

Professional Repo Market and Collateral Management Course
interaction between repo and bonds

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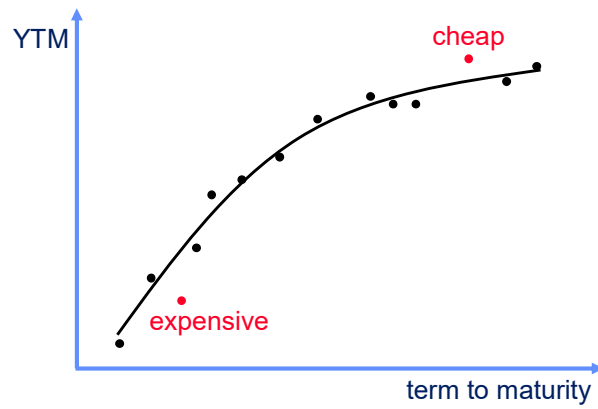
repo & bonds

- efficient pricing of bonds depends on an accurate & smooth **yield curve**
- accurate & smooth yield curve depends on the ability of dealers to buy **cheap** bonds & sell **expensive** bonds --- this requires repo

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- should we buy the **cheap** bond?
- should we sell the **expensive** bond?
- is there real **relative value**?

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should we buy the cheap bond?

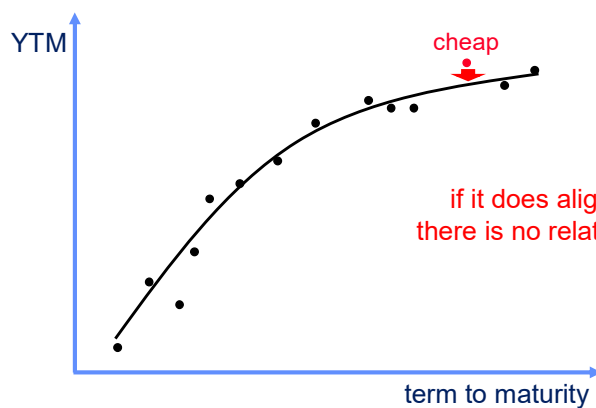
- what is cost of running the long position?
- cost of long position --- pay repo but earn coupon
- if coupon < repo, pay **negative carry**
- dealers would be reluctant to take long positions
- is this why the bond is cheap --- what its repo rate?

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if we add in cost of repo funding,
will the value of this 'cheap' bond rise & its yield fall
into line with equivalent adjusted value of comparables?



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should we sell the expensive bond?

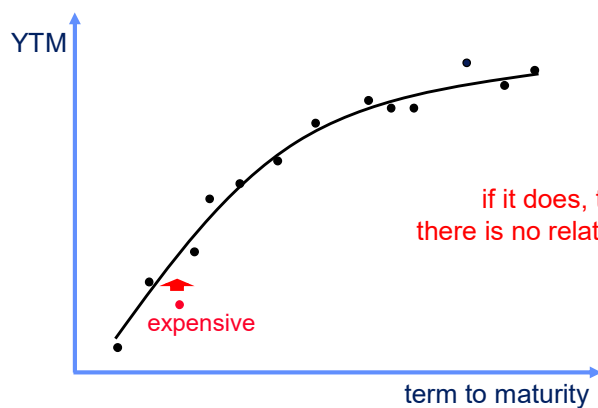
- what is cost of running the short position?
- cost of short position --- earn repo, pay coupon
- if coupon > repo, pay **positive carry**
- dealers would be reluctant to take short positions
- is this why bond is expensive --- what is its repo rate?

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if we add in cost of repo funding,
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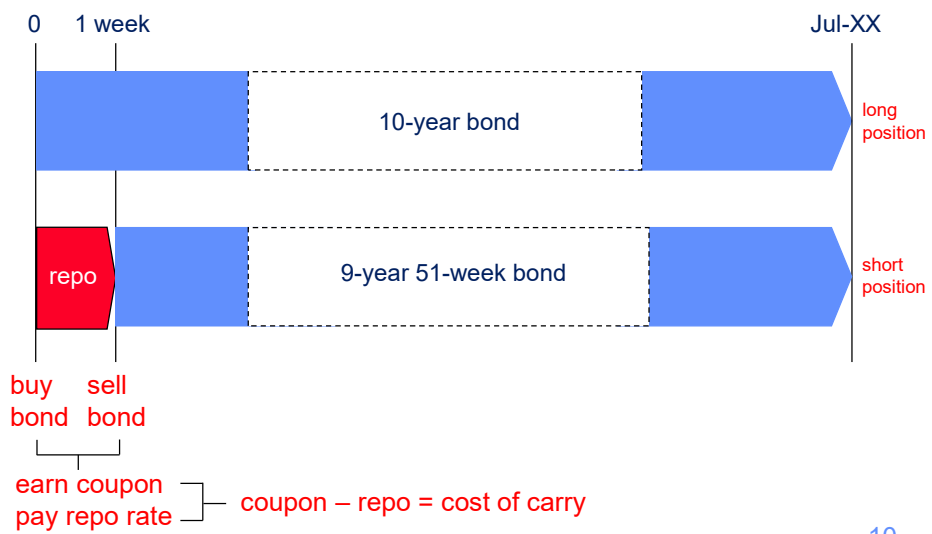
efficient pricing of securities

- build cost of carry into price/yield of bond
- calculate the break-even --- forward price/yield

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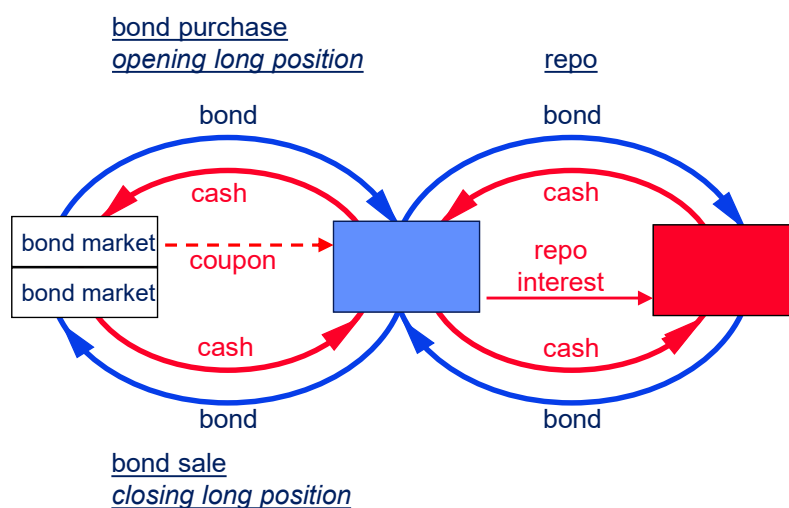
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- cost of carry = coupon – repo
- coupon > repo = **positive** cost of carry = net income profit on long position
- coupon < repo = **negative** cost of carry = net income loss on long position

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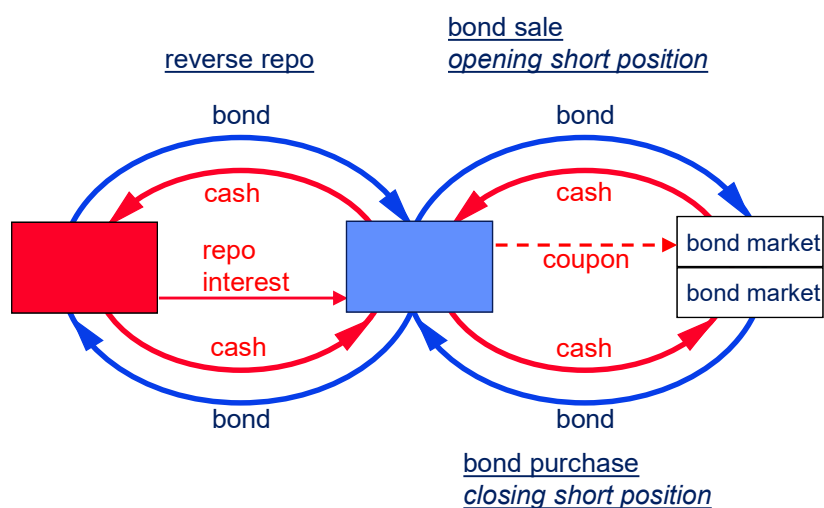
repo & bonds

- coupon – repo = cost of car
- coupon > repo = positive cost of carry = net income profit on long position
- coupon < repo = negative cost of carry = net income loss on long position
- coupon > repo = **positive** cost of carry = net income loss on short position
- coupon < repo = **negative** cost of carry = net income profit on short position

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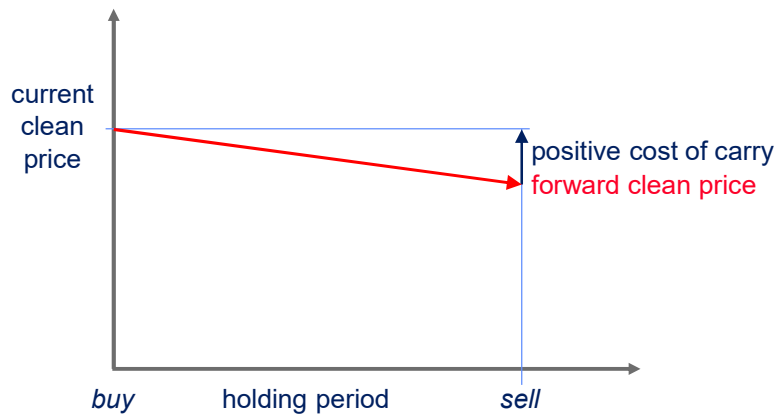


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- holder of bond can afford for its clean price to fall by amount equivalent to profit from positive cost of carry
- future clean price is called **forward price** of bond
- forward price = current clean price – cost of carry



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example

- buy EUR25 million nominal 4.5% 04/07/XX
- price 94.55, yield 5.28956%
- 83 days accrued interest
- fund with repo for 30 days at 4.25%

in 1 month:

$$\text{accrued interest} = 25,000,000 \times \frac{\text{nominal value } 4.5 \times 30}{100 \times 365} = 92,466$$

$$\text{repo interest} = 23,893,322 \times \frac{\text{market value } 4.25 \times 30}{100 \times 360} = 84,622$$

$$\text{market value} = 25,000,000 \left(\frac{94.55}{100} + \frac{4.5 \times 83}{100 \times 365} \right) = 23,893,322$$

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repo & bonds

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$$\text{carry} = 92,466 - 84,622 = 7,844$$

$$\text{break-even value} = 23,637,500 - 7,844 = 23,629,656$$

$$\text{value at clean price} = 25,000,000 \left(\frac{94.55}{100} \right) = 23,637,500$$

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repo & bonds

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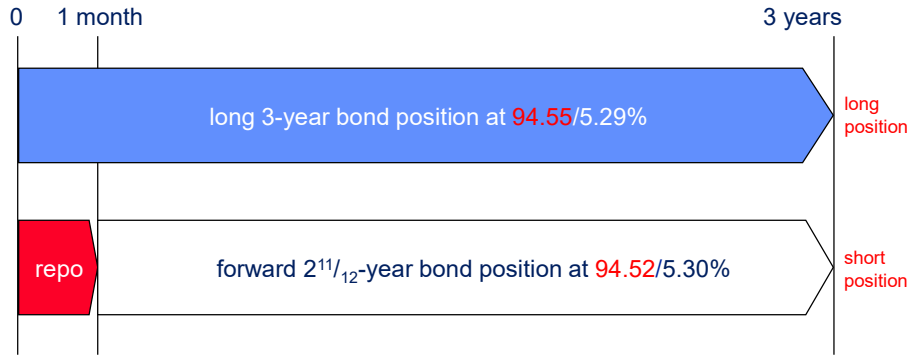
$$\text{forward price} = 23,629,656 / 25,000,000 * 100 = 94.518626$$

$$\text{forward yield} = 5.300\% (+1\text{bp})$$

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DBR4 1/2 07/04/09 Govt COC DL19 Corp COC

COST OF CARRY ANALYSIS

DEUTSCHLAND REP DBR4 1/2 07/04/09 94.4400/94.5000 (5.29/5.28) BGN @ 7/07

SETTLEMENT DATE 9/25/00 FIX (1=PRICE or 2=YIELD) 2 COMPOUNDING METHOD
 PRICE 94.550000 ACCRUED INTEREST 1.0233 2 [1= CD COMPOUND
 YIELD 5.28956 2= PROCEEDS
 WORKOUT DATE 7/ 4/09 -VALUE 100,000 3= SCIENTIFIC]
 CHOOSE: BUSINESS OR CALENDAR DAYS C

COST OF CARRY

REPO RATE	4.25	1 = REPO or 2 = REVERSE	1	BASIS-ACT/360	
REPO	B.P.	PRICE	NET P & L FOR	BREAKEYEN	
TERMINATION DATE	EQUIV	SPREAD	PICK UP	25000 (M)FACE	PRICE / YIELD
NEXT DAY (9/25/00)	5.084	83.4	0.0022	553.60	94.548954/ 5.28989
30 DAYS (10/25/00)	5.095	84.5	0.0673	16816.55	94.518626/ 5.29976

BOND BORROW

1 = REGULAR or 2 = FED.	1	BREAKEYEN		
B.P.	PRICE	NET P & L FOR		
TERMINATION DATE	SPREAD	PICK UP	1000 (M)FACE	PRICE / YIELD
NEXT DAY (9/25/00)	150.0	-0.0040	-39.82	94.555151/ 5.28896
30 DAYS (10/25/00)	150.0	-0.1195	-1194.67	94.705359/ 5.27147

**** CALENDAR DAYS USED ****

Copyright 2000 BLOOMBERG L.P. Frankfurt 1-69-920410 Hong Kong 2-377-6000 London 171-330-7500 New York 212-318-2000
 Princeton 609-293-3000 Singapore 226-3000 Sydney 2-3777-6686 Tokyo 3-3201-8300 Sao Paulo 11-5048-1600
 1356-1004-0 09-3ul-00 6:41:42

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repo & bonds

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<HELP> for explanation.                               DL19 Corp  FPA
Enter <1><GO> to send screen via <MESSAGE> System.
FORWARD PRICING ANALYSIS                               Page 1 of 2
DEUTSCHLAND REP DBR4 1/2 07/04/09 94.4400/94.5000 (5.29/5.28) BGN @ 7/07
CUSIP: EC1557874

ENTER ALL OF THE FOLLOWING FIELDS
SETTLEMENT DATE 9/25/00                                BUMP ALL DATES FOR WEEKENDS/HOLIDAYS (Y/N) 
PRICE 94.550000( 5.290)(1=CD ,2=PROCEEDS ,3=SCIENTIFIC )
REPO RATE (ACT/360) 4.2500                                COMPOUNDING METHOD : 2
FACE AMOUNT M 25000                                     REINVEST COUPONS (Y/N) 
TERMINATION DATE 10/25/00 <DR> TERM (IN CAL. DAYS) 30

B/E REPO RATE = 4.25000

ENTER ONE OF THE FOLLOWING FIELDS                       INVOICE PAYMENT
(BP)                                                    SETTLEMENT = 23,893,321.92
NET PROFIT/LOSS                                         TERMINATION = 23,977,944.10
FORWARD PRICE 94.518626 94-16 5/8                     NET CHANGE = 84,622.18
DROP 0.031374 (0-01 )

YIELD 5.300
YIELD DROP -1.0198 bps

NOTES :

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Copyright 2000 BLOOMBERG L.P. Frankfurt 1-63-920410 Hong Kong 2-377-6000 London 171-330-7500 New York 212-318-2000
 Price for 609-279-3000 Singapore 226-3000 Sydney 2-3777-8686 Tokyo 3-3201-8300 Sao Paulo 11-3048-4500
 1356-1004-0 09-Jul-00 6:38:33

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repo & bonds

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<HELP> for explanation.                               DL19 Corp  BSR
Enter <1><GO> to send screen via <MESSAGE> System.
BUY/SELL BACK REPO ANALYSIS                               Page 1 of 2
BB Number: EC1557874
DEUTSCHLAND REP DBR4 1/2 07/04/09 94.4400/94.5000 (5.29/5.28) BGN @ 7/07

SETTLEMENT 9/25/00
PRICE 94.550000 (ACCRD# 1.02328767)
REPO % (ACT/360) 4.2500 (ACCRD# DAYS: 83)
FACE AMT M 25000
Minimum Piece: 1 / Minimum Increment: 1
TERMINATION 10/25/00
FORWARD PRICE 94.518626 (ACCRD# 1.39315068)
FORWARD POINTS 0.031374 (ACCRD# DAYS: 113)

YIELD 5.28956%
WORKOUT DATE / PRICE
Worst 7/ 4/09 100

TERM (actual # days): 30
YIELD 5.29976%
WORKOUT DATE / PRICE
Worst 7/ 4/09 100

REINVESTMENT OF COUPONS                                COLLATERAL 100.00% OF MONEY
DATE AMOUNT RATE
/ / / /
/ / / /
/ / / /
COMPOUNDING METHOD: BX
P = Proceeds or B = Bullet

* MONEY AT TERMINATION *
SETTLEMENT AMOUNT 23,893,321.92
REPO INTEREST 84,622.18
TERMINATION MONEY 23,977,944.10

HOLD BOND PRICE/FACE AMOUNT PX

NOTES :

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Copyright 2000 BLOOMBERG L.P. Frankfurt 1-63-920410 Hong Kong 2-377-6000 London 171-330-7500 New York 212-318-2000
 Price for 609-279-3000 Singapore 226-3000 Sydney 2-3777-8686 Tokyo 3-3201-8300 Sao Paulo 11-3048-4500
 1356-1004-0 09-Jul-00 13:42:45

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- but cost of carry based on coupon ignores **pull-to-par**
- pull-to-par means a bond price will converge to par by maturity
- discount bonds will make capital gains --- adding to carry
- premium bonds will make capital losses --- subtracting from carry
- pull-to-par capital gains/losses need to be factored into carry when estimating forward price/yield
- pull-to-par is measured by coupon-YTM differential over holding period (YTM converges to coupon by maturity)
- to adjust carry & forward price for pull-to-par, replace coupon with YTM

carry = YTM – repo rate

$$\begin{aligned}\text{carry} &= 5.28956\% \text{ (A/A)} - 4.25\% \text{ (A/360)} \\ &= 5.28956\% \text{ (A/A)} - 4.309\% \text{ (A/A)} = 0.9805\%\end{aligned}$$

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- but adjusting carry for pull-to-par ignores **roll/slide down/up to maturity** because adjustment by replacing coupon with YTM implicitly assumes YTM remains constant
- in fact, a bond price will change over time as the bond moves towards maturity & YTM follows the shape of the yield curve
- assuming a fixed yield curve: positive yield curves will make capital gains; negative yield curves will make capital losses
- these capital gains/losses (roll/slide = current YTM – future YTM) are not factored into carry but do contribute to the mark-to-market valuation of positions

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- carry will also be exposed to the **volatility** of the yield curve
- analyze with carry-to-risk metric (current & historic) to identify safest positions (assuming stable rates)

$$\text{carry-to-risk} = \frac{\text{carry}}{\text{volatility}}$$

- carry & volatility are annualized (volatility = standard deviation)