price of 101-16.
 - Quoted price = 101.5/\$100 par
 - Accrued interest = $\$100 \times 49/184 \times 4.875\%/2 = \$0.649117/\$100$ par
 - Invoice price = $\$102.149117/\100 par
 - Invoice price = $\$1,021,491.17/\$1,000,000$ par

Example (Continued)

- Initial trade was August 14, but nothing settled that day.
- On August 15, dealer paid and received equal amounts of cash on outright purchase and starting leg of repo, and received and delivered same security. Outright sale was also transacted that day.
- On August 18, dealer received and delivered same security on closing leg of repo and outright sale, and paid \$1,020,209.19 on closing leg of repo and received \$1,021,491.17 on outright sale.
- Dealer's net profit was \$1,281.98.

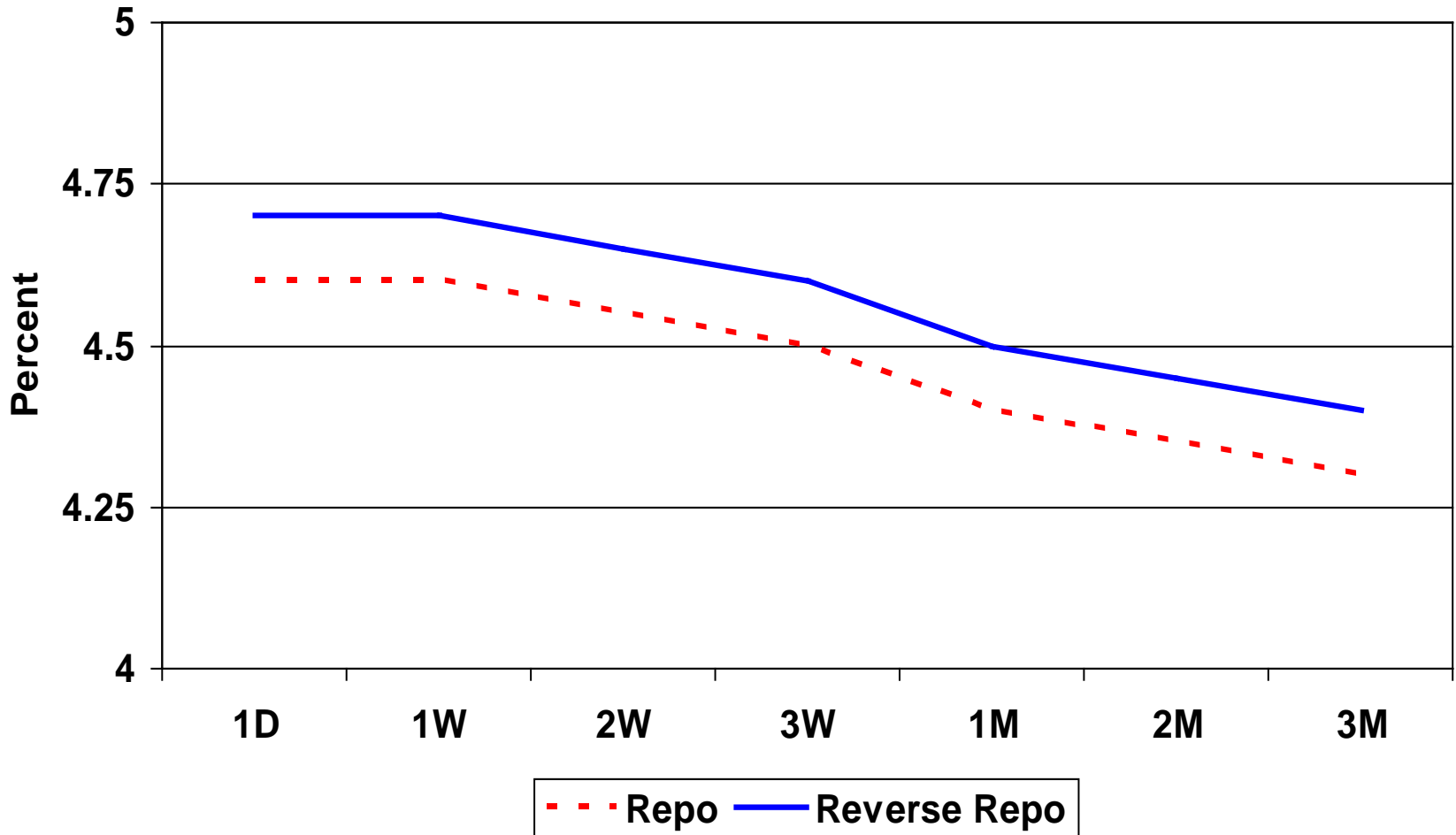
Carry

- Market participants often divide profit into part due to price changes and part due to **carry**.
- Profit = price change + interest income – financing cost, where price change is based on flat or quoted price.
- Carry = interest income – financing cost
- In example, dealer's net profit was \$1,281.98.
- Profit = \$1,250 + \$397.42 - \$365.44
 - \$1,250 is due to price change.
 - \$31.98 is due to carry.
 - Carry is positive in this example (positive carry is typical when the yield curve is upward sloping).

Running a Matched Book

- A dealer may also act as a market maker (intermediary), entering into repos with some customers and offsetting reverse repos with other customers.
- Dealer is compensated by bid-ask spread: dealers' borrowing rates are lower than lending rates (that is, repo rates are lower than reverse repo rates).

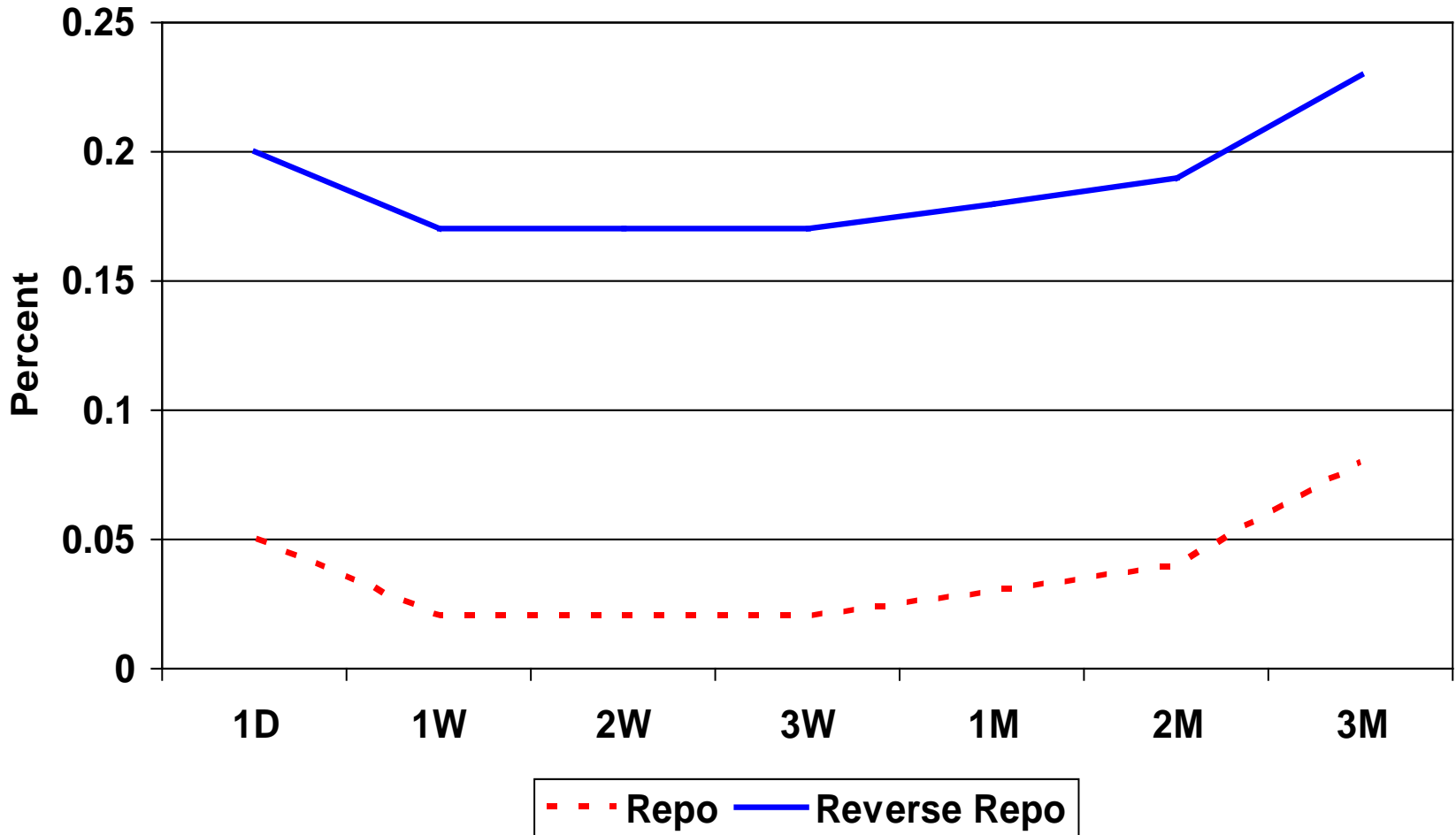
Repo Rates and Reverse Repo Rates: October 22, 2007



Source: Bloomberg.

Note: Plotted repo and reverse repos rates are for Treasury general collateral.

Repo Rates and Reverse Repo Rates: November 2, 2009



Source: Bloomberg.

Note: Plotted repo and reverse repos rates are for Treasury general collateral.

Monetary Policy Implementation

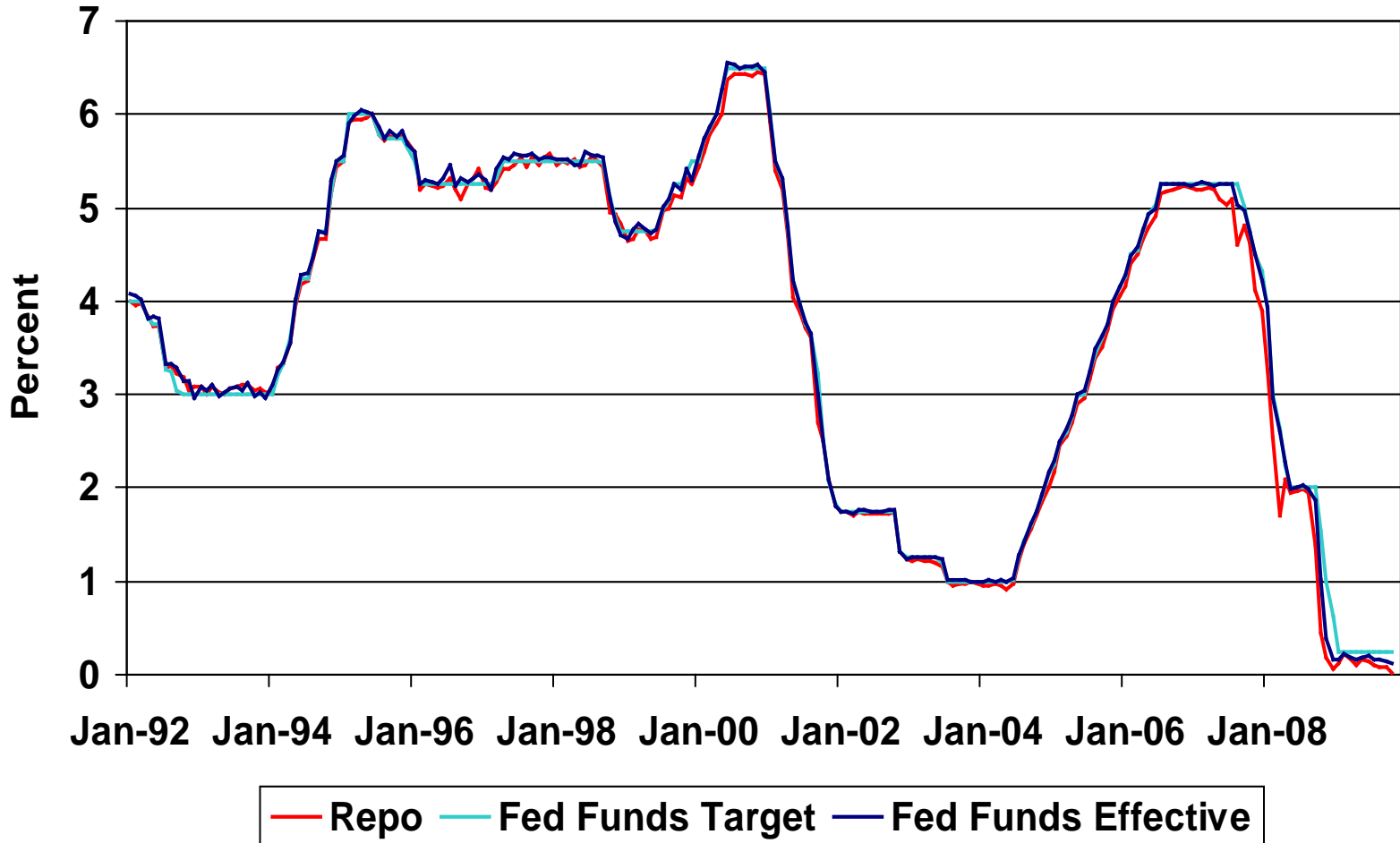
- Repos and reverse repos are used by the Fed to implement monetary policy.
 - A repo temporarily adds reserves to the banking system.
 - A reverse repo temporarily drains reserves.
- Operations conducted with primary dealers via auctions.
- Three types of general collateral accepted in repos: Treasuries, agencies, and MBS.
- Asset-specific haircut is applied to collateral.
- Typical term is overnight, but up to 65 days possible.

Note: For more details on the Fed's use of repos, see:
<http://www.ny.frb.org/aboutthefed/fedpoint/fed04.html>.

Determinants of GC Rates

- GC rates generally track those on other money market instruments, taking credit risk differentials into account.
- Overnight GC rate is typically less than fed funds rate because fed funds transactions are not secured.
 - 7-8 basis point spread, on average, since January 1992.
- GC Treasury rates are typically less than GC agency and MBS rates.
 - 4 bp and 7 bp spreads, on average, since January 1992.
- GC rates are typically higher than those on Treasuries of comparable maturity, because Treasuries are safer.
- Changes in credit concerns drive changes in spreads.

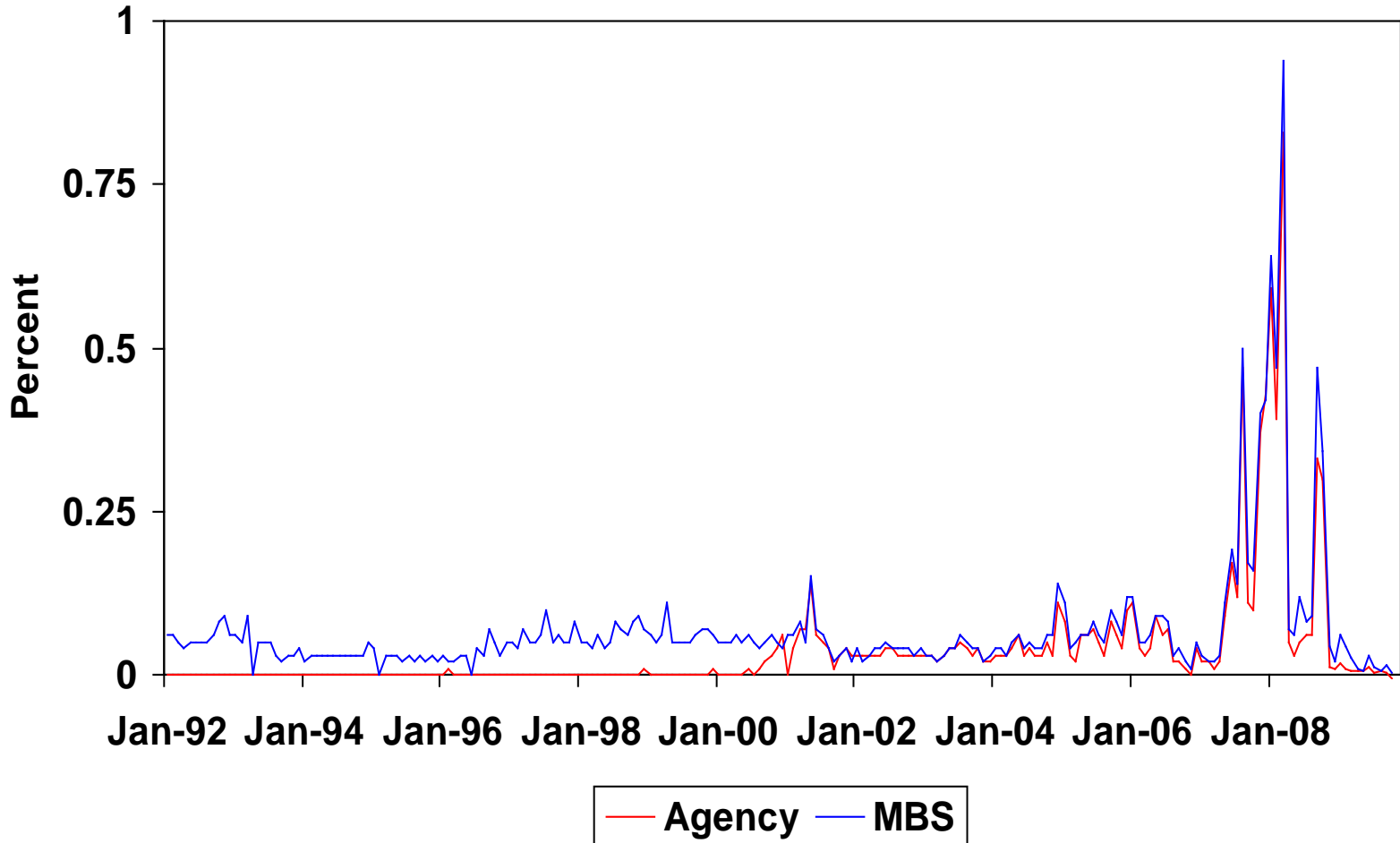
Overnight Fed Funds and Repo Rates



Sources: Bloomberg, Federal Reserve.

Notes: Average rates by month. Plotted repo rate is overnight Treasury general collateral rate.

Agency and MBS GC Spreads



Source: Bloomberg.

Note: Average overnight spreads to Treasury collateral by month.

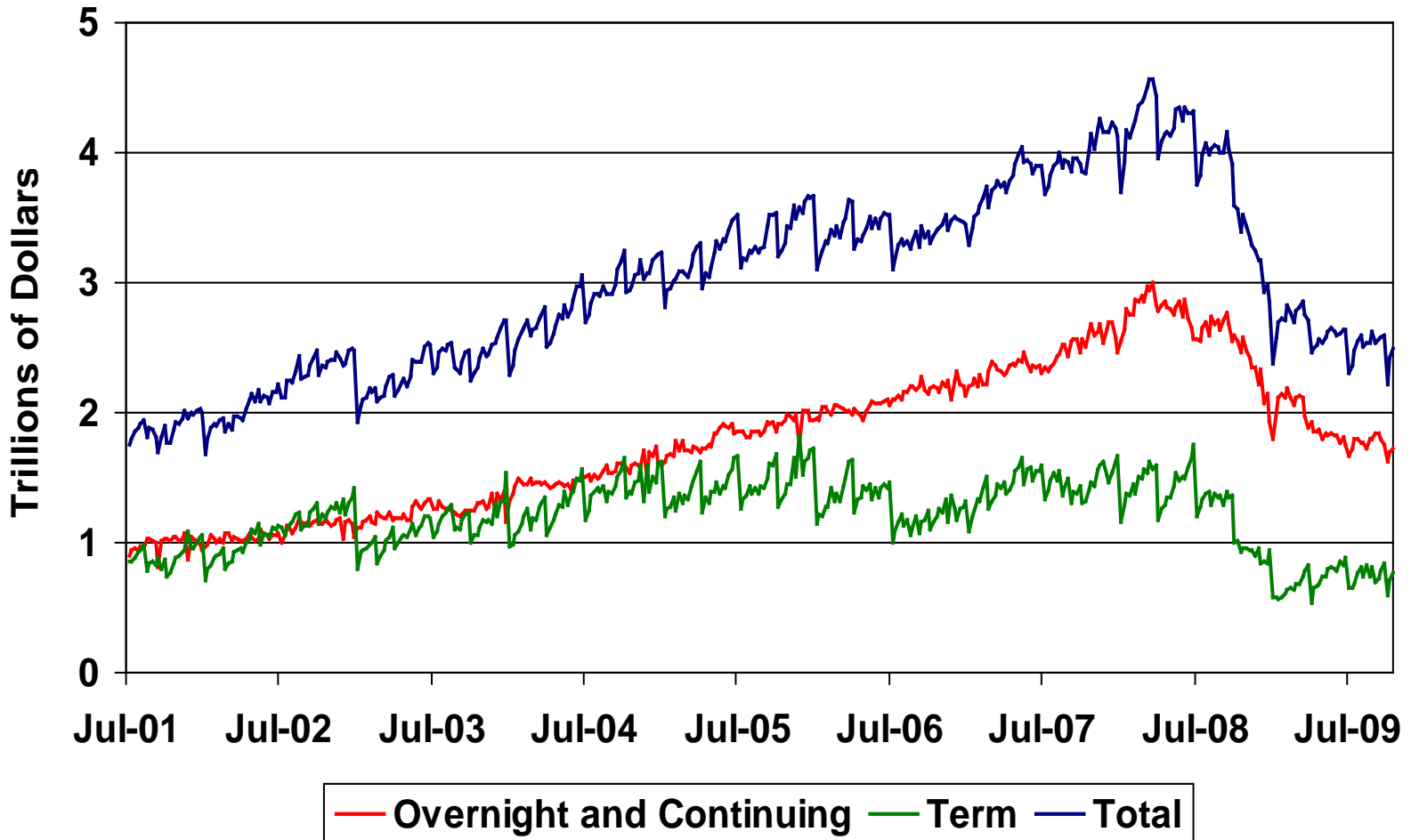
Repo Market Functioning in 2008

- Repo market became severely impaired in early 2008.
 - Concerns about counterparty creditworthiness and collateral.
 - Haircuts increased.
 - Higher compensation required to lend against riskier collateral.
- Disruptions compel dealers to seek alternative sources of funding or liquidate positions, or file for bankruptcy.
 - Near failure of Bear Stearns, failure of Lehman Brothers.
 - Unprecedented actions by Federal Reserve.

Note: For details on the Fed's Primary Dealer Credit Facility (PDCF) and Term Securities Lending Facility (TSLF), see:

http://www.newyorkfed.org/research/current_issues/ci15-4.html and
http://www.newyorkfed.org/research/current_issues/ci15-2.html.

Primary Dealer Repos Outstanding



Source: Federal Reserve Bank of New York.

Special Collateral Repos

- A **special collateral** repo is a repo in which the lender of funds wants to borrow a particular security.
- A special collateral repo is thus a device for borrowing and lending securities and not money.
- Rate on a special collateral repo is commonly called a **specials rate**.
- Owner of a security may be willing to lend it if it is offered the opportunity to borrow money at a specials rate below where it can relend the money on a GC repo.

Note: For more details on special collateral repos, see:
http://www.frbatlanta.org/filelegacydocs/fisher_2q02.pdf.

Example

- Suppose a dealer wants to borrow \$5 million par of the on-the-run 2-year note over a weekend (that is, 3 days).
 - Suppose the specials rate is 3%, even though GC rate is 5%.
 - To keep things simple, let's assume that this is a par bond (price = \$100/\$100 par and that there is no haircut).
- Dealer enters into a reverse repo with a mutual fund, borrowing the security against lending \$5 million in cash.
- On Monday, the dealer returns the security and gets back its cash plus interest at a rate of 3%.
- In this example, the interest is \$1,250 ($\$1,250 = \$5,000,000 \times 3\% \times 3/360$).

Uses of Special Collateral Repos I

- Dealers and others (such as hedge funds) use special collateral repos to finance short positions.
- That is, a dealer can sell a security and then enter into a reverse repo specifying that specific security as collateral.
- The security gets reversed in and delivered to the buyer.
- The dealer receives money for the security from the buyer, which can get passed to the securities lender.
- On a future date, the dealer buys back the security and returns it to the lender, and can use the returned money plus interest to pay for the bought security.

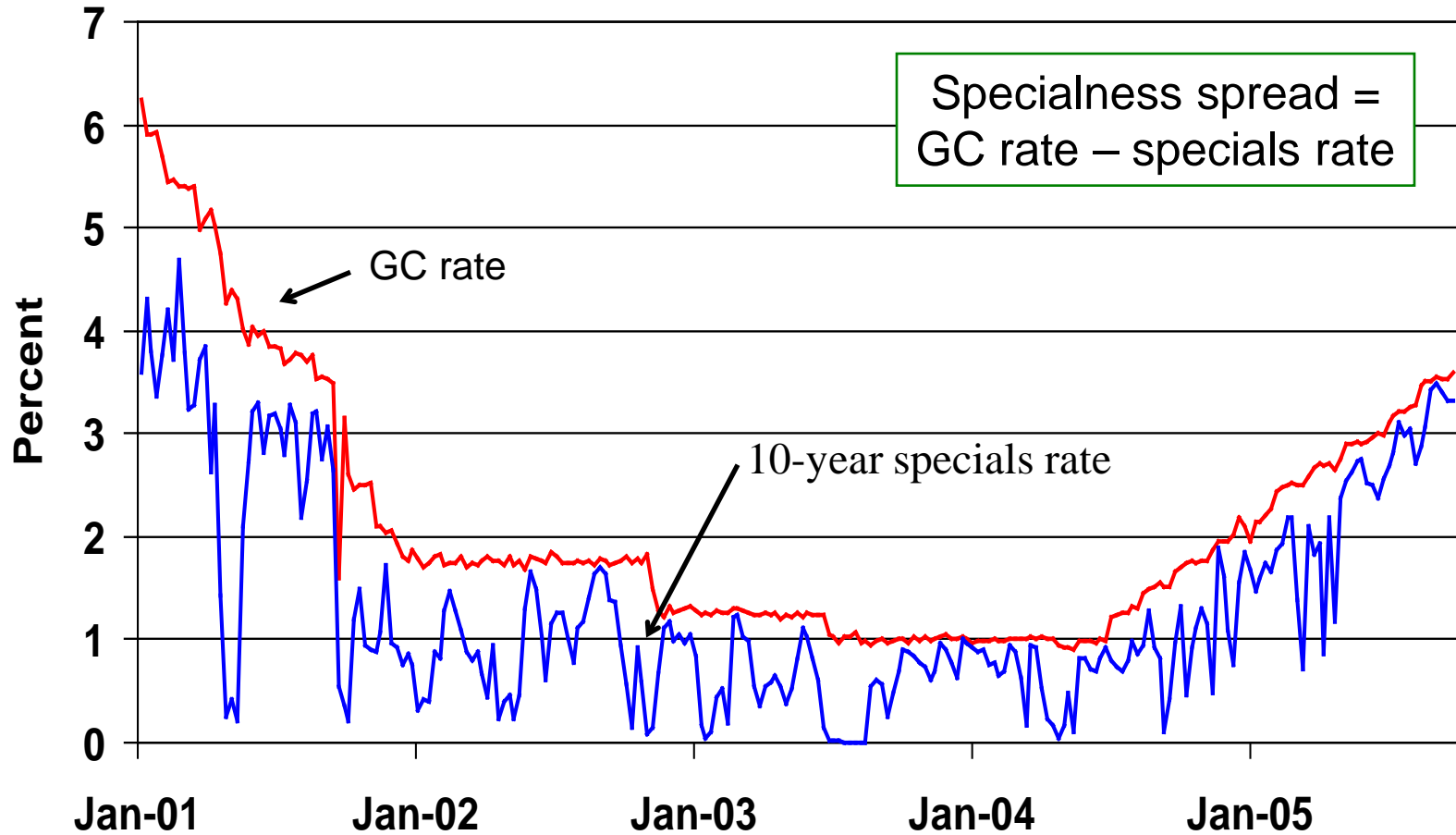
Uses of Special Collateral Repos II

- Mutual funds, pension funds, central banks, and other owners of Treasury securities can borrow money at an advantageous rate by lending out the securities.
- What if they don't need the money?
- They can relend the money on a GC repo, which offers a higher rate than they're paying on the special collateral repo, and thereby capture the spread between the two.
- In our last example, the mutual fund could have loaned out the money on GC repo at 5% and thus captured the 2% spread.

Specialness Spreads

- The difference between the GC rate and the specials rate for a security is called the security's **specialness spread**.
- If the demand to borrow a security is modest relative to the available supply, then the specials rate will usually be just below (e.g., 1/8%) the GC rate.
- If the demand to borrow is strong, or supply is limited, then the specials rate may be well below the GC rate, and the specialness spread will be correspondingly large.
- In the last example, the specialness spread was 2%.
 - Specialness spread = GC rate – specials rate.
 - In example, specialness spread = 5% - 3% = 2%.

GC Rate and 10-Year Specials Rate



Source: GovPX.

Note: Chart plots average rates by week.

Average Specialness Spreads

Security	On-the-Run	First Off-the-Run
3-month bill	6.4	-
6-month bill	5.4	-
2-year note	107.8	82.2
5-year note	142.2	18.5
10-year note	156.6	29.8
30-year bond	7.9	8.0

Source: GovPX.

Note: The table reports average specialness spreads in basis points for the January to August 2001 period.

Evidence on Specialness Spreads

- They are volatile.
- They can be quite large.
- They tend to be much larger for on-the-run securities.
- They differ by original maturity.
- They are bound below at zero, because specials rate can never be above the GC rate.
- Until recently, they were typically bound above by the GC rate, because specials rates rarely went below zero.
 - Option to *fail* on settlement puts lower bound on specials rates.
- There is a strong auction cycle pattern.

On-the-Run Securities and Specials Rates

- On-the-run issues are more liquid.
- Liquidity makes them good candidates for short as well as long positions.
 - Shorts tend to have brief holding periods.
 - Shorts need to be able to cover short positions quickly and with low transaction costs.
- High shorting demand for on-the-run issues tends to make them special.

Specials Rates and the Auction Cycle

- Specialness tends to be small right after a security is issued, increase over time, and then decline sharply when the security goes off-the-run.
- When an issue is new, many of the shorts may still be in the old issue.
- As an issue ages, its *available* supply declines as the securities are bought up by buy-and-hold accounts that don't make the securities available for lending.
- When a security goes off the run, the short base migrates to the new issue.

Note: For an article on specialness over the auction cycle, see:
http://www.newyorkfed.org/research/current_issues/ci2-10.html.

Settlement Fails

- A **settlement fail** occurs when a seller fails to deliver securities to a buyer on the scheduled settlement date and, consequently, fails to receive payment.
- Historically, convention in the Treasury and other fixed income markets was to reschedule delivery to the next business day at an unchanged invoice price.
- The seller thereby loses, and the buyer gains, the time value of money for one day.

Note: For an article explaining settlement fails, see:

http://www.newyorkfed.org/research/current_issues/ci11-9.html.

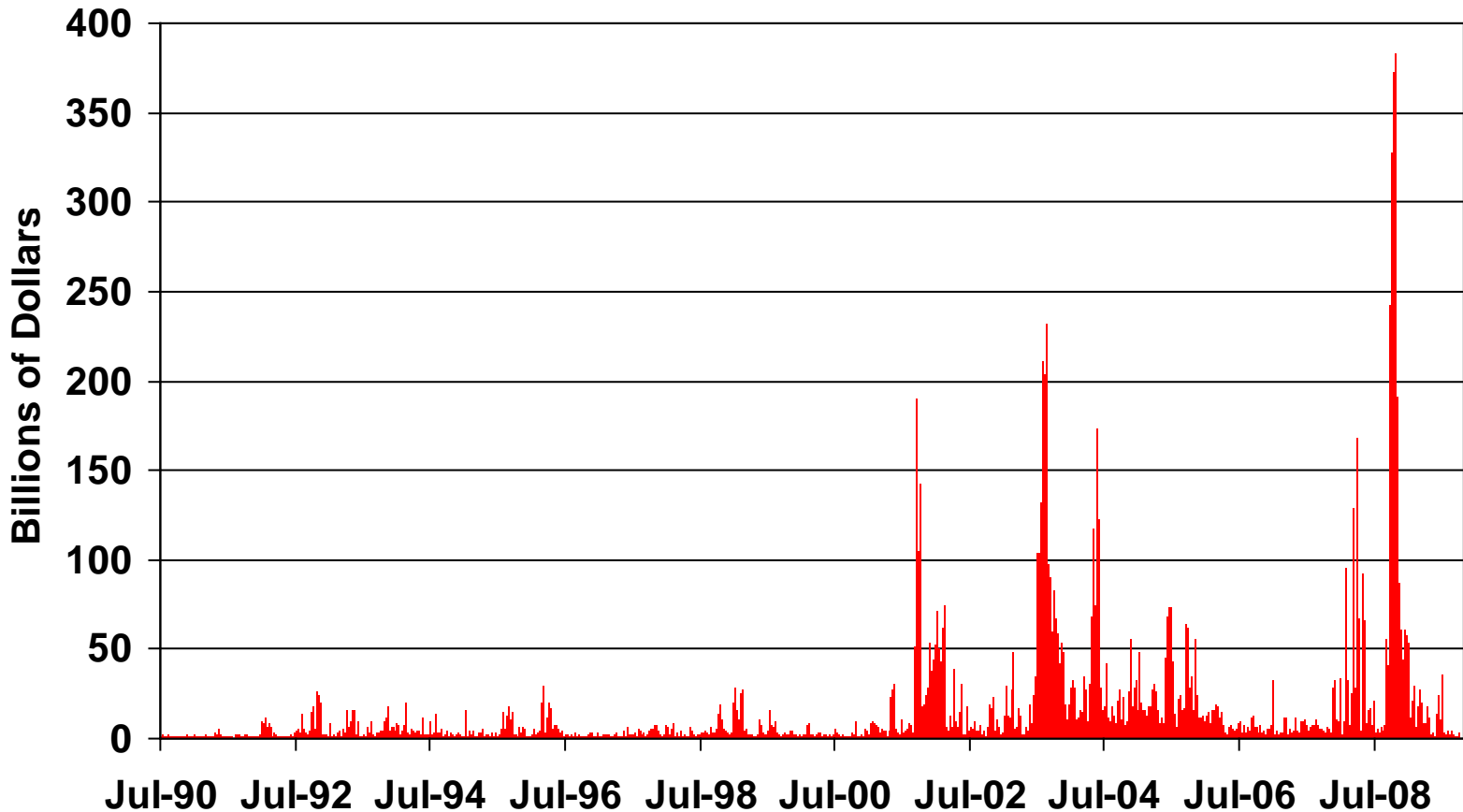
Why Settlement Fails Occur

- Miscommunication
 - Occurs regularly on a small scale.
- Operational problems
 - Occurred on a massive scale after September 11.
- Failure to receive same securities in settlement of an unrelated purchase.
 - Leads to daisy chains and round robins of fails.
- Short seller has insufficient incentive to borrow security to make delivery.
 - Common when specials rates were near zero.

Settlement Fails and Specials Rates

- Historically, the cost of a settlement fail was comparable to the cost of borrowing a security on a special collateral repo at a rate of zero.
 - In both cases, one lost the time value of money for one day.
- The option to fail thus put a lower bound on specials rates (and hence upper bound on specialness spreads).
- That is, sellers generally preferred to fail on delivery then enter into a contract where they received negative interest rates on their money.
- Episodes of high settlement fails thus coincided with instances where specials rates were at or near zero.

Settlement Fails



Source: Federal Reserve Bank of New York

(http://www.newyorkfed.org/markets/pridealers_failsdata.html).

Note: Average daily fails to deliver of U.S. Treasury securities by week.

Adoption of Fails Charge

- Effective May 1, 2009, Treasury Market Practices Group recommended adoption of a fails charge.
- Fails charge of up to 3% per annum, depending on the level of the reference rate.
 - Specifically, charge = $\max(3\% - R, 0)$, where R is reference rate (currently, minimum of fed funds target range).
- Charge increases cost of failing, and increases incentive for negative rate trading, in low rate environment.
- In practice, implementation has spurred marked increase in negative rate trading and facilitated market clearing.

Fed's Securities Lending Program

- The Federal Reserve lends Treasury *and agency debt* securities from its portfolio on an overnight basis.
 - The program was initiated to mitigate settlement fails.
 - Agency debt securities included since July 9, 2009.
- Fed auctions securities off to dealers each day at noon.
- Fed specifies minimum borrowing fee (currently 5 bp).
- The program is structured so that the borrowing fee is effectively a specialness spread.
 - Dealers borrow a specific security from the Fed, while agreeing to provide a general security as collateral.

Note: For more details on the Fed's securities lending program, see: <http://www.newyorkfed.org/markets/securitieslending.html>.

Why Dealers Borrow from Fed

- To satisfy late-appearing borrowing demands.
 - Fed purposely set program time to be late in the trading day.
- To reduce financing costs
 - Dealer thinks it can borrow more cheaply from the Fed than in the private market.
- To earn trading profits
 - Dealer lends securities early in the day on the expectation that it will be able to borrow securities more cheaply in the Fed's auction.
- Evidence: Use of program is generally consistent with the law of one price in terms of incidence of borrowing, quantity of borrowing, and prices paid in auctions.

Squeezes

- A **squeeze** is a shortage of supply relative to demand leading to abnormal price in outright and/or repo markets.
- By this definition, there need not be intent on the part of any market participants to bring these conditions about.
- A squeeze is certainly illegal if there is collusion, but collusion is not necessary for activity to be illegal.
- The 1991 Salomon brothers scandal is the best known case of price manipulation.
 - Case centered around auction rule violations and, in particular, violations of the *35% rule*.

Some Recent Squeezes

- March 2001 52-week bill in spring 2000: lower-than-expected available supply (?) for first 52-week bill sold on a quarterly cycle.
 - http://www.newyorkfed.org/research/staff_reports/sr120.html
- 5- and 10-year notes after September 11: initial disruptions after attacks may have hindered lending, leading to more protracted episode of low specials rates and fails. Treasury eventually reopened 10-year note on a *snap* basis.
 - <http://www.newyorkfed.org/research/epr/02v08n2/0211flem.html>
- May 2013 10-year note in summer of 2003: specials rates went negative because of ancillary costs of fails.
 - http://www.newyorkfed.org/research/current_issues/ci10-5.html

Asset Pricing Effects of Specialness

- Specialness effectively offers a return to a security's owners that supplements the security's principal and interest payments.
 - That is, if one owns a security that is trading special, one can capture the security's specialness spreads.
- This return should be reflected (or capitalized) in the security's price, so that more special securities trade with higher prices (all else equal).
- Empirical evidence supports this hypothesis.

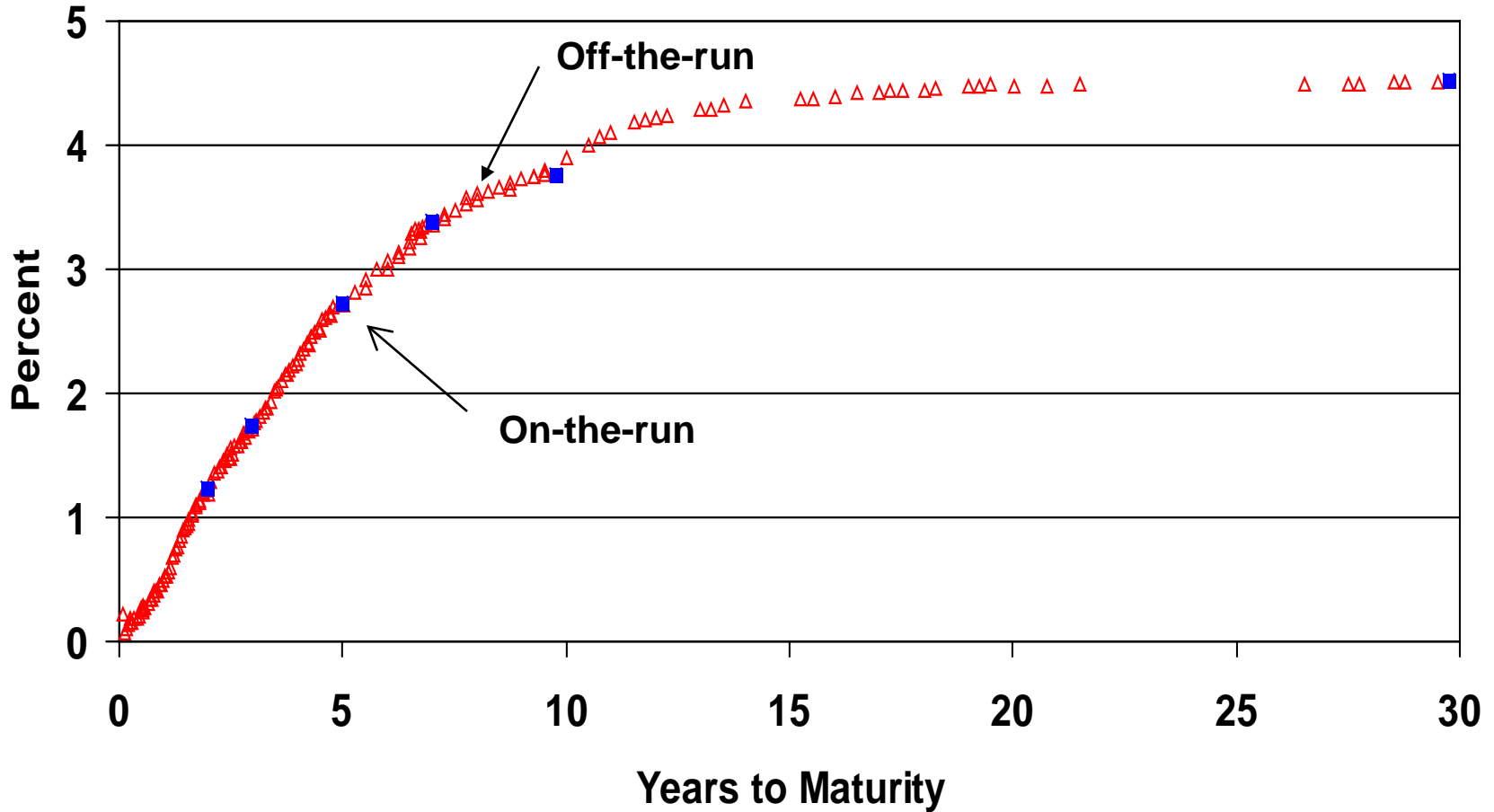
Example

- Suppose the 3-month term specials rate for a just issued 10-year note is 3% and the 3-month term GC rate is 5%.
- How much is this specialness worth (per \$100 par)?
 - Assume there are 90 days in the 3-month period.
 - Assume the note's price is \$100 per \$100 par.
- Specialness value (for specialness over the next n days)
= price \times specialness spread \times n/360
- That is: specialness value = \$100 \times (5% - 3%) \times 90/360
= \$0.50
- That is, the note should trade \$0.50 higher per \$100 par than an otherwise comparable note.

On-the-Run Liquidity Premium

- On-the-run securities typically trade with higher prices (lower yields) than comparable off-the-run securities.
- This reflects a premium for the specialness of the on-the-run securities and a premium for the liquidity of the on-the-run securities.
- Effects together are often called the **liquidity premium**.
 - Not to be confused with the risk/term premium phenomenon.
- The liquidity premium tends to rise during times of market disruption, such as during the fall of 1998.

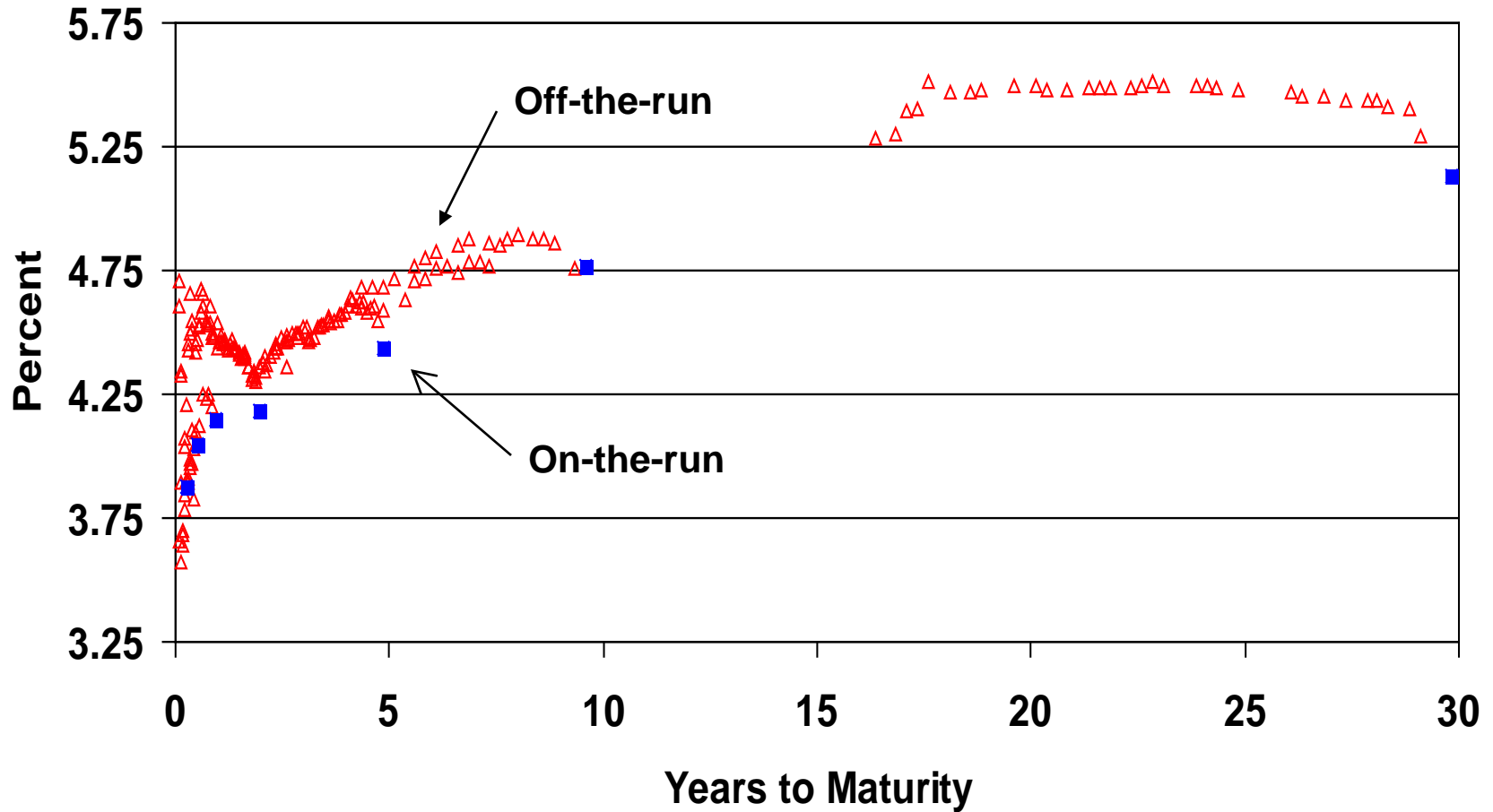
August 10, 2009 Treasury Yield Curve



Source: Federal Reserve Bank of New York.

Note: Chart excludes securities with less than 30 days to maturity, callable bonds, and TIPS. 53

October 9, 1998 Treasury Yield Curve



Source: Bear Stearns, GovPX.

Note: Chart excludes securities with less than 30 days to maturity, callable bonds, and TIPS. 54

Specialness vs. Liquidity

- Specialness and liquidity effects are related, but they are not the same.
- Effects are related because shorting tends to occur in issues that are liquid and expected to remain that way.
- However, issues can be highly liquid and not special.
 - Often the case with on-the-run bills.
- Moreover, issues can be special and not liquid.
 - Commonly occurs with squeezes.
- There's evidence that both effects matter for prices.