

# The Money Market

an important growing segment:

**REPO**

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# The Money Market

The **Money Market** refers to the market for short term borrowing and lending, usually undertaken by banks

- **Federal Funds Rate:** rate for borrowing / lending balances kept at the Federal Reserve
- **Eurodollar Rate:** rate of interest of dollar deposits at a European-based bank
- **LIBOR** (Libor Interbank Offered Rate): average interest rate the banks charge to each other for short term **uncollateralized** borrowing / lending
- **Repo Rate:** interest rate charged for short term borrowing / lending with **collateral**

# The Repo Market

- It plays an important role in the fixed income industry, as it is used by traders to borrow and lend cash (and securities) on a collateralized basis. Because borrowing is collateralized, it is considered a safer way to lend cash and/or securities, and this contributed to its growth over the years making the REPO Mkt one of the most important sources of financing for traders.

Two basic contracts/transactions:

- **Repurchase Agreement (Repo)**
  - cash borrowing collateralized by a security/bond --
- **REVERSE REPO**
  - security borrowing collateralized by cash --

# REPO -- definition

- A **Repurchase Agreement (Repo)** is an agreement to **sell** some securities to another party and **buy them back** at a **fixed date** and for a **fixed amount**. The price at which the security is bought back is greater than the selling price and the difference implies an interest called Repo Rate

With a **REPO** a trader **borrowes cash** giving the cash-lender a **security/bond** as **collateral**. At the maturity date, trader repays the debt – principal + interest – and gets back the security/bond.

# Reverse Repo -- definition

- A **Reverse Repo** is the *opposite* of a Repo transaction, namely, it is the **purchase** of the security for cash with the agreement **to sell it back** to the original owner at a predetermined price, determined, once again, by the Repo Rate.

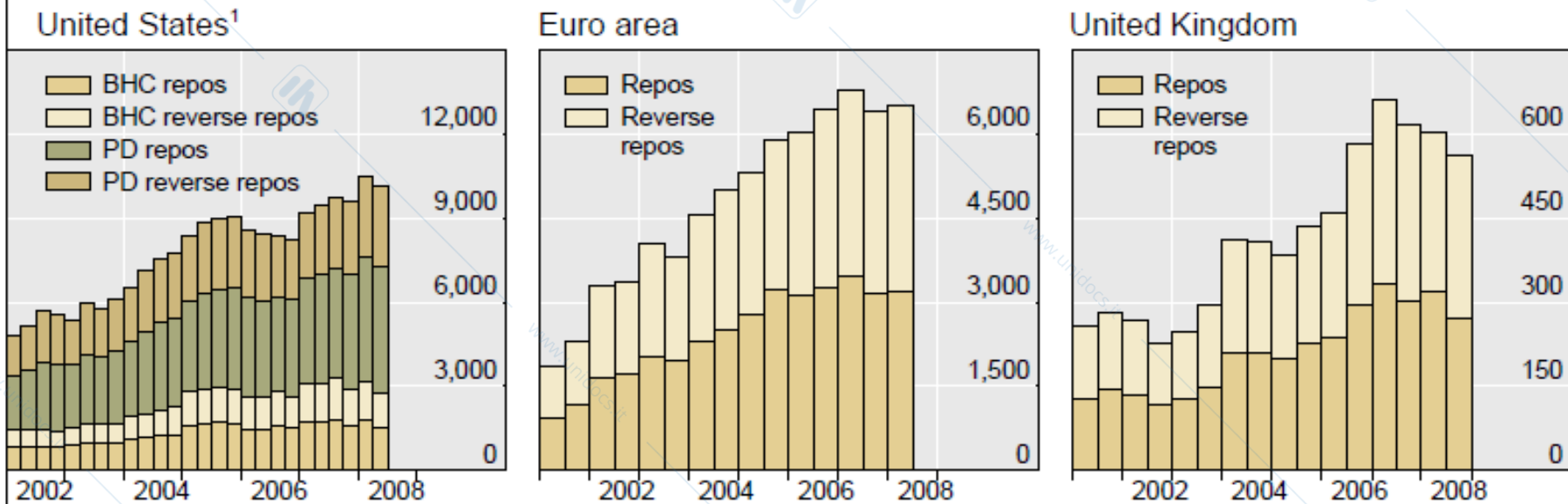
With a **Reverse Repo** a trader **borrow**s a **security** giving the security-lender **cash as collateral**. At the maturity date, trader returns the security and gets back its cash plus interest

# The Repo Mkt has grown steadily over the years

# Size of repo and reverse repo markets

## Repo markets, amount outstanding

In billions of national currency units



<sup>1</sup> BHC = bank holding companies; PD = US primary dealers.

Sources: Bank of England; Federal Reserve Bank of New York; ICMA, *European Repo Market Survey*.

Graph 1

# REPO - a closer view

- A REPO transaction amounts to ***collateralized cash-borrowing***
- A trader entering into a repo with a repo dealer is ***borrowing cash*** in exchange for the security, which is held as «hostage» by the repo dealer. If at the end of the repo term the trader were to default, the repo dealer could sell the security and recover his credit.

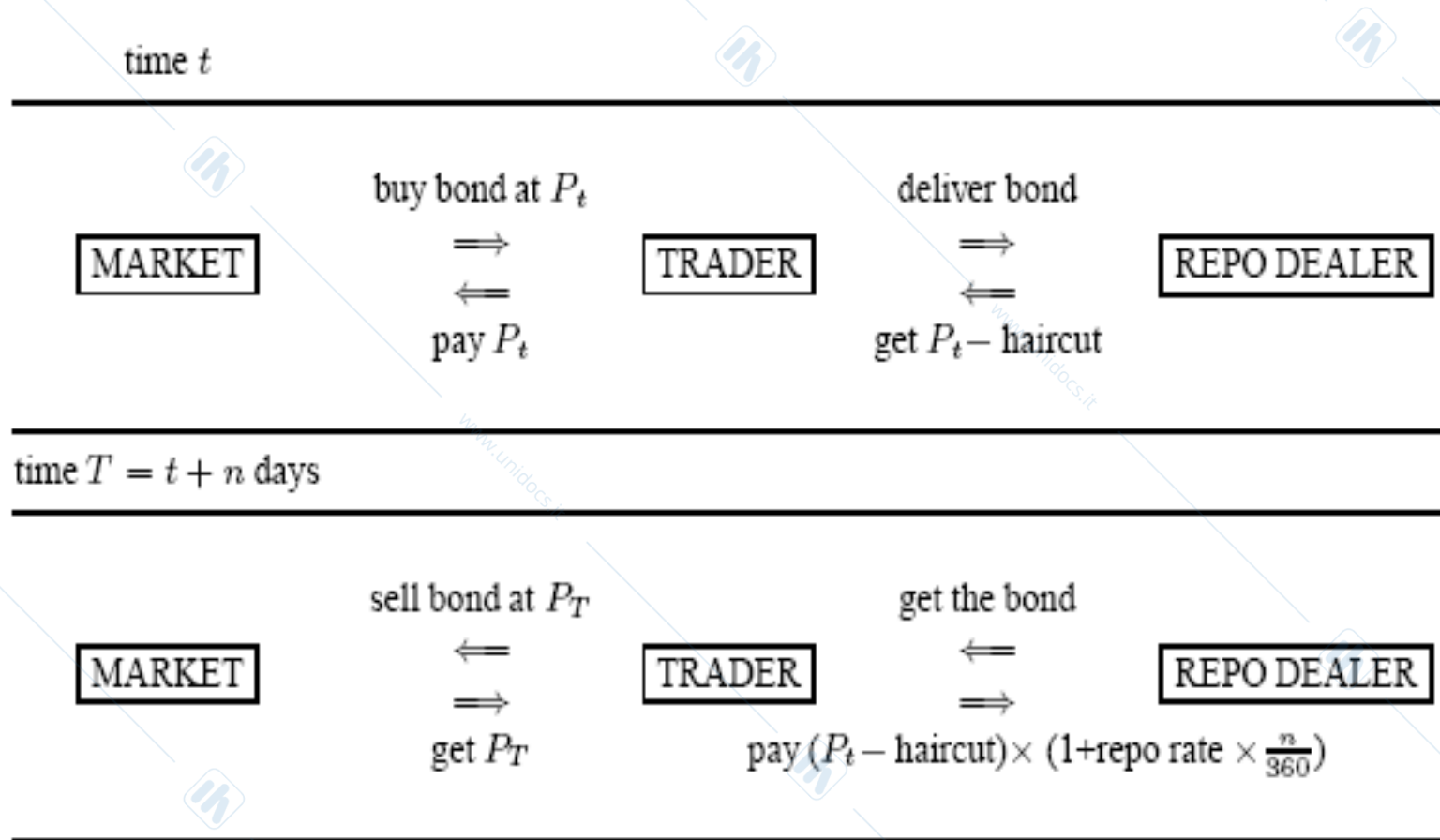
# Repo

- Can be used for the purpose of raising cash – borrowing cash.
  - It can be used for taking a long position in a given security, and finance this position with external financing (specifically, borrowing collateralized by the security itself).
- 
- The extent of *External financing* that can be raised – borrowed – will be limited by the «haircut»

# Repo Transaction

At time  $t$ , a trader wants to take a **long** position until time  $T$

Figure 1.4 Schematic Repo Transaction



# Repo transaction

- At time  $t$  the bond price is  $P_t$ , the bond posted as collateral to the repo dealer gives trader cash:

$$P_t - \text{haircut}$$

$(P_t - \text{haircut})$  is the amount borrowed at date  $t$  collateralized by a bond with mkt value  $P_t$ ; the haircut is the trader's own capital invested in the security; trader's leverage =  $P_t / \text{haircut}$

- At  $T = t + n$  the transaction is closed: trader gets back its bond from the repo dealer in exchange for cash payment:  $(P_t - \text{haircut}) + \text{Repo interest}$

$$\text{Repo interest} = (n/360) \times \text{Repo rate} \times (P_t - \text{haircut})$$

-- 360 stems from the day count convention in the repo mkt --

# Repo transaction

At T the bond mkt value is  $P_T$ , trader's profit:

$$\text{Profit} = (P_T - P_t) - \text{Repo interest}$$

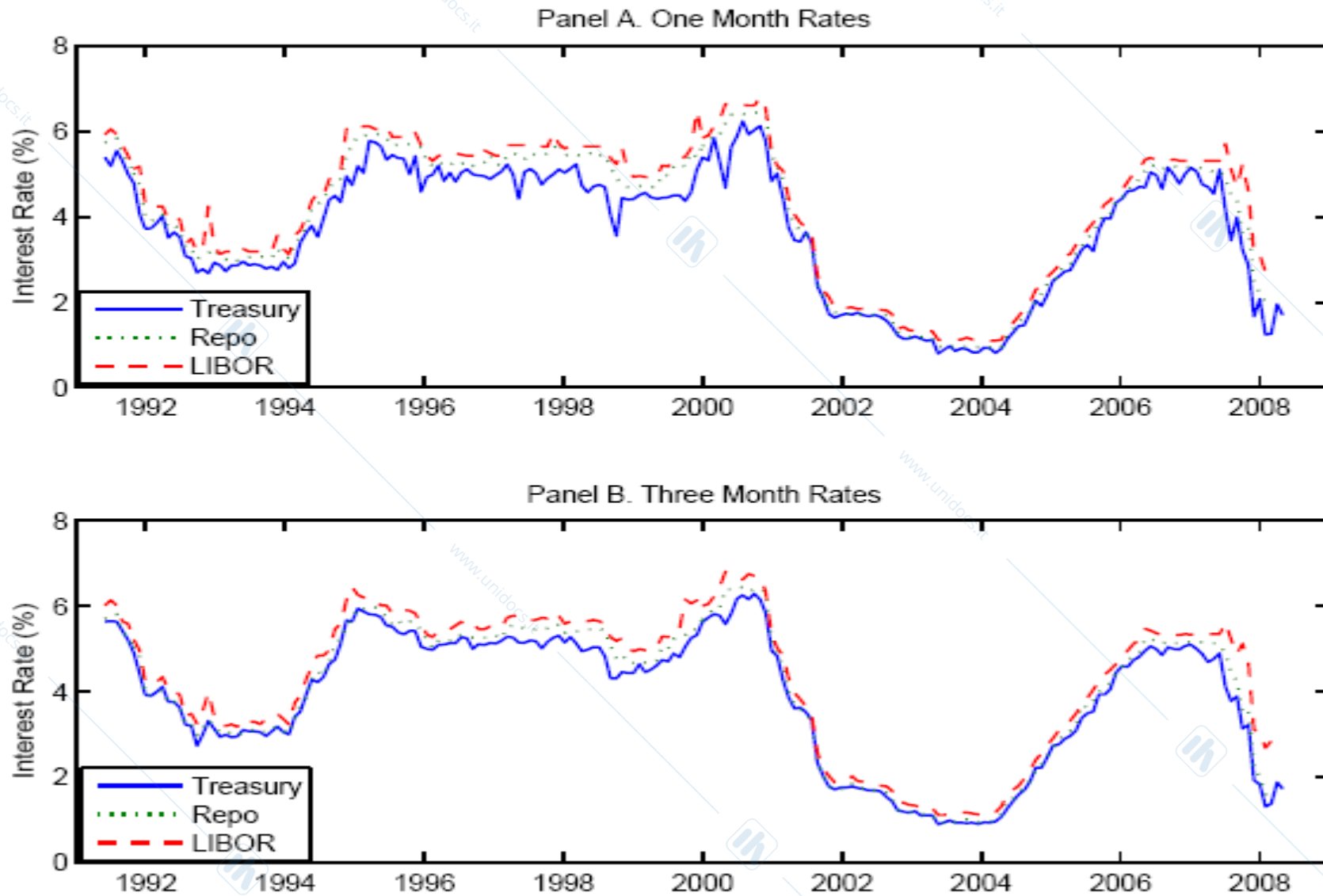
$$= (P_T - P_t) - \left[ \frac{n}{360} \times \text{Repo rate} \times (P_t - \text{haircut}) \right]$$

- Capital at risk = haircut (very small)
- Return on capital
  - =  $[(P_T - P_t) - \text{Repo interest}] / \text{haircut}$ 
    - Very highly levered position.
  - The trader earns the accrued interest between t and T  
Accrued interest is inglobed into  $P_T - P_t$ .

# Repo rates

- Since borrowing is collateralized by the value of the asset, the REPO rate is lower than other borrowing rates available to banks, such as LIBOR (Libor Interbank Offered Rate).
- Fig.1.6 plots T-bill rate, Repo and Libor rates for one month and 3 months maturity. For both maturities: the T-bill rate is the smallest and the LIBOR is the highest of the three rates – borrowing and lending at the LIBOR rate are riskier as the loans are uncollateralized.

**Figure 1.6 Short-Term Rates: 1991 - 2008**



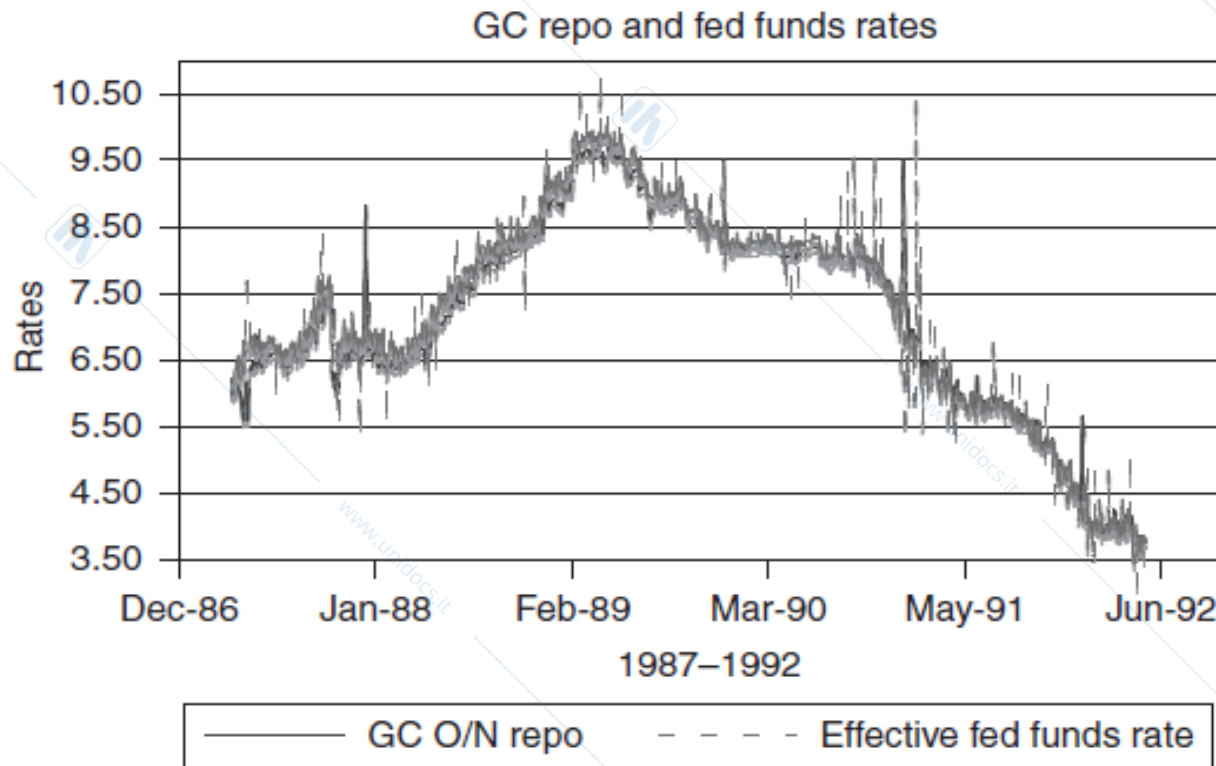
Source: Federal Reserve Board, British Bankers Association, Bloomberg.

- Other important definitions and characteristics of repo mkts are:
- General Collateral Rate (GCR)
- Special Repo Rate

# General Collateral Rate

- In a **general collateral repo** contract, the lender of cash is willing to accept **any** security within a **class of securities**. Sometimes such a contract is referred to as a **GC repo contract** and the rate on that contract is referred to as the **GCR (General Collateral Rate)**. This is the Repo rate on most Treasury securities, such as the off-the-run Treasuries.
- In a GC repo contract, the lender of cash (such as a mutual fund or fixed-income asset management firm) is primarily interested in earning interest income with limited counterparty credit risk. As long as the class of securities specified in the GC repo contract can be quickly liquidated at a low transaction cost in the market without an adverse price reaction, the lender of cash is comfortable in entering into the GC repo contract.

## GC repo rates tend to track Effective Fed funds rates



**FIGURE 5.8**

Integration of Money Market Interest Rates, December 1986–June 1992

## GC repo rates versus Effective Fed funds rates

- There are important differences between the Fed funds rates and the GC repo rates.
  1. Fed fund rates apply to the market for reserves and therefore to depository institutions, which are required to carry reserves. GC repo rates apply to repo transactions, which are undertaken by much broader set of participants, including depository institutions.
  2. Fed funds rates apply to transactions that are not collateralized. But as we have seen, repo rates apply to transactions that are backed by a class of collateral.
  3. There are important intraday and market microstructure situations that cause Fed funds rates to fluctuate within each day. GC repo rates may also reflect seasonal fluctuations on predictable days such as quarter-ends and year-ends.

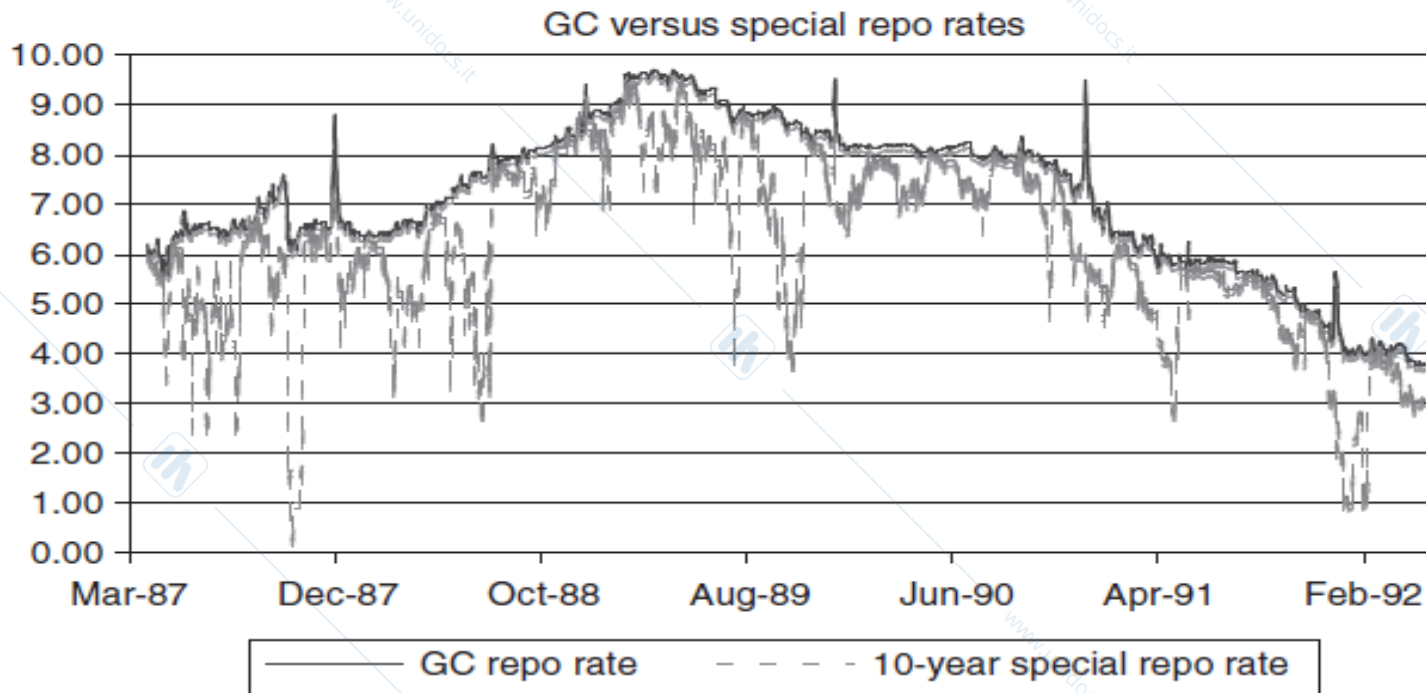
# Special Repo Rate

- In a special collateral repo contract, the lender of funds *specifies a particular security as the only acceptable collateral*.

Such contracts are referred to as *special repo contracts* and the interest rates on such contracts are referred to as *special repo rates*. These are generally lower than the GCR (General Collateral Rate).

At times, one particular security is in high demand and hence the repo rate falls to a level substantially low than the GCR.

On-the-run Treasury securities typically are “on special” – the Repo rate charged for collateralized borrowing is smaller than the GCR.

**FIGURE 5.11**

Special Repo Rates and General Collateral Rates, March 1987–February 1992

The special repo rate is typically lower than the GCR (General Collateral Rate) in the same security class. In other words, the special rate on a 10-year Treasury note will be lower than the GCR for Treasury securities as a class.

# REVERSE REPO

- A **Reverse Repo** is the *opposite* of a REPO: it is the purchase of the security for cash with the agreement to sell it back to the original owner at a predetermined price, determined, once again, by the Repo Rate.

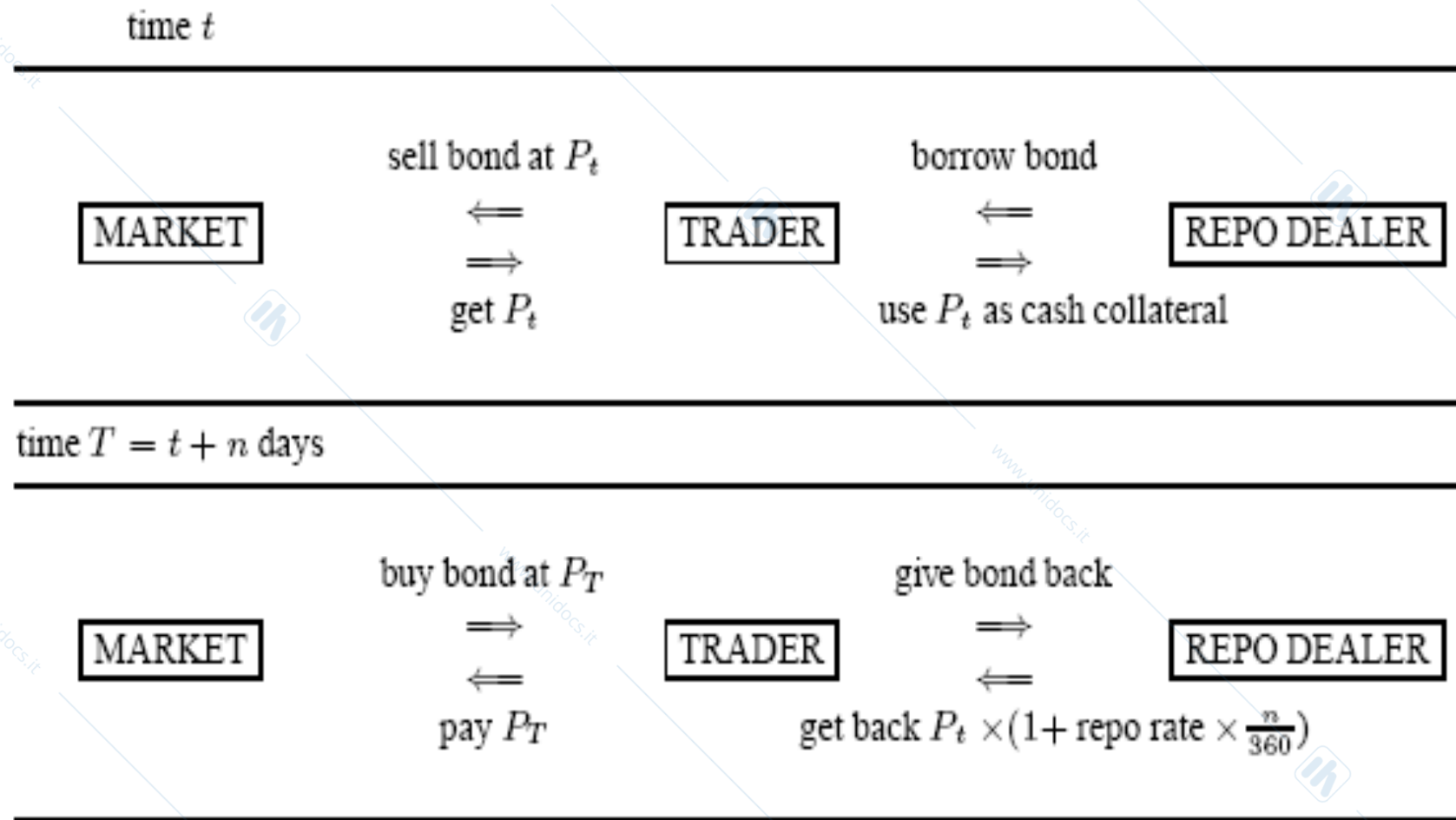
# Reverse Repo

- Can be used for the purpose of **depositing** cash **safely** – cash-loan secured by collateral.
- It can be used for taking a **short position** in a given security -- because a **Reverse Repo entails the borrowing of a security**

# Reverse Repo: Short Position

- Indeed, if the trader at date  $t$  wants to bet that the security price at date  $T$  will be lower :
- At date  $t$ : A) it borrows the security (via a reverse repo); B) sells it in the mkt at the mkt price  $P_t$ ; and C) posts  $P_t$  as cash collateral with the dealer;
- At date  $T$ : A) buys the bond at the mkt price  $P_T$ ; B) gives the bond back to the dealer in exchange for the agreed cash payment ( $P_t + \text{Repo Interest}$ ); C) completes the bond-purchase transaction by paying  $P_T$  to the mkt counterparty.

Figure 1.5 Reverse Repo Transaction



# Reverse Repo

- Profit from the reverse repo:
- **Profit =  $P_t - P_T + \text{Repo interest}$**   
where:
- Repo interest =  $(n/360) \times \text{Repo rate} \times P_t$

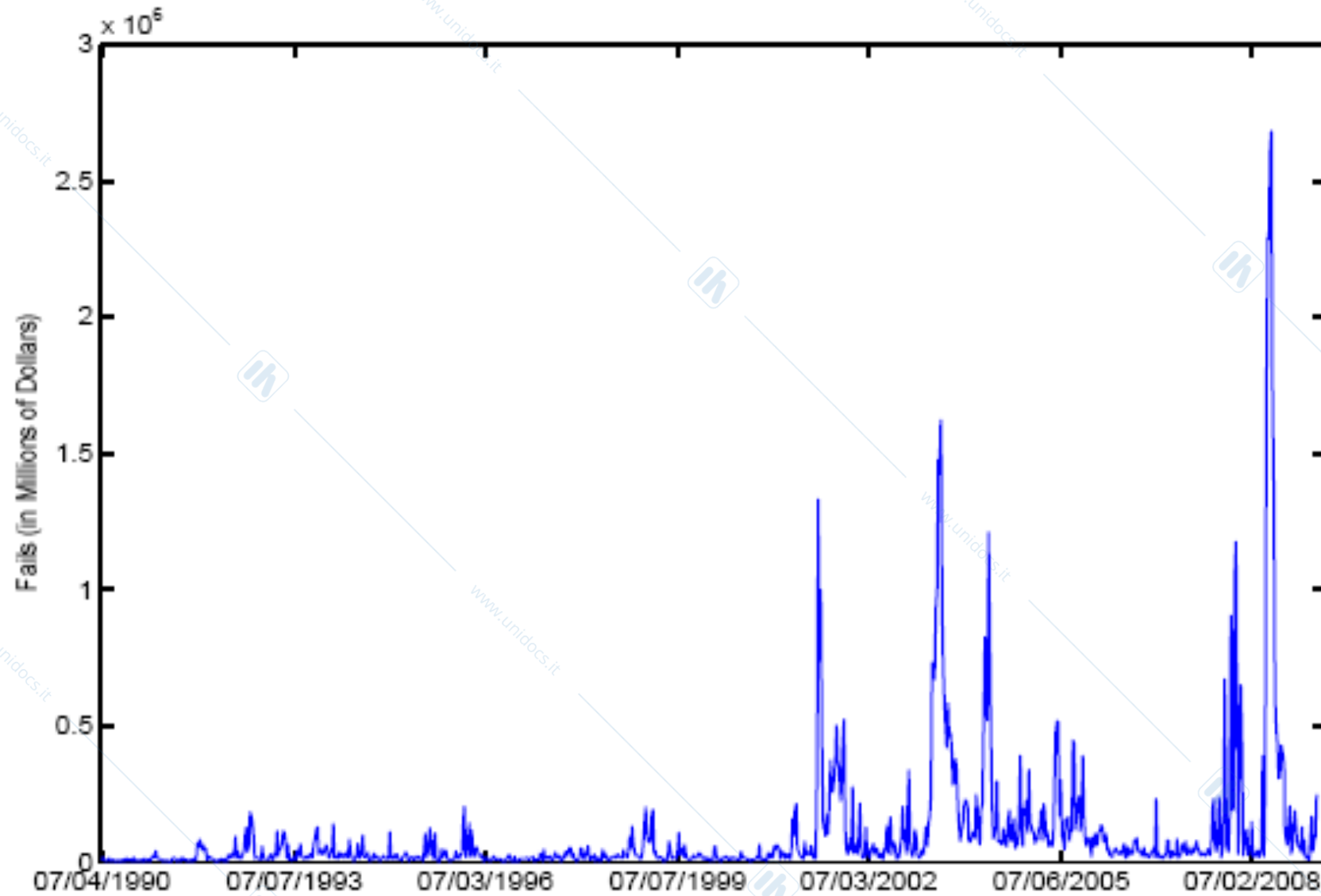
# Failure to deliver -- FAIL

- Consider the reverse REPO displayed in Fig.1.5. At maturity (time T), the trader must return the bond to the Repo dealer in exchange for the cash amount
- $P_t + \text{Repo Interest}$   
$$= P_t \times [1 + (n/360) \times \text{Repo rate}].$$

What happens if the trader does not return the security? Such an occurrence is called a **fail**.

Fig. 1.7 reports the cumulative weekly failures of delivering Treasury securities, in million of \$, by primary dealers: Notice the 2008 spike.

Figure 1.7 Primary Dealers Fails to Deliver: 1990 to 2009



Source: Federal Reserve Bank of New York.

# Fail - What's the cost/benefit?

- Up to May 2009, failure to deliver would have simply implied that the Repo dealer would have kept the cash received,  $P_t$ , plus the repo interest.
- The cost for failing to deliver for the trader was simply to forgo the repo interest.

# The 2008 Spike in delivery fails

- The financial crisis of 2007-2009:
  - i) led the Federal Reserve to lower the reference Fed funds rate close to zero, and the repo rates also fell to essentially zero. When the repo rate is closed to zero, the cost for a trader to fail to deliver the bond is very small (he forgoes the tiny interest), and the trader may want to keep the bond itself, if this bond is particularly valuable.
  - ii) Generated a «flight to quality» : investors switched from risky assets to safe US Treasuries, as the demand for safe collateral increased. This made it difficult/costly for traders with short positions to find the bonds to return to their counterparties in their Reverse Repo. – As a result, the number of fails spiked in the last quarter of 2008.

# Fails in Repo Mkts

- *Fails* occur in repo markets when a security is not delivered (as promised in the contract) on the contractual maturity date agreed on by the counterparties.
- Fails that occur when a counterparty is unable to deliver a security may trigger a chain of failures – snowball effect.
- Starting May 1, 2009, the federal Reserve imposed a penalty charge (which was nil before) of 3% over its Fed funds rate for failing to deliver the bonds in the Repo transactions that the FED conducts daily. In addition, the FED has been encouraging mkt participants to adopt a similar charge as part of best practices in repo mkt transactions.

# Fails.....

- An outcome of the penalty for fail to deliver: on May 1, 2009 the repo rate for some Treasury securities that were on special became negative. How can this be? A trader that needs to deliver a given Treasury security to a counterparty is willing to pay to get hold of the security rather than incurring the penalty. In particular, the trader can enter into a reverse repo with another dealer at a negative repo rate to obtain the Treasury security to deliver to the original counterparty.

# Repo Mkt- Conclusions

- Repo and reverse repo markets are used to finance securities and to earn interest on a collateralized basis.
- These markets allow dealers and hedge funds to take significant leveraged positions with fairly low counterparty credit risk.
- The Fed engages in repo and reverse repo with primary dealers to execute its open market mandate.
- GCR (General Collateral Rates) refer to collateralized borrowing/lending rates when a class of securities are accepted as collateral.
- Special repo rates refer to collateralized borrowing/lending rates when only specified securities are accepted as collateral.

# Repo Mkt - Conclusions (continued)

- GC repo rates tend to track closely other short-term interest rates such as effective Fed funds rates, LIBOR and OIS rates.
- There are important differences between these short-term interest rates.
- Fails tend to occur when the GC repo rates are low. This incentive has since been addressed through a “fail penalty” of 300 basis points, allowing Special repo rates to go negative.
- **Forward prices on bonds can be arrived at using term repo rates** (see the example below)

# Example of a Repo transaction p.1

On August 31, 2007, the 30-year T-bond with a coupon of 5.00% and maturing on May 15, 2037, was quoted at a **clean price** of 102.50.

- The general collateral repo rate for a term of one month was 4.775%.
- A bond dealer receives an order from a client to buy this bond forward in one month's time. What is the forward price that dealer should quote? Why? How should the dealer hedge the exposure, assuming that the deal is done on August 31, 2007?

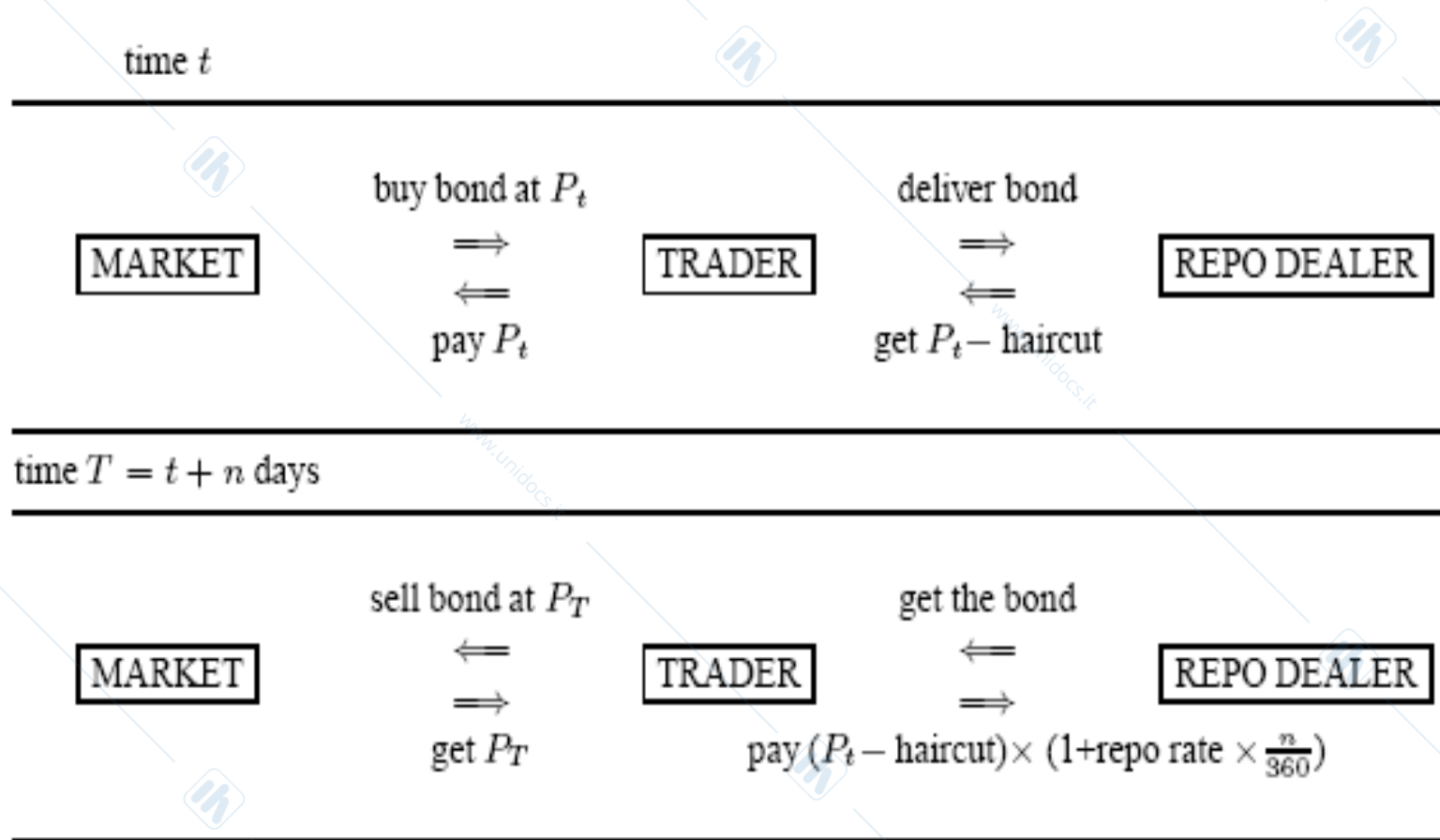
*dealer is asked to set the price today of a bond to be delivered in a month time.*

**Hint** : think how a *REPO* works

# Repo Transaction

At time  $t$ , a trader wants to take a **long** position until time  $T$

Figure 1.4 Schematic Repo Transaction



# Example of a Repo transaction p.2

The dealer will first compute the forward price as follows:

- 1.** Borrow cash to buy the bond in the repo markets for a one-month term on August 31, 2007.
- 2.** Figure out how much has to be paid in the repo markets on September 30, 2007, to retrieve the collateral.
- 3.** This is the forward price at which the dealers will break even. Any additional profit margin would depend on the extent of competition.

## Repo example worked out

	C	D	E	F	G	H	I
8	Settlement date		8/31/07				
9	Benchmark	Coupon	MD	YTM	PCD	NCD	Days
10							Accrued
11	Thirty-year	5.00%	5/15/37	4.84%	05/15/07	11/15/07	108
12							
13	Accrued	Clean-price	Dirty price				
14							
15	1.4674	102.5000	103.96741				
16							
17	Repo Rate			4.775%			
18	Term			9/30/07			
19	# days			30	= F16-E8		
20	Money to be borrowed on		8/31/07	103.96741	= E15		
21	Money to be repaid on		9/30/07	104.38111	= E15*(1+F19/360*F17)		
22	Accrued on 9/30/2007			1.8750	= (F18-G11)/(H11-G11)*D11/2*100		
23	Quoted Forward Price			102.5061	= F21 - F22		
24							
25	Note that the quoted forward price is less than the current price of the bond, due to positive carry.						

**FIGURE 5.3**

Forward Price on Bonds Using Repo Markets