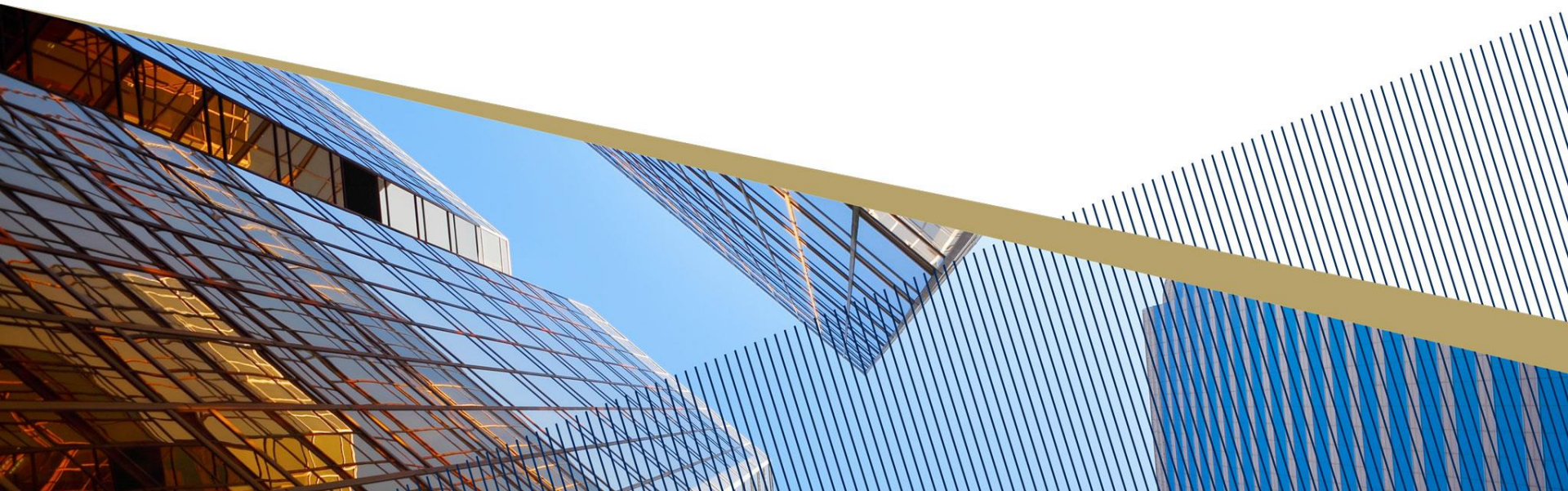
ICMA

International Capital Market Association

ICMA Workshop: Professional Repo and Collateral Management
1-2 June 2017



Welcome to delegates from ICMA and ERCC

Godfried De Vidts, Chairman of ICMA's ERCC Committee

Welcome to delegates from UBS

Gareth Allen, Global Head of Asset Sourcing and Optimization – Group ALM, UBS

The repo instrument: legal, economic and operational character

Richard Comotto, ICMA Centre at Reading University

Professional Repo & Collateral Management Course

The repo instrument: legal, economic, operational character

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

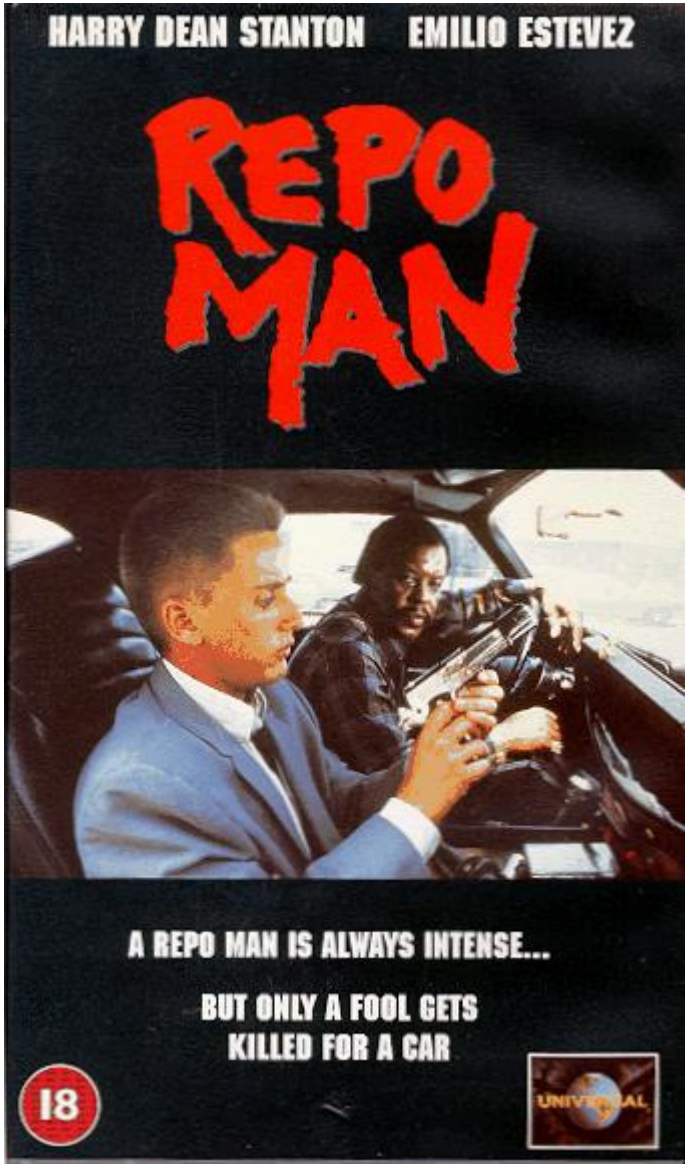
repo instrument

- name
- basic mechanics
- terminology
- legal structure
- economic operation
- core uses
- legal structure v economic operation
  - do you understand repo?
  - accounting for repo
- things like repo
- risk on repo --- credit, liquidity, operational, legal

name

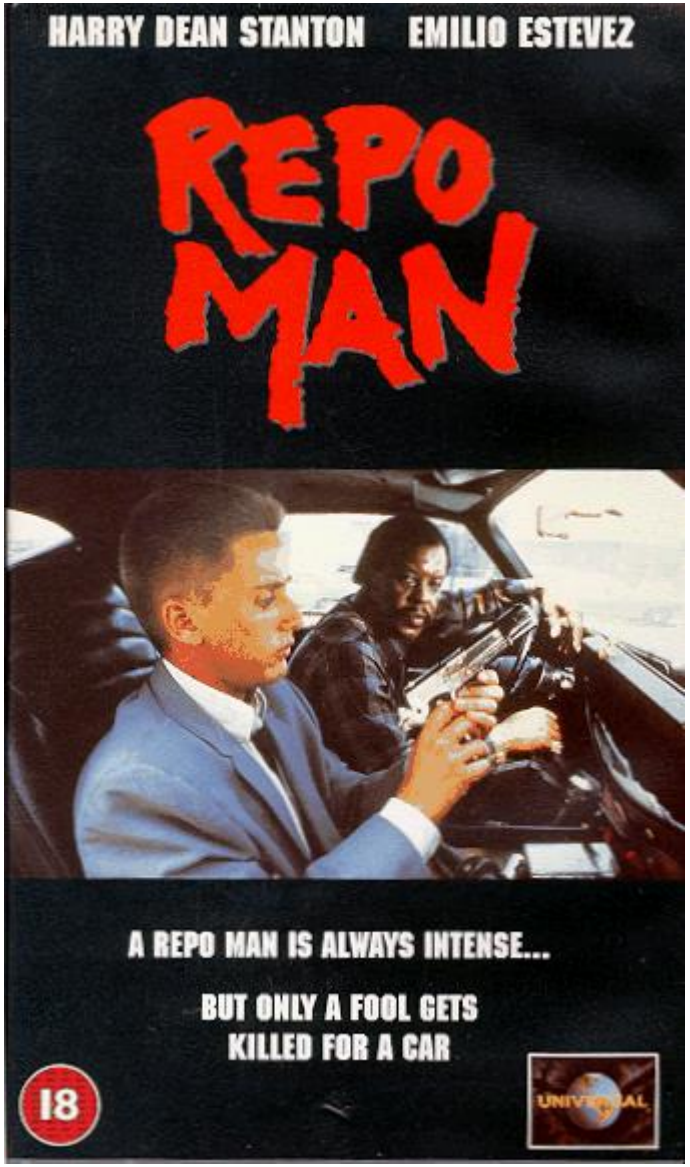
- what is the origin of the name?

name


HARRY DEAN STANTON
EMILIO ESTEVEZ
REPO MAN
A REPO MAN IS ALWAYS INTENSE...
BUT ONLY A FOOL GETS KILLED FOR A CAR
18

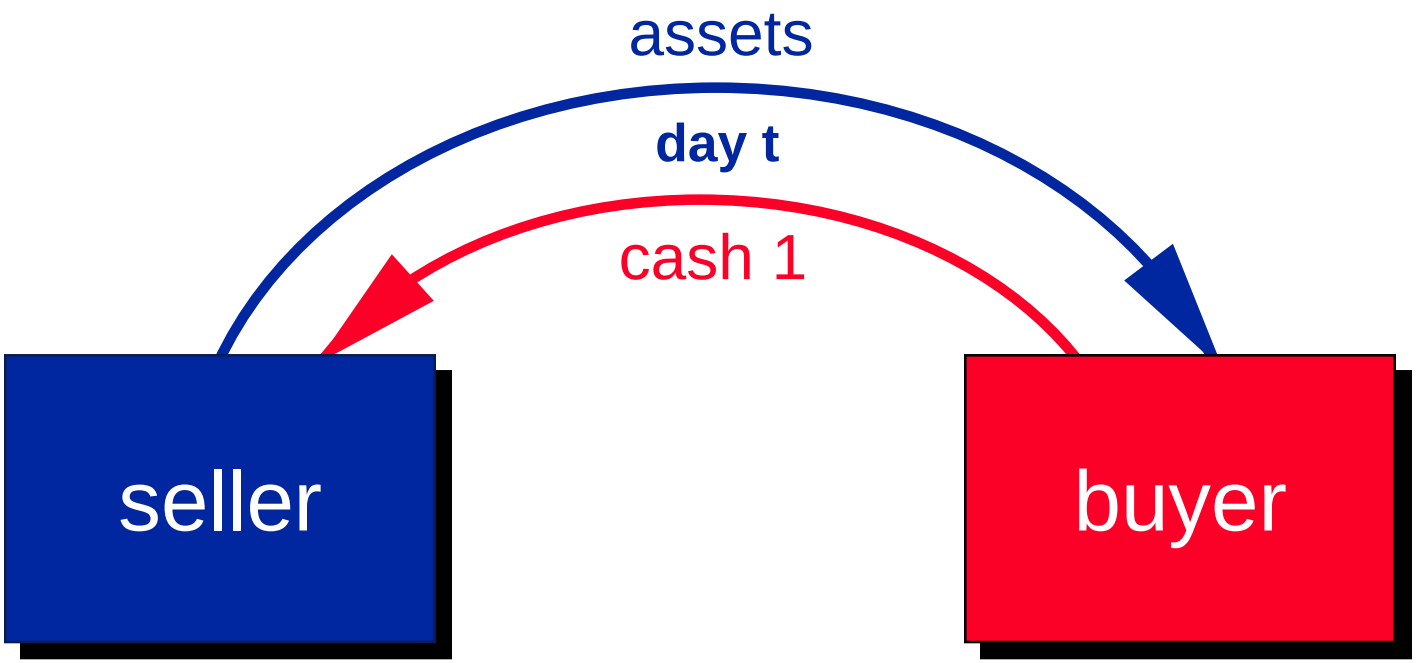
name

repossession



basic mechanics

basic mechanics



basic mechanics

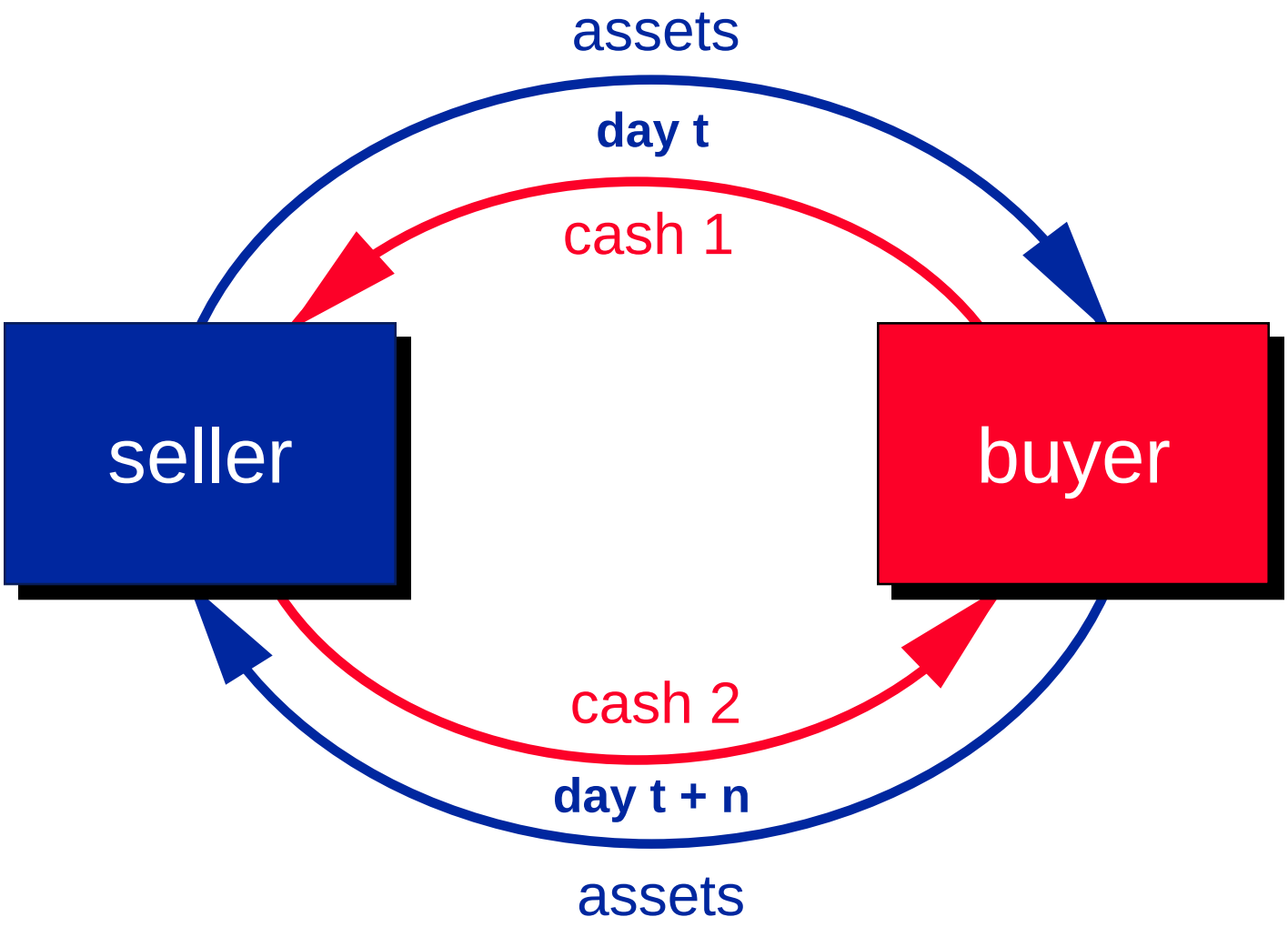
- if seller defaults, buyer can make himself whole by liquidating assets, which therefore act as "collateral"
- what makes good collateral?
  - default risk-free
  - liquid
    - easy to value
    - easy to liquidate

basic mechanics

- if seller defaults, buyer can make himself whole by liquidating assets, which therefore act as “collateral”
- what makes good collateral?
  - default risk-free
  - liquid
    - easy to value
    - easy to liquidate

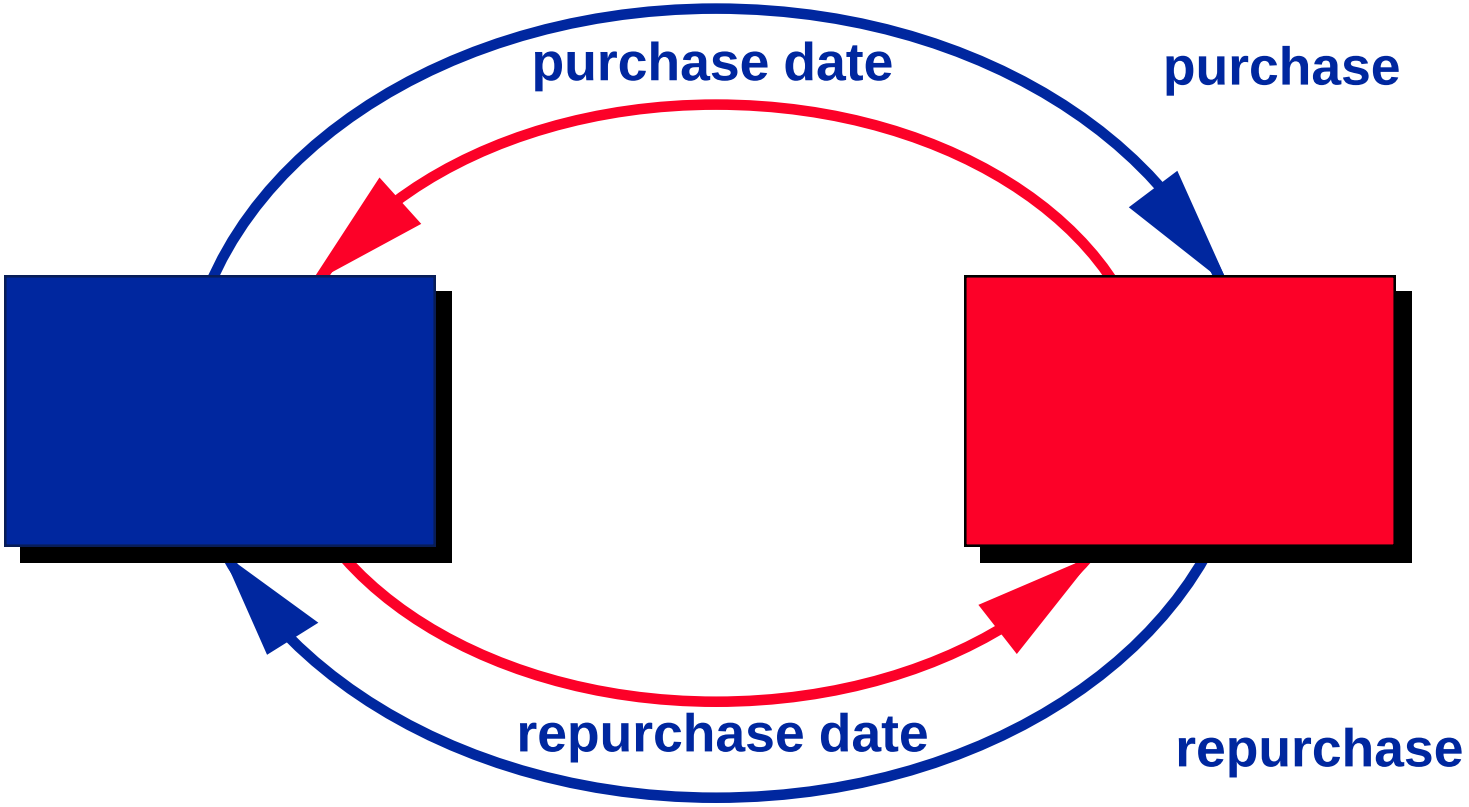
} usually government securities

basic mechanics

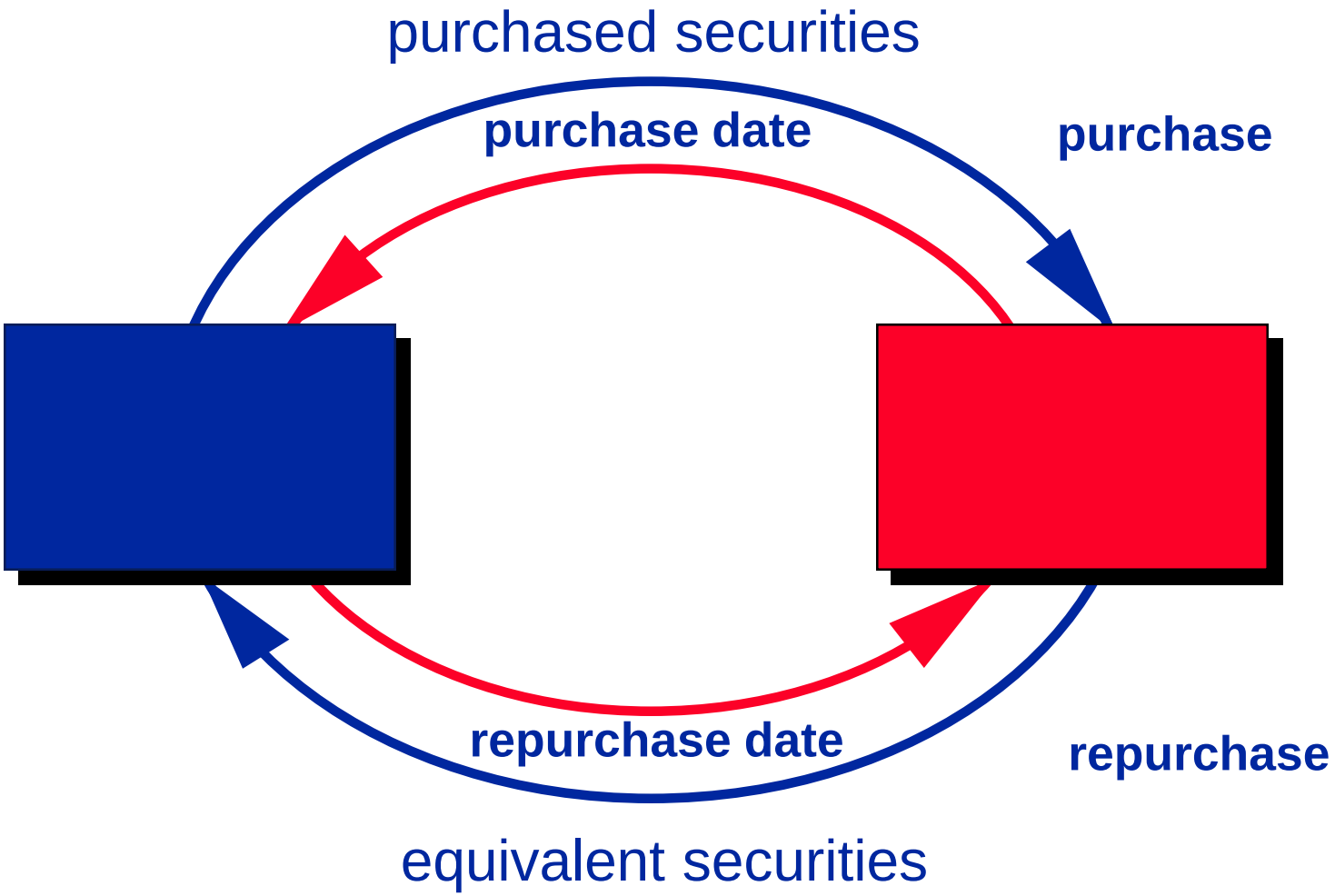


operationally = two transactions

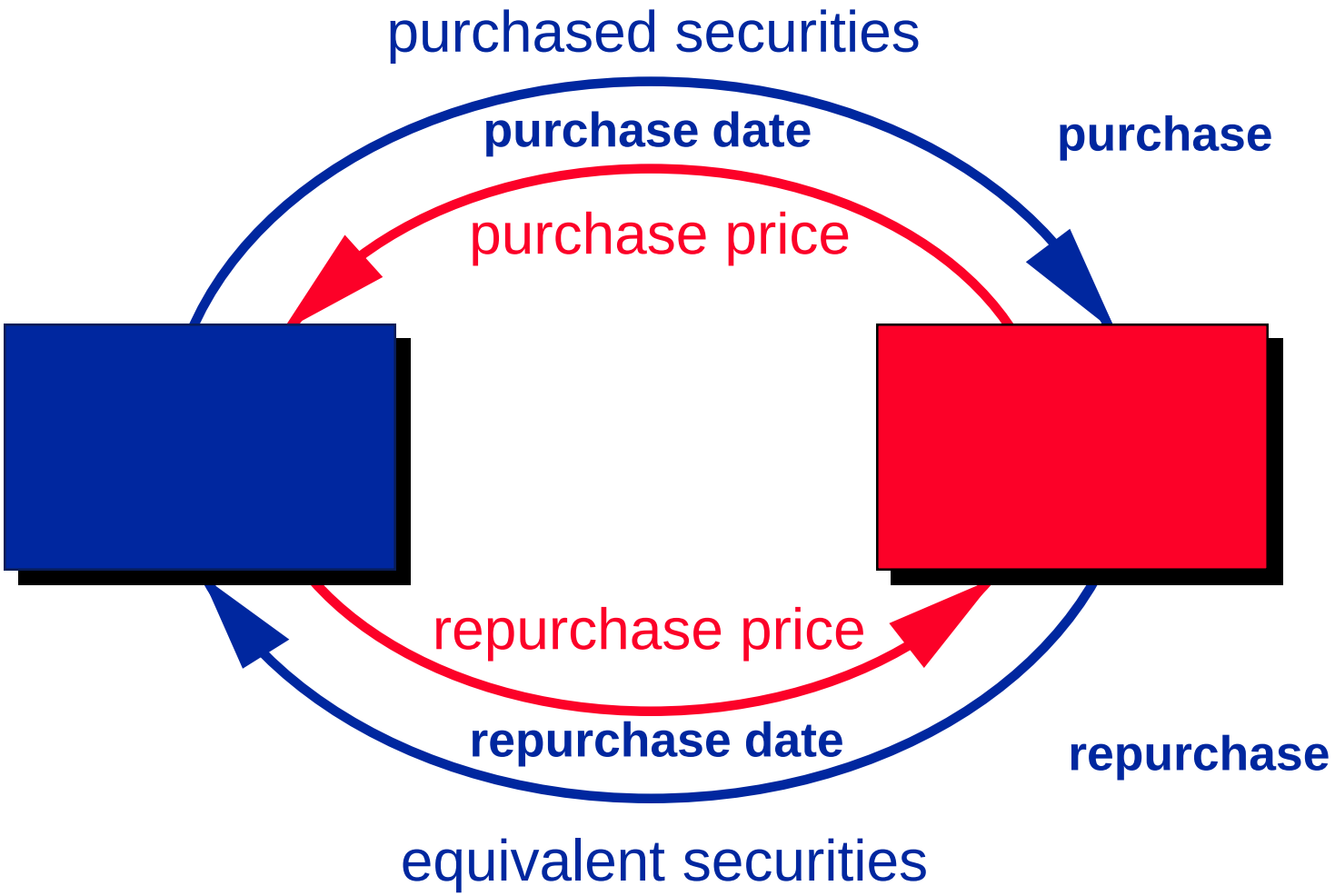
terminology



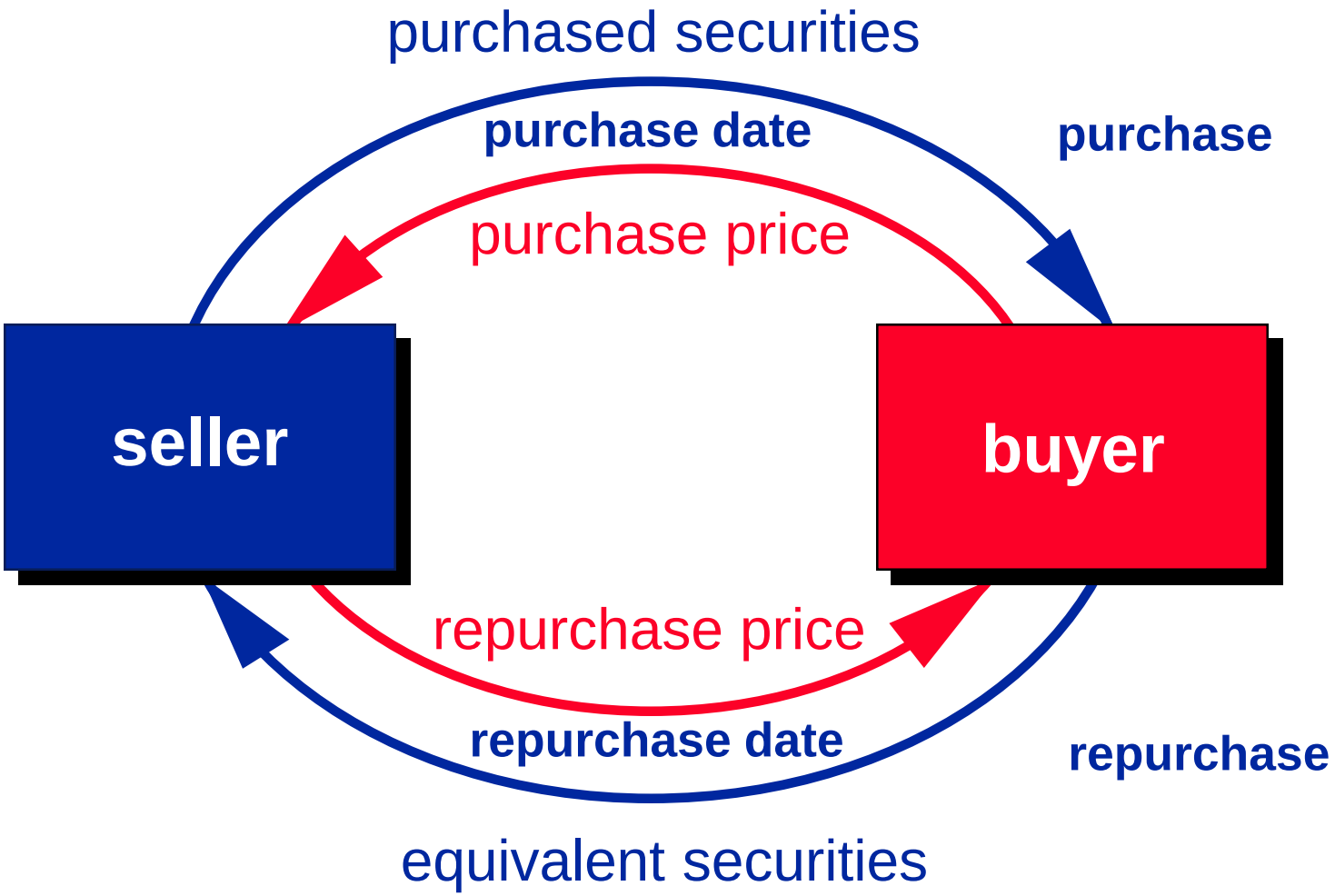
terminology



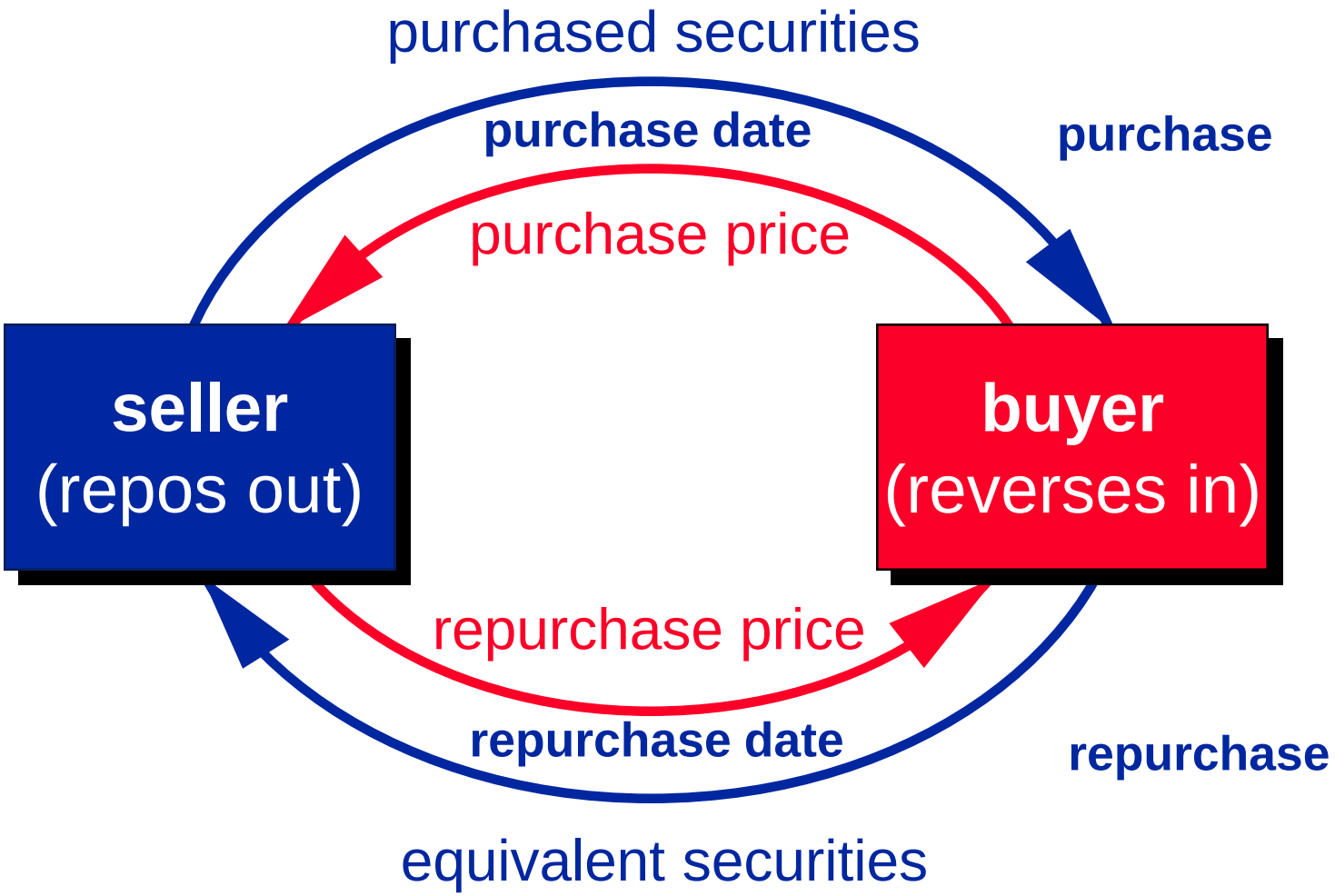
terminology



terminology



terminology

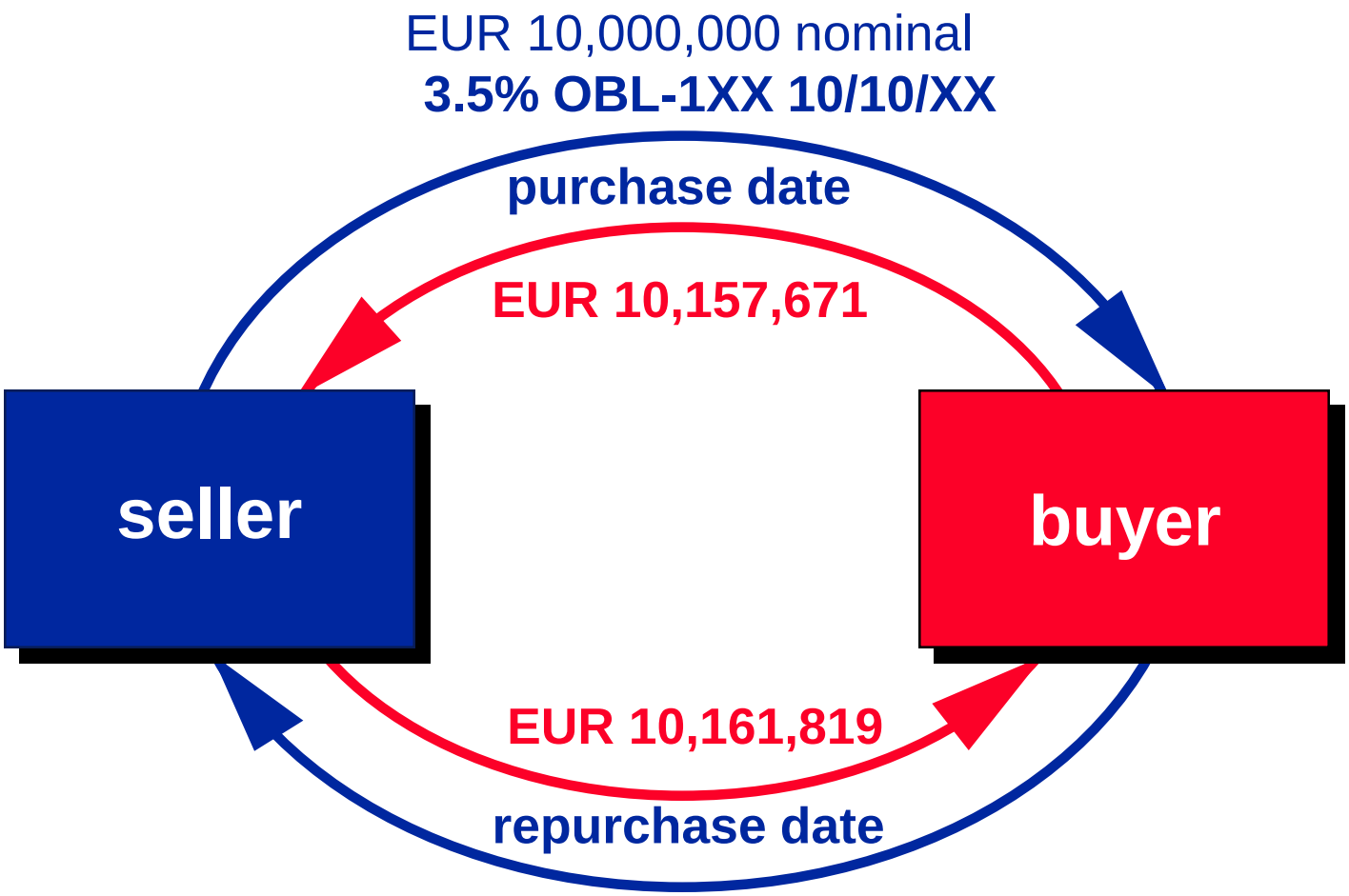


terminology

definitions in GMRA 2000

- purchased securities
  - delivered by seller at the start
  - includes substitute securities
- equivalent securities
  - delivered by buyer after the purchase date
- purchase price --- paid by buyer at start
  - used to describe amount
  - purchase price of sell/buy-back is defined differently
- repurchase price --- purchase price + repo interest owed or paid by seller
  - used to describe amount
  - usually thought of as payment at end but a repurchase price can be calculated each day during term of repo

terminology



10,161,819 = 10,157,671 + 4,148

legal structure

- repo is a sale of a quantity of assets & simultaneous agreement to repurchase the same quantity of equivalent assets at a future date or on demand for original value plus a return on the use of cash
- **quantity** means same nominal amount, redemption value, face value or number of securities
- **equivalent** means:
  - economically but not legally identical
  - definition in GMRA [2(t)]:
    - same issuer, part of same issue, identical type, identical description
    - identical nominal value
    - identical amount unless otherwise agreed
    - equivalent property after corporate event [GMRA 2(t)(B)]
    - notwithstanding redenomination into EUR [GMRA 2(t)(A)]
  - definitions in other master agreements:
    - “same or similar” [EMA]
    - “substantially the same” [MRA]

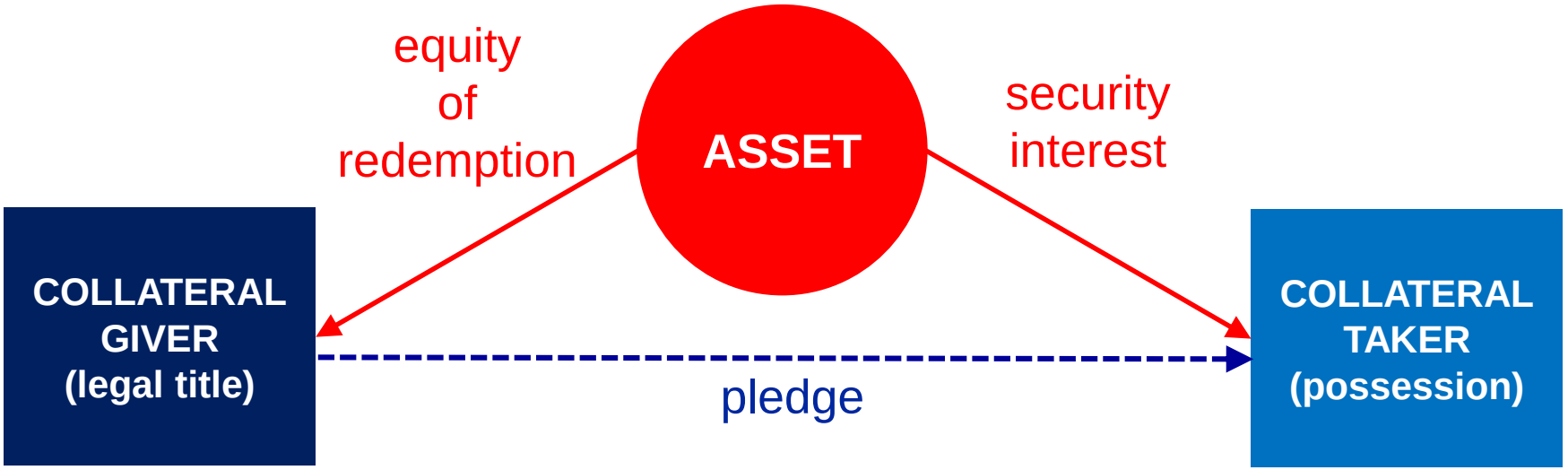
legal structure

- immediate sale & future repurchase of collateral means a true sale & outright transfer of legal & beneficial title to collateral to the buyer
- seller gives up:
  - proprietary rights in collateral in exchange for rights against counterparty
  - right to the return of the very same collateral --- buys back equivalent assets
- buyer acquires
  - legal title means unencumbered right of use
  - beneficial title means rights to benefits of ownership = coupons, dividends, corporate actions, voting rights

legal structure

why not give a security interest in the collateral?

- usually a pledge
- borrower generally retains ownership
- secured lender has limited property rights --- customarily, only right to dispose of secured collateral in event of bankruptcy



legal structure

why not give a security interest in the collateral?

- security interests are subject to the statutory insolvency process
  - security interests need to be validated by fulfilling formalities called 'perfection' requirements
  - in a default, the insolvency court will typically impose:
    - **stays on enforcement** of rights to collateral
    - **claw-backs** of transfers suspected of being fraudulent or giving undue preference pre-bankruptcy
    - limitations on 'ipso facto' clauses such as insolvency being event of default
    - restrictions on method of disposal of collateral
- in most jurisdictions, security interests are therefore likely to be contested, expensive & uncertain, making them unsuitable for collateralising money market (short term) transactions

legal structure

why transfer title to collateral?

- buyer has more certain control over collateral than security interest --- reduces credit risk
- buyer has automatic right to re-sell collateral during the term of the repo --- reduces liquidity risk

economic operation

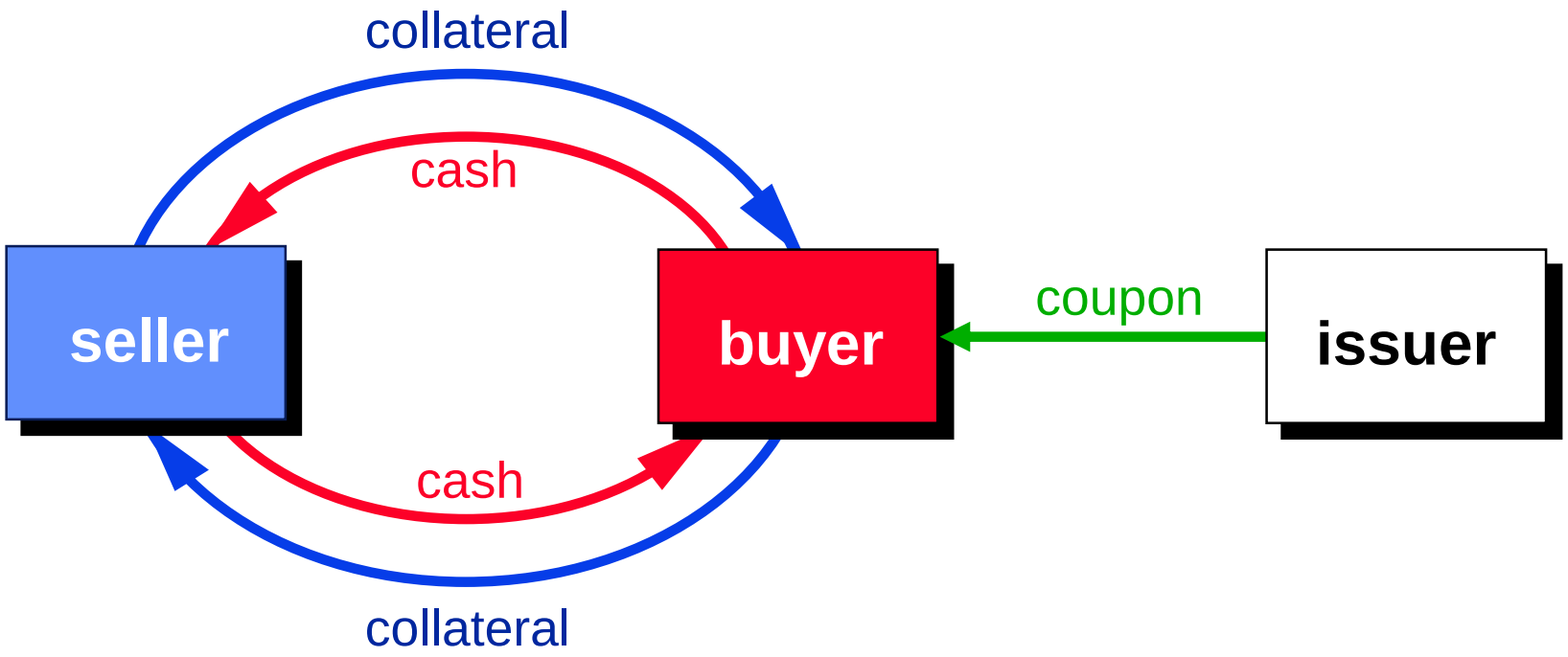
- obligation to make a future repurchase of collateral for original value means the transfer of title to the buyer is only temporary
- this creates loan of cash against loan of collateral
- repo functions like secured loan/deposit
  - capital at start = capital at end
  - return is for use of cash, not coupon or dividend for holding asset --- analogous to interest income & is commonly called ‘repo interest’ (but is legally the difference between two bond prices)
  - common to talk about ‘borrowing’ & ‘lending’ cash & collateral in a repo, even though it is buying & selling

economic operation

- obligation to make a future repurchase of collateral for original value also means risk on collateral impacts seller, not buyer
  - market risk --- if collateral value falls (rises), seller has to repurchase at original value & suffers loss (profit)
  - credit risk --- if issuer of collateral defaults, seller has to repurchase at higher pre-default price
- repurchase is forward transaction in which seller hedges buyer against risk on collateral
- but seller will not take risk on collateral unless he receives return on collateral
  - capital gain/loss from changes in clean price
  - income accrued during repo
  - income paid during repo

economic operation

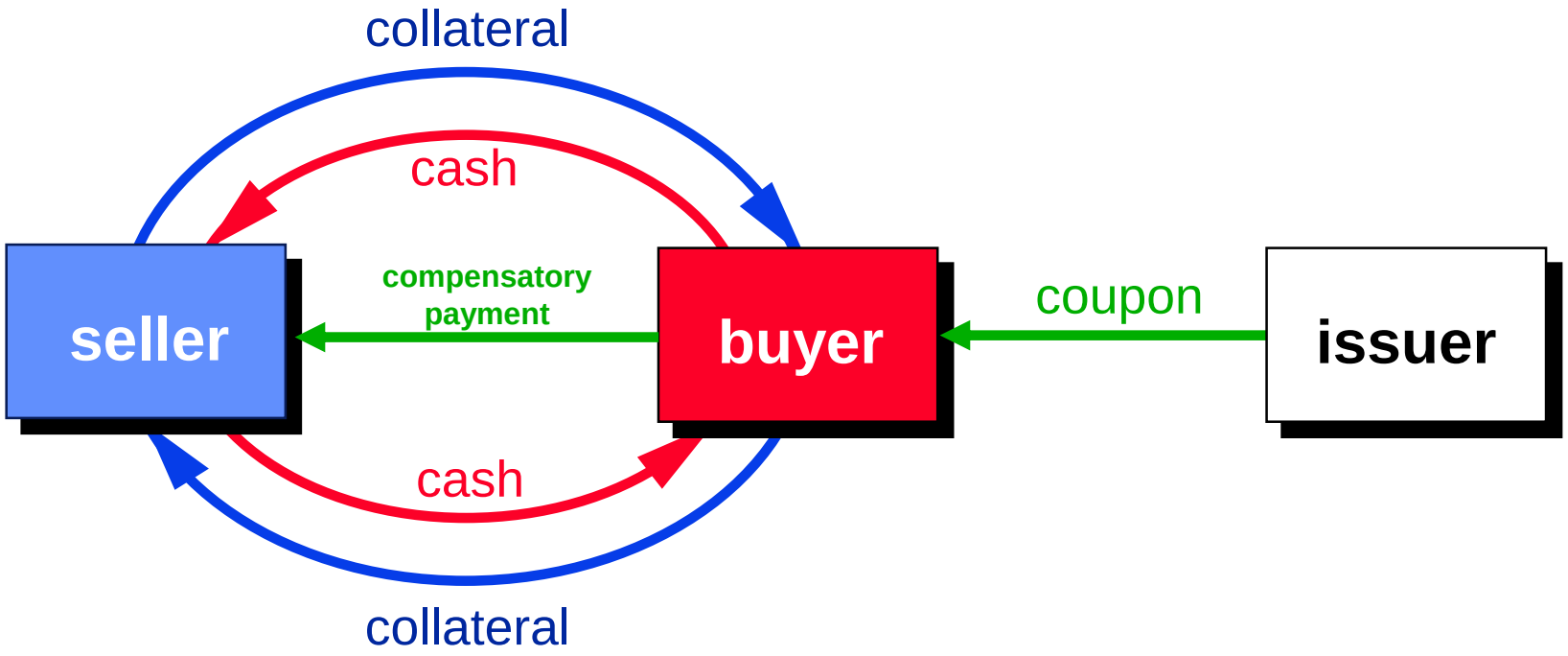
income paid on **repurchase transaction**



Note: repo return (ie return on cash) is not shown.

economic operation

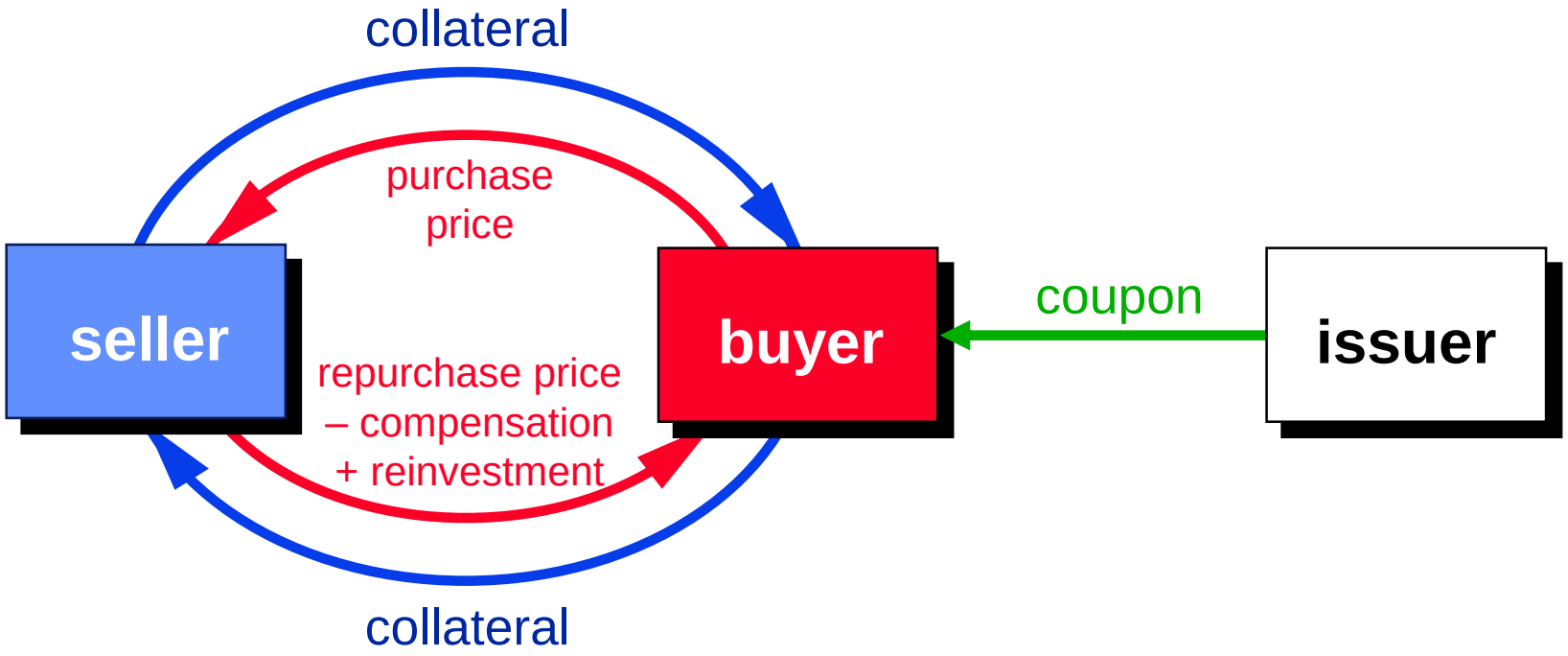
income paid on **repurchase transaction** --- buyer compensates seller by means of same-day payment



Note: repo return (ie return on cash) is not shown.

economic operation

income paid on **sell/buy-back** --- deferred compensation instead of income payment



Note: repo return (ie return on cash) is not shown.

economic operation

summary

- **purchase** transfers legal title to buyer in order to:
  - reduce his legal risk --- reduce credit risk
  - allow re-use of collateral --- reduce liquidity risk
  - reduced risk is rewarded with more lending at lower rates
- **repurchase** shifts risk/return back to seller in order to:
  - allows seller to borrow cash & give security as collateral but keep risk/return on security --- seller can use repo purely for financing securities
  - allows buyer to lend cash & take securities as collateral but without taking risk/return on security --- buyer can use repo purely for cash investment
- by end of repo, seller gets back any return on collateral (capital gains, income accrued or paid during repo)
- it is as though collateral had never been repoed out
- repo should not change investment risk of seller or expose buyer to investment risk on collateral

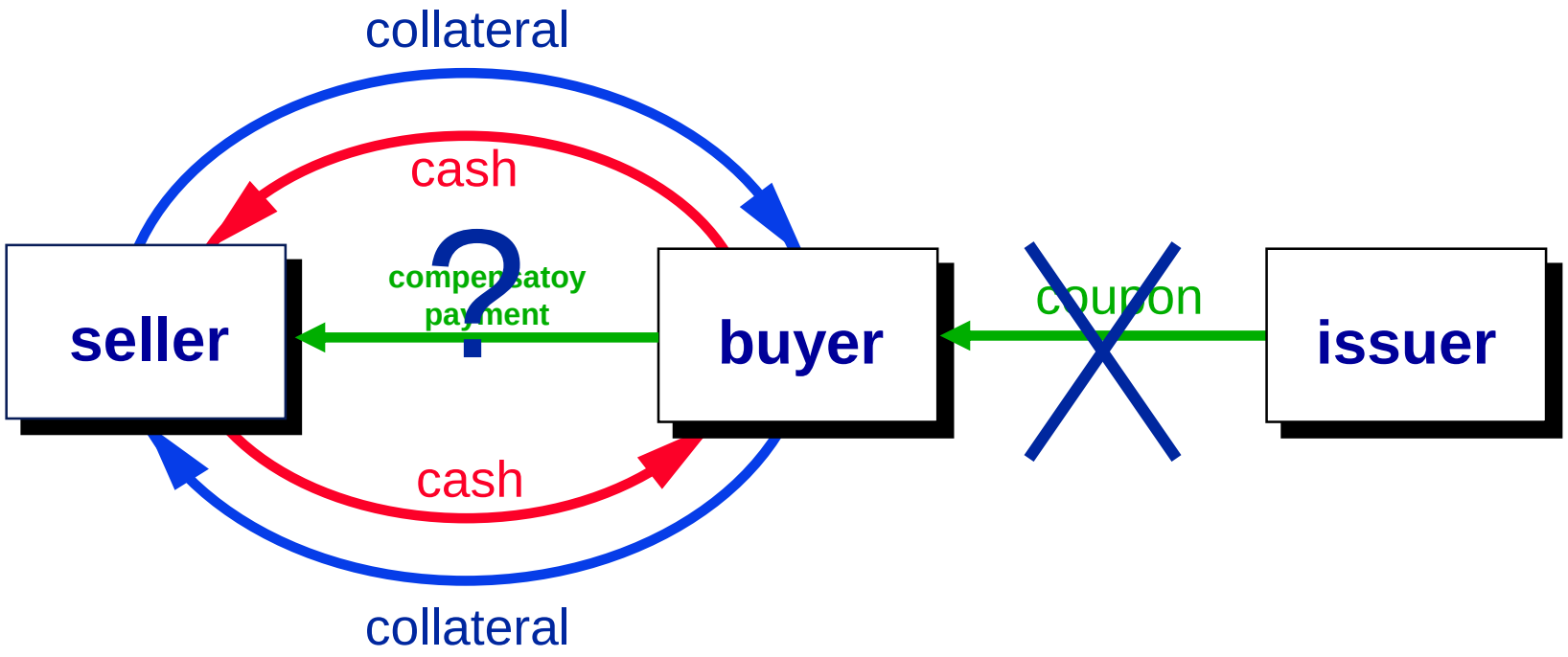
legal structure & economic operation

do you really understand repo?

- what happens if income is not paid on collateral?
- how to account for repo?

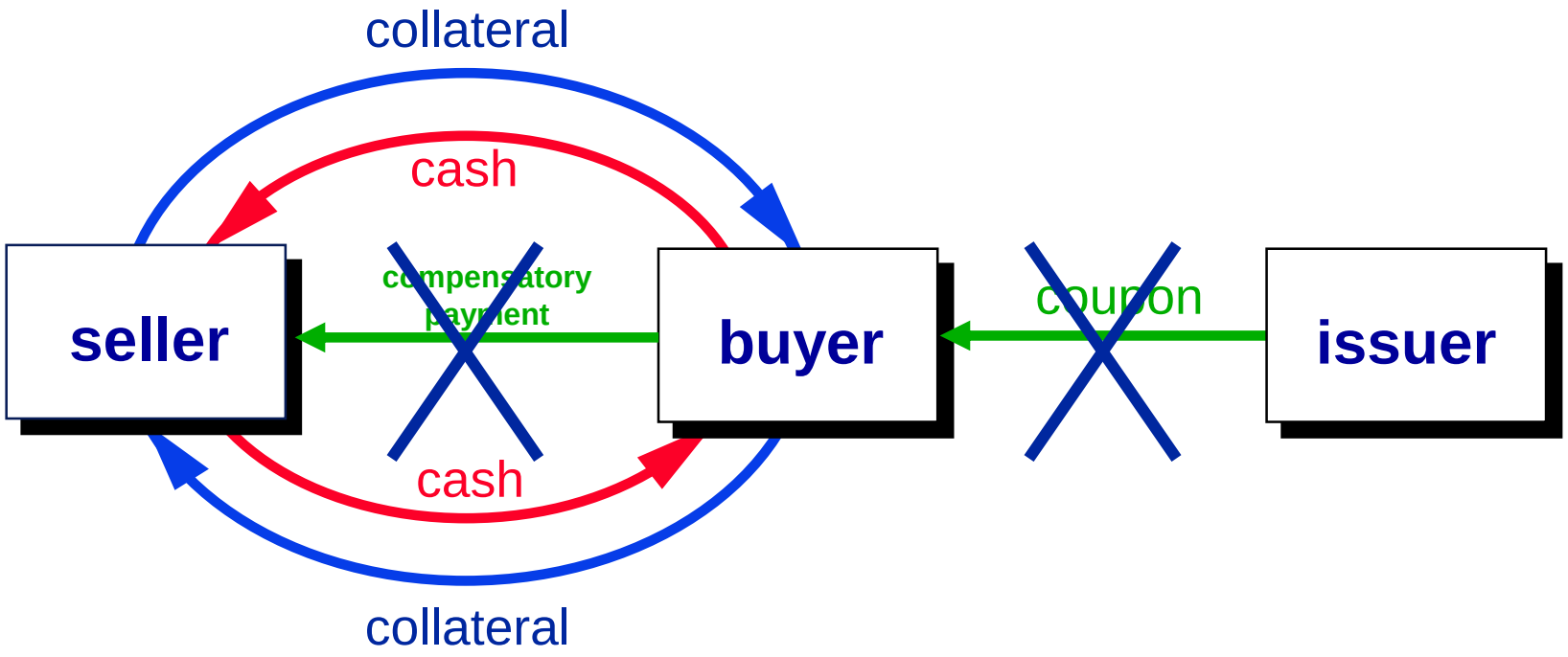
legal structure & economic operation

question: if income is not paid on collateral, does buyer pay compensatory payment?



legal structure & economic operation

answer: no, the seller retains the risk on the collateral & only passes through what he receives



legal structure & economic operation

question: how to account for repo?

before repo

seller

assets		liabilities	
bonds	100	capital	10
		debt	90
	100		100

buyer

assets		liabilities	
cash	100	capital	10
		debt	90
	100		100

repo of 10 of bonds

legal structure & economic operation

question: how to account for repo?

before repo

seller

assets		liabilities	
bonds	100	capital	10
		debt	90
	100		100

buyer

assets		liabilities	
cash	100	capital	10
		debt	90
	100		100

after repo

assets		liabilities	
bonds	100	capital	10
cash	10	debt	100
	110		110

repo of 10 of bonds

because risk/return on collateral is taken by seller
it stays on his balance sheet

legal structure & economic operation

answer: like an unsecured deposit

before repo

seller

assets		liabilities	
bonds	100	capital	10
		debt	90
	100		100

buyer

assets		liabilities	
cash	100	capital	10
		debt	90
	100		100

after repo

assets		liabilities	
bonds	100	capital	10
cash	10	debt	100
	110		110

assets		liabilities	
cash	90	capital	10
loan	10	debt	90
	100		100

repo of 10 of bonds

because risk/return on collateral is taken by seller
it stays on his balance sheet

things like repo

repo has legal & economic analogues

- repo is analogous to FX swap
- legally both involve immediate sale & future repurchase
- economically both create exchange of loans
- however, FX swap exchanges two cash amounts, so is off-balance sheet & accounted for like derivative

things like repo

US repo is different

- title transfer subject to recharacterisation risk in US (US courts look to substance)
- pledging in US easy
- so repo collateral is pledged, not sold
- but problems with pledging are resolved by:
  - exemption of repo pledges from basic rules of Bankruptcy Code ('safe harbors')
  - giving buyer a contractual general right of use
- result is different legal form, but same economic effect as title transfer repo
- US market talks about 'pledging' & 'rehypothecation' but we should not!

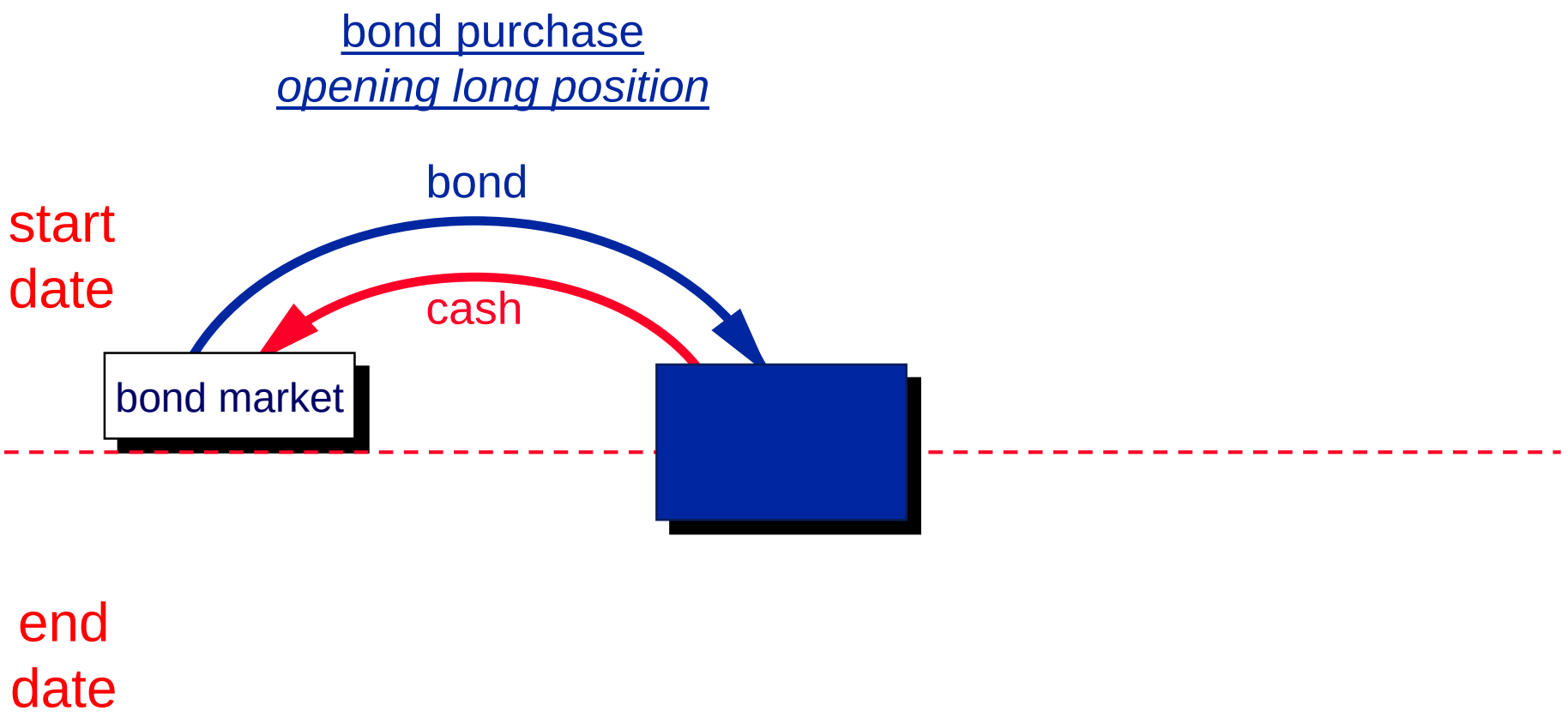
core uses

- why do firms do repo?
- why do firms do reverse repo?

core uses

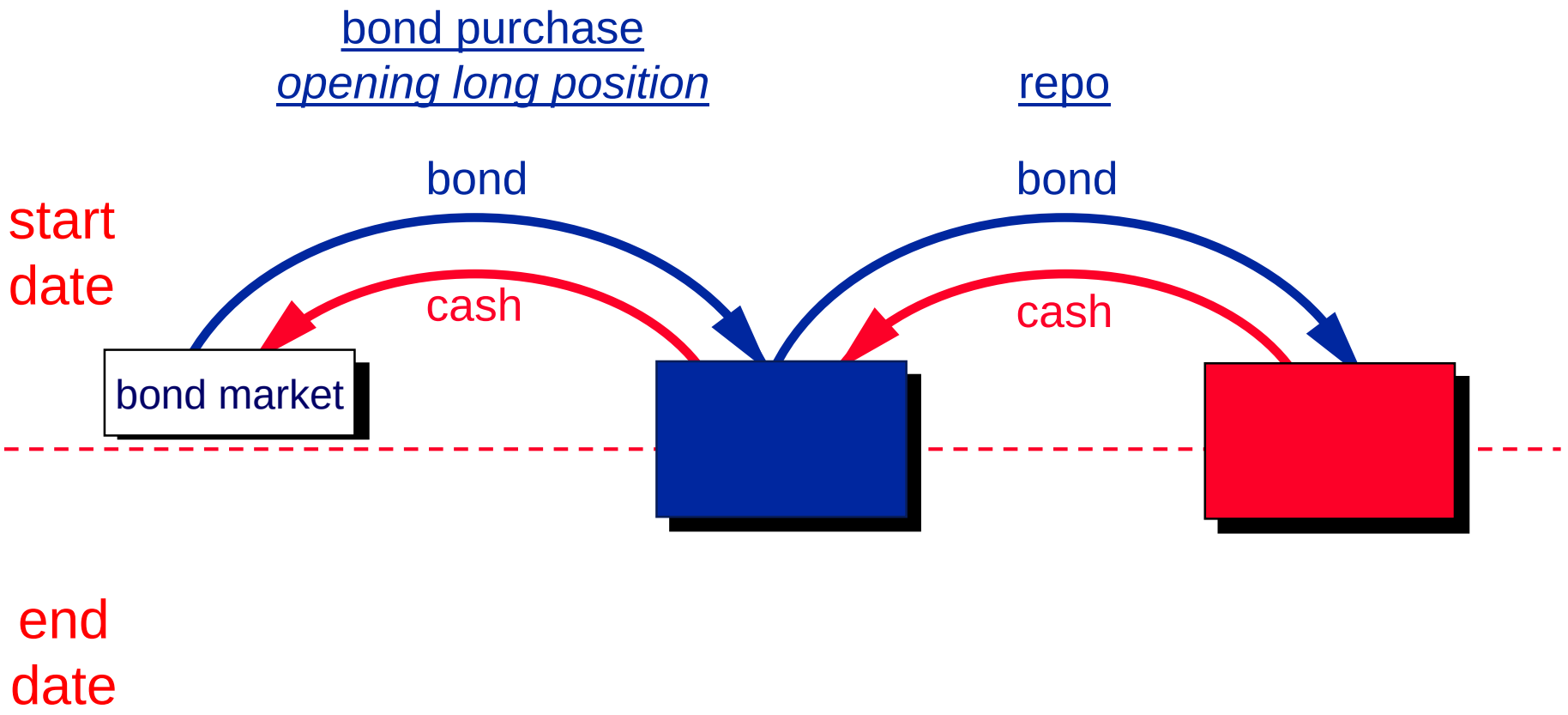
- sellers can use repo to borrow cash to **finance long positions** & buyers can use reverse repo to lend cash --- cash-driven repo
- buyers can use reverse repo to borrow securities to **cover short positions** & sellers can use repo to lend securities --- securities-driven repo

core use --- funding long position



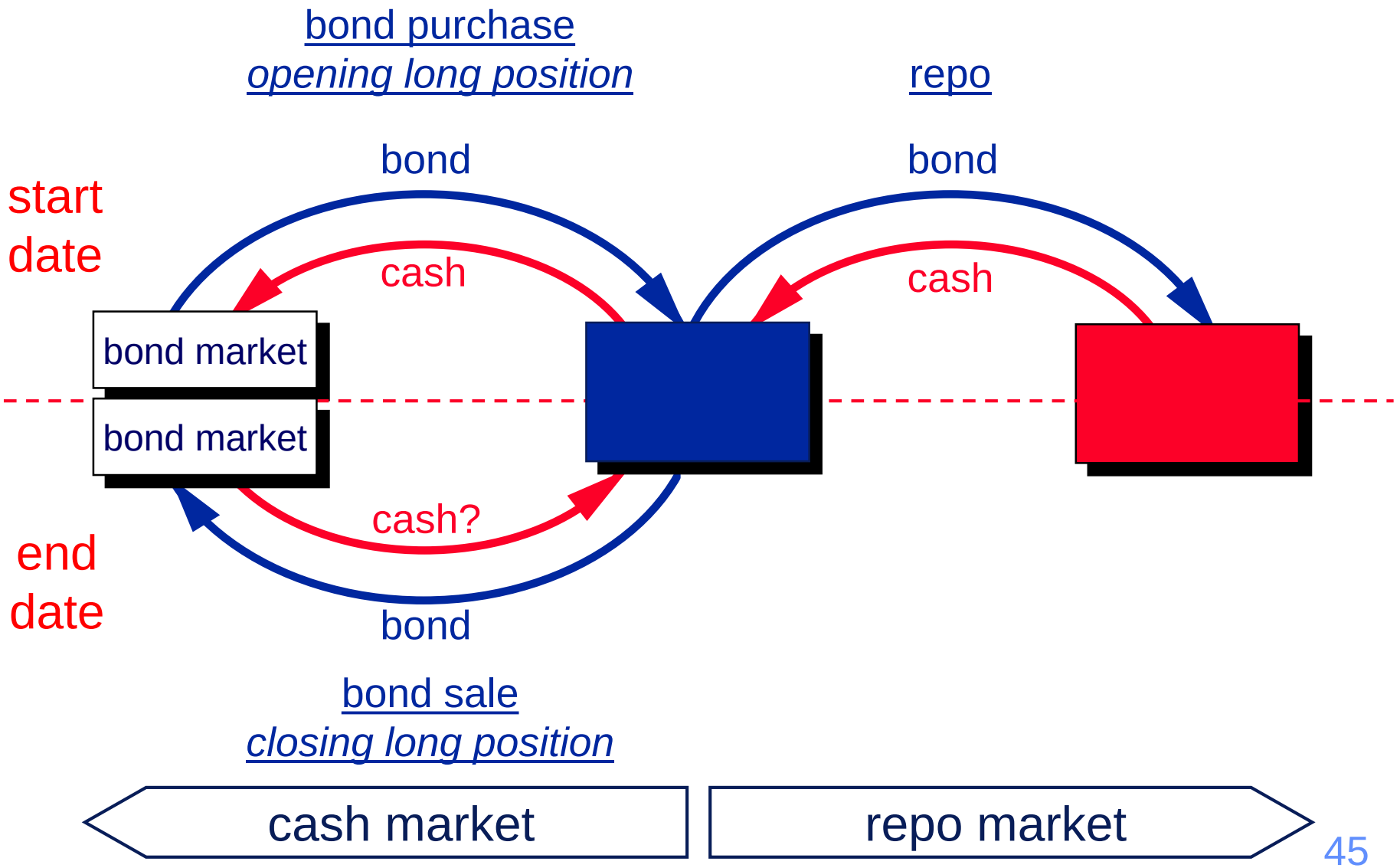
cash market

core use --- funding long position

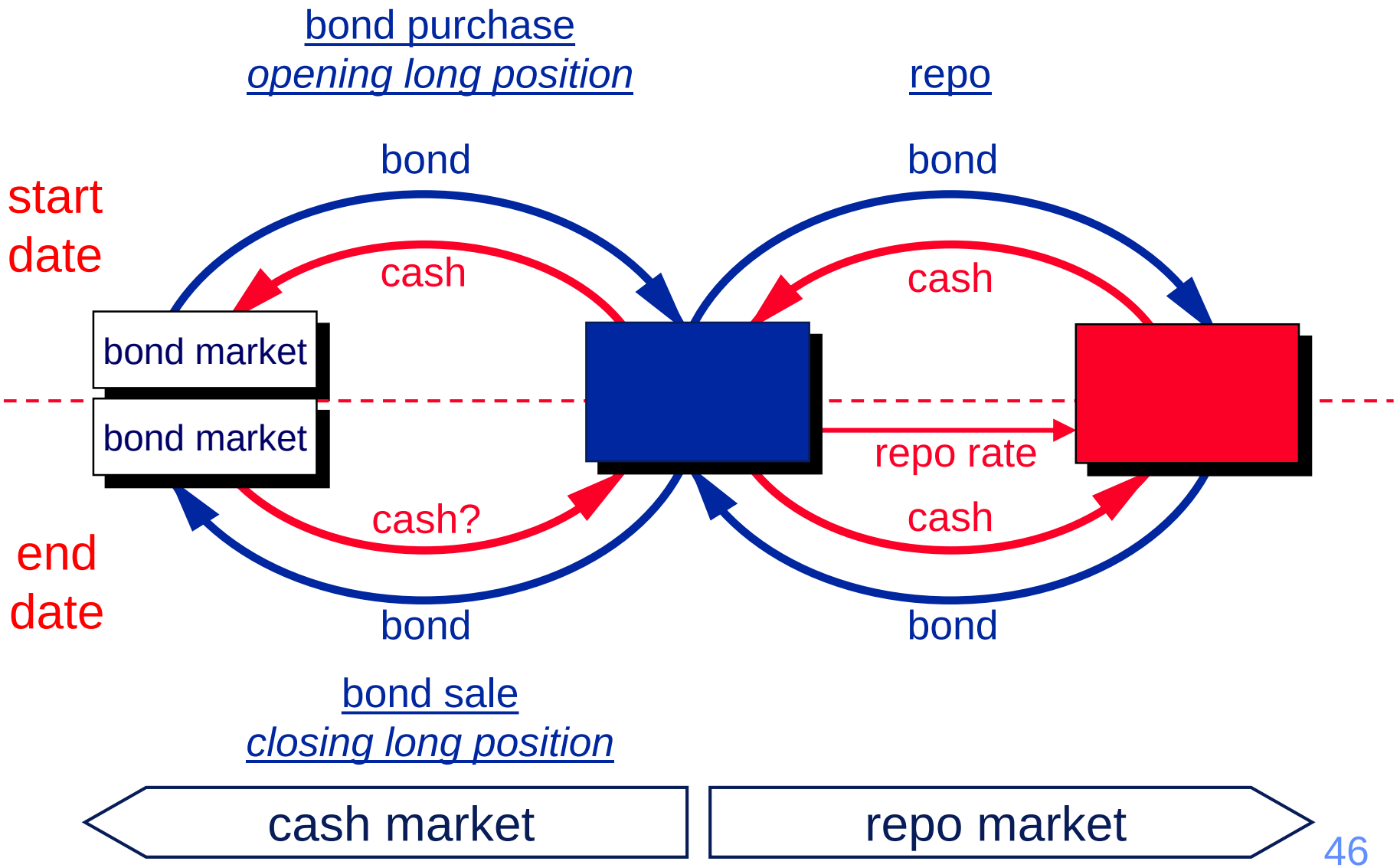


cash market | repo market

core use --- funding long position



core use --- funding long position



core use --- funding long position

date	action	BTAN delivery	cash payment
Tuesday 2 June	buy 10 million nominal of 5Y BTAN in cash market from Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		

core use --- funding long position

date	action	BTAN delivery	cash payment
Tuesday 2 June	buy 10 million nominal of 5Y BTAN in cash market from Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week repo of 10 million nominal of 5Y BTAN to JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		

core use --- funding long position

date	action	BTAN delivery	cash payment
Tuesday 2 June	buy 10 million nominal of 5Y BTAN in cash market from Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week repo of 10 million nominal of 5Y BTAN to JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		
Thursday 4 June	receive 10 million nominal of 5Y BTAN from Citi and pay 10,550,000	+10,000,000 nominal from Citi	-10,550,000 to Citi
	deliver 10 million nominal of 5Y BTAN to JP Morgan and receive 10,550,000	-10,000,000 nominal to JP Morgan	+10,550,000 from JP Morgan

core use --- funding long position

date	action	BTAN delivery	cash payment
Tuesday 2 June	buy 10 million nominal of 5Y BTAN in cash market from Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week repo of 10 million nominal of 5Y BTAN to JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		
Thursday 4 June	receive 10 million nominal of 5Y BTAN from Citi and pay 10,550,000	+10,000,000 nominal from Citi	-10,550,000 to Citi
	deliver 10 million nominal of 5Y BTAN to JP Morgan and receive 10,550,000	-10,000,000 nominal to JP Morgan	+10,550,000 from JP Morgan
Tuesday 9 June	sell 10 million nominal of 5Y BTAN in cash market to SocGen for delivery on T+2 (Thursday) for 10,100,000 (dirty price 101.00)		

core use --- funding long position

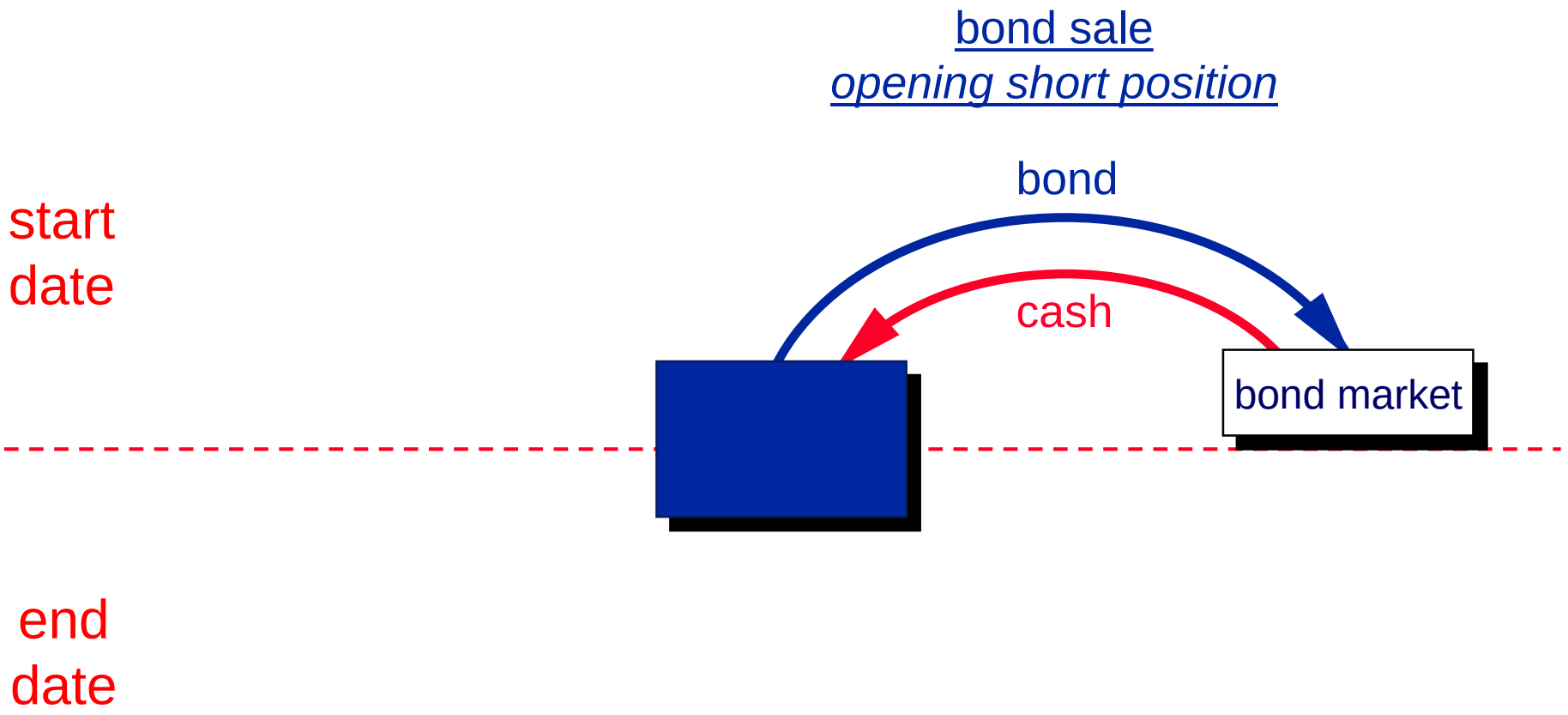
date	action	BTAN delivery	cash payment
Tuesday 2 June	buy 10 million nominal of 5Y BTAN in cash market from Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week repo of 10 million nominal of 5Y BTAN to JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		
Thursday 4 June	receive 10 million nominal of 5Y BTAN from Citi and pay 10,550,000	+10,000,000 nominal from Citi	-10,550,000 to Citi
	deliver 10 million nominal of 5Y BTAN to JP Morgan and receive 10,550,000	-10,000,000 nominal to JP Morgan	+10,550,000 from JP Morgan
Tuesday 9 June	sell 10 million nominal of 5Y BTAN in cash market to SocGen for delivery on T+2 (Thursday) for 10,100,000 (dirty price 101.00)		
Thursday 11 June	deliver 10 million nominal of 5Y BTAN to SocGen and receive 10,100,000	-10,000,000 nominal to SocGen	+10,100,000 from SocGen
	unwind repo by repurchasing 10 million nominal of 5Y BTAN from JP Morgan and paying 10,550,205 [= 10,550,000 * (1 + ((0.10 * 7)/(100 * 360)))]	+10,000,000 nominal from JP Morgan	-10,550,205 to JP Morgan

core uses

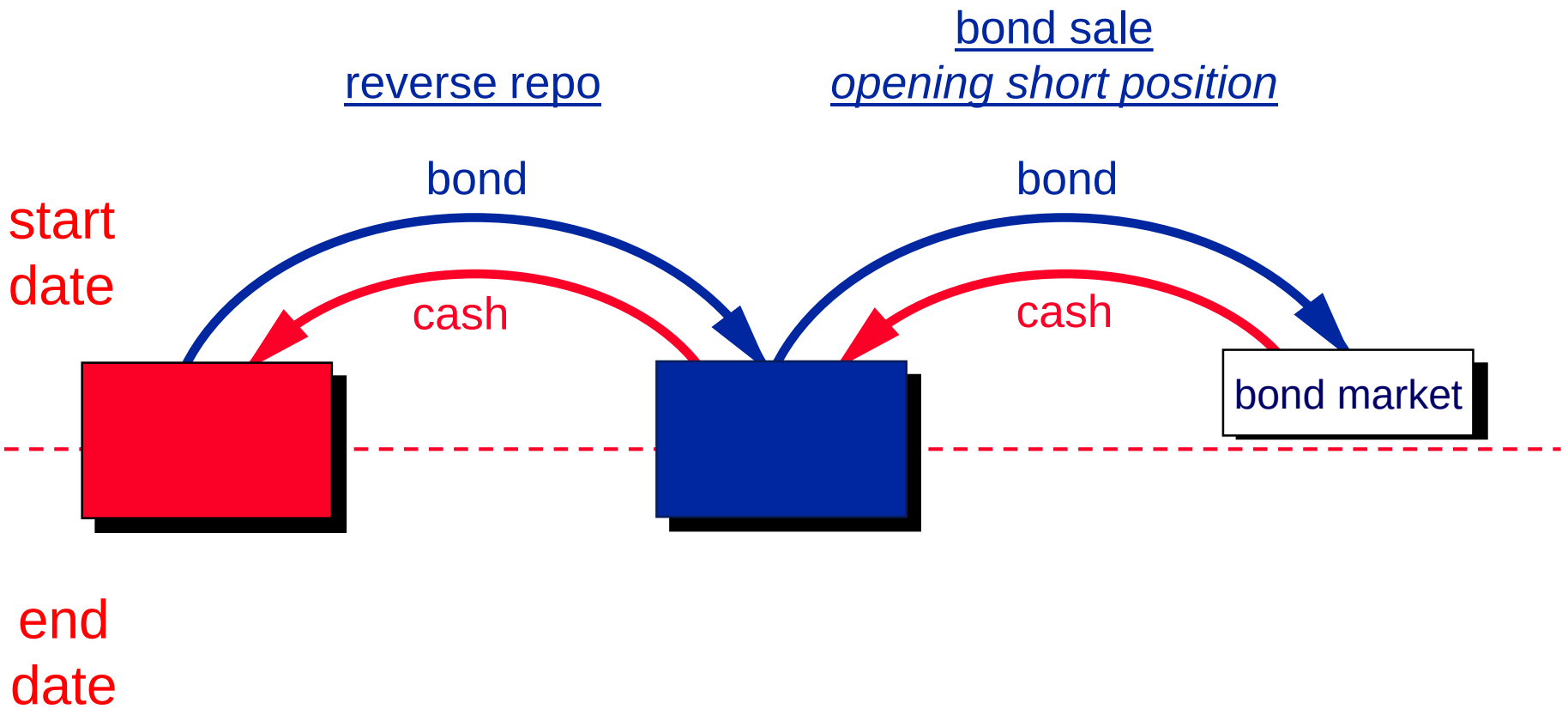
why repo?

- seller
  - liquidity management (borrowing)
  - funding trading inventory (especially for market-makers)
  - funding long risk positions
  - funding long hedges of short cash or derivative positions
  - funding long positions to arbitrage against short cash or derivatives positions
- buyer
  - liquidity management (lending) & reducing risk
- seller or buyer
  - credit intermediation (matched-book trading)

core use --- covering short position



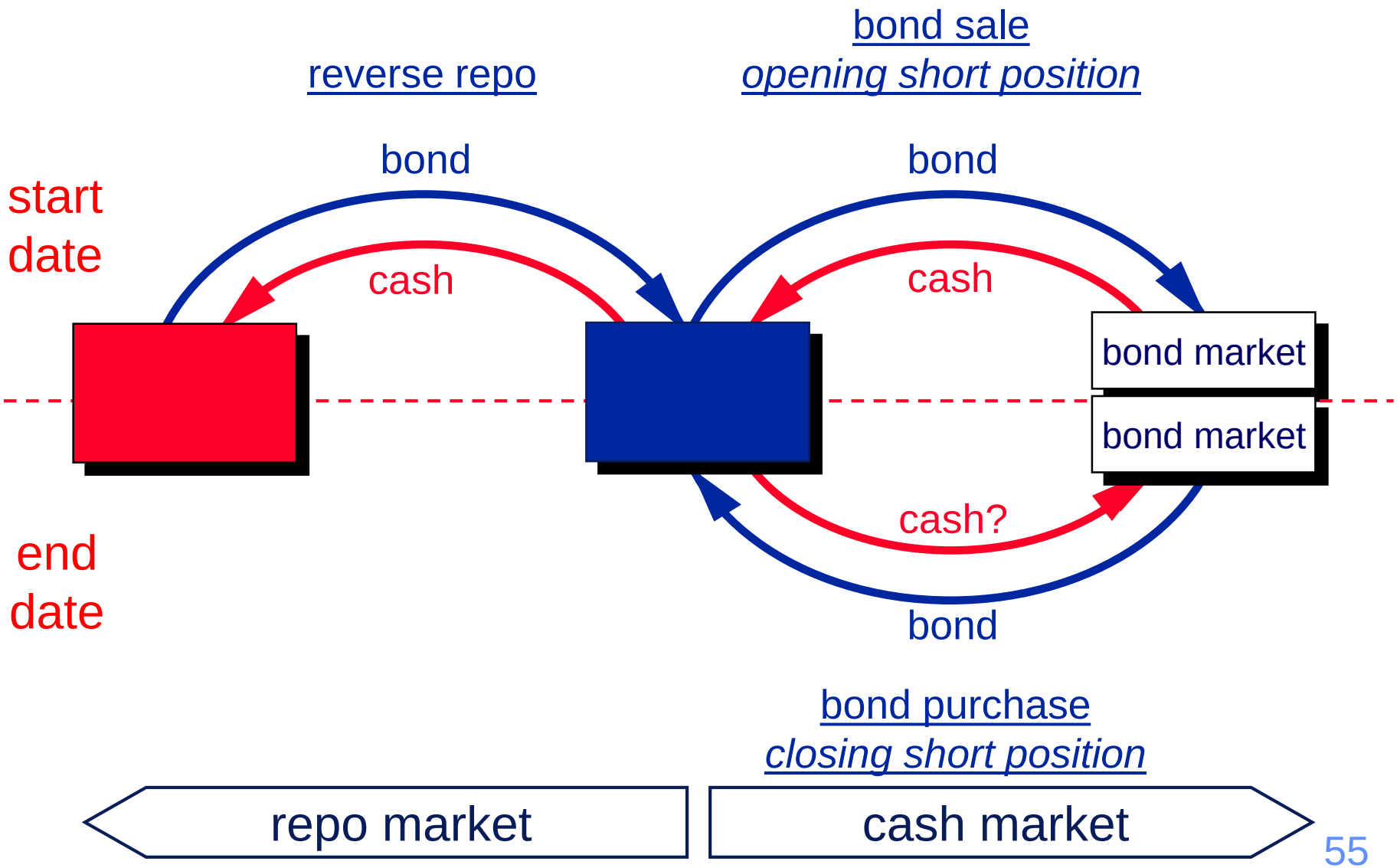
core use --- covering short position



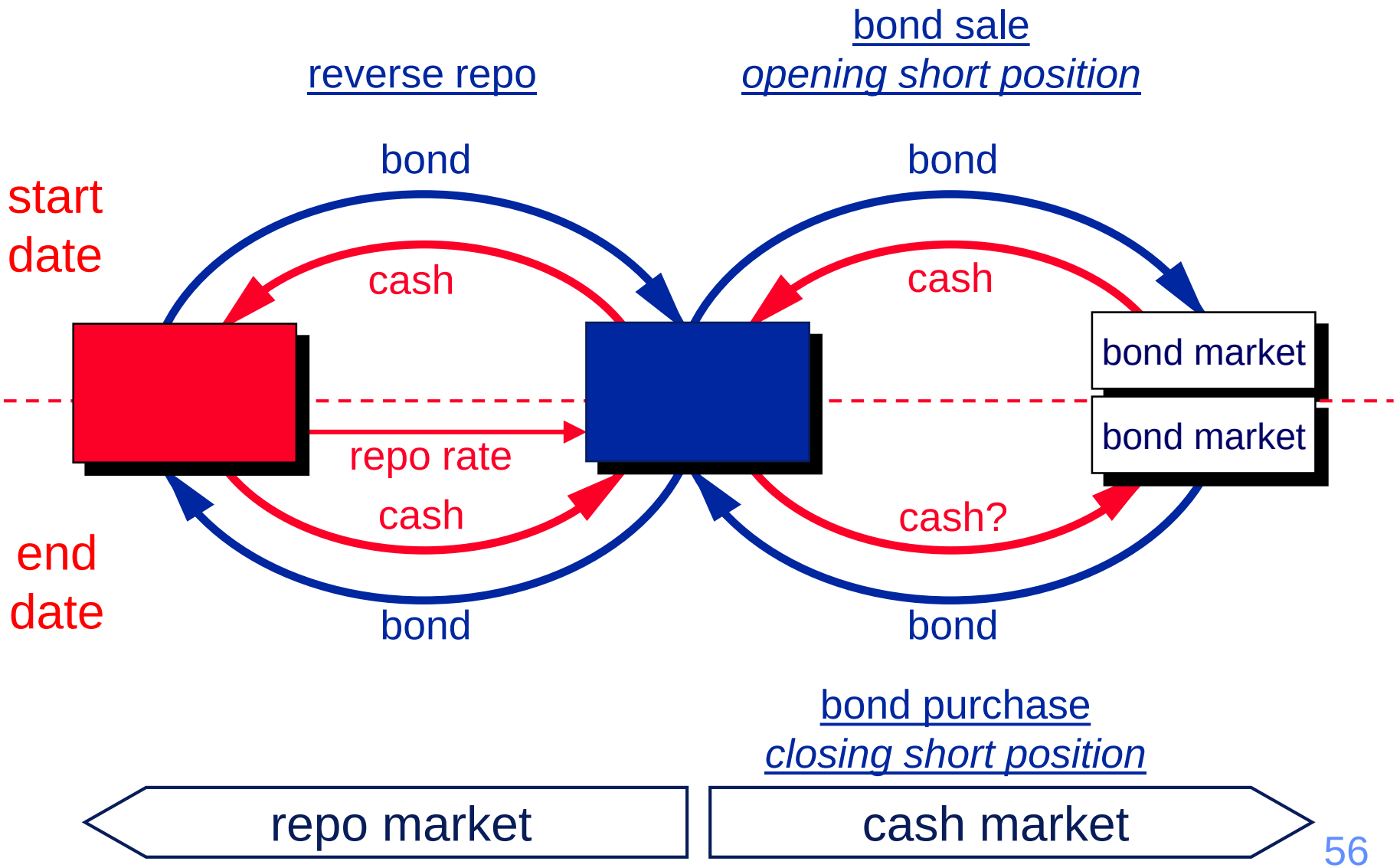
repo market

cash market

core use --- covering short position



core use --- covering short position



core use --- covering short position

date	action	BTAN delivery	cash payment
Tuesday 2 June	sell 10 million nominal of 5Y BTAN in cash market to Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		

core use --- covering short position

date	action	BTAN delivery	cash payment
Tuesday 2 June	sell 10 million nominal of 5Y BTAN in cash market to Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week reverse repo of 10 million nominal of 5Y BTAN from JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		

core use --- covering short position

date	action	BTAN delivery	cash payment
Tuesday 2 June	sell 10 million nominal of 5Y BTAN in cash market to Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week reverse repo of 10 million nominal of 5Y BTAN from JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		
Thursday 4 June	deliver 10 million nominal of 5Y BTAN to Citi and receive 10,550,000	-10,000,000 nominal to Citi	+10,550,000 from Citi
	receive 10 million nominal of 5Y BTAN from JP Morgan and receive 10,550,000	+10,000,000 nominal from JP Morgan	-10,550,000 to JP Morgan

core use --- covering short position

date	action	BTAN delivery	cash payment
Tuesday 2 June	sell 10 million nominal of 5Y BTAN in cash market to Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week reverse repo of 10 million nominal of 5Y BTAN from JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		
Thursday 4 June	deliver 10 million nominal of 5Y BTAN to Citi and receive 10,550,000	-10,000,000 nominal to Citi	+10,550,000 from Citi
	receive 10 million nominal of 5Y BTAN from JP Morgan and receive 10,550,000	+10,000,000 nominal from JP Morgan	-10,550,000 to JP Morgan
Tuesday 9 June	buy 10 million nominal of 5Y BTAN in cash market from SocGen for delivery on T+2 (Thursday) for 10,100,000 (dirty price 101.00)		

core use --- covering short position

date	action	BTAN delivery	cash payment
Tuesday 2 June	sell 10 million nominal of 5Y BTAN in cash market to Citi for delivery on T+2 (Thursday) for 10,550,000 (dirty price 105.50)		
Wednesday 3 June	agree 1-week reverse repo of 10 million nominal of 5Y BTAN from JP Morgan at a repo rate of 0.10% for delivery on T+1 (Thursday) for EUR 10,550,000 (have assumed that bond price has not changed)		
Thursday 4 June	deliver 10 million nominal of 5Y BTAN to Citi and receive 10,550,000	-10,000,000 nominal to Citi	+10,550,000 from Citi
	receive 10 million nominal of 5Y BTAN from JP Morgan and receive 10,550,000	+10,000,000 nominal from JP Morgan	-10,550,000 to JP Morgan
Tuesday 9 June	buy 10 million nominal of 5Y BTAN in cash market from SocGen for delivery on T+2 (Thursday) for 10,100,000 (dirty price 101.00)		
Thursday 11 June	receive 10 million nominal of 5Y BTAN from SocGen and pay 10,100,000	+10,000,000 nominal from SocGen	-10,100,000 to SocGen
	unwind reverse repo by delivering 10 million nominal of 5Y BTAN to JP Morgan and receive 10,550,205 [= 10,550,000 * (1 + ((0.10 * 7)/(100 * 360)))]	-10,000,000 nominal to JP Morgan	+10,550,205 from JP Morgan

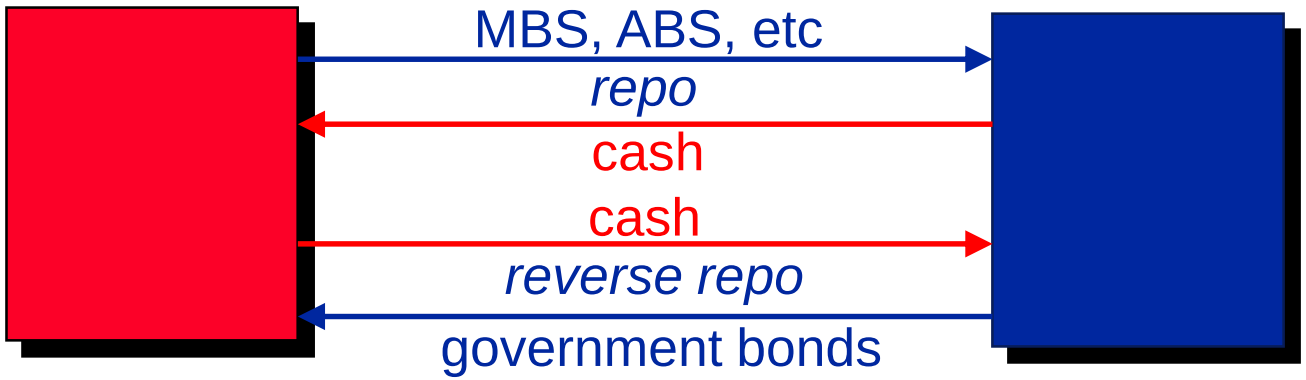
core uses

why reverse repo?

- buyer
  - avoiding fails
  - hedging transitory short positions (market-makers)
  - covering short risk positions
  - covering short hedges of long cash or derivatives positions (including market-makers)
  - covering short positions to hedge new issues
  - covering short positions to arbitrage against long cash or derivatives positions
- seller
  - yield enhancement (lending specials for cheap cash)
- buyer or seller
  - trading specials
  - collateral transformation (swapping collateral)

core uses

collateral/liquidity swaps are often executed as back-to-back repo & reverse repo



credit risk

- probable loss on repo =

  Probability of Default (PD) x Loss Given Default (LGD)

- collateral reduces LGD
- PD on repo is joint probability of default by repo counterparty & collateral issuer
  - if repo counterparty defaults, liquidate collateral
  - if collateral issuer defaults, resort to repo counterparty

  } double indemnity

  - what if repo counterparty & collateral issuer default simultaneously?

  } wrong-way risk

credit risk

joint Probability of Default

assume cumulative default probabilities:

- PD of AA counterparty, AA collateral = 0.0075%

credit risk

joint Probability of Default

assume cumulative default probabilities:

- PD of AA counterparty, AA collateral = 0.0075%
- counterparty/collateral correlation = 0
- joint probability of default?

credit risk

joint Probability of Default

assume cumulative default probabilities:

- PD of AA counterparty, AA collateral = 0.0075%
- counterparty/collateral correlation = 0
- joint probability of default
  = 0.0075% x 0.0075% = 0.000000563%

credit risk

joint Probability of Default

assume cumulative default probabilities:

- PD of AA counterparty, AA collateral = 0.0075%
- counterparty/collateral correlation = 1
- joint probability of default?

credit risk

joint Probability of Default

assume cumulative default probabilities:

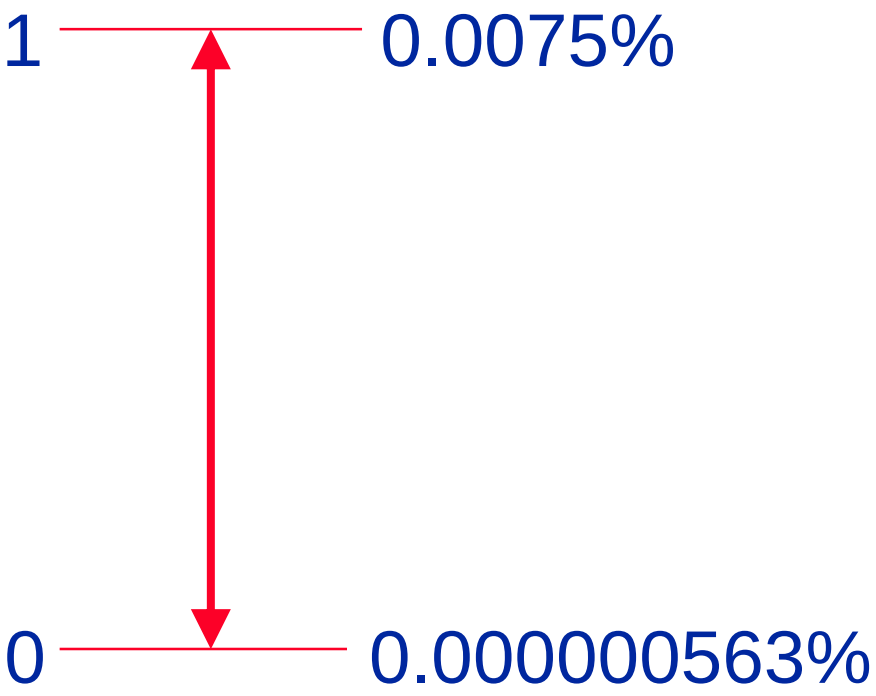
- PD of AA counterparty, AA collateral = 0.0075%
- counterparty/collateral correlation = 1
- joint probability of default = 0.0075%

credit risk

Probability of Default

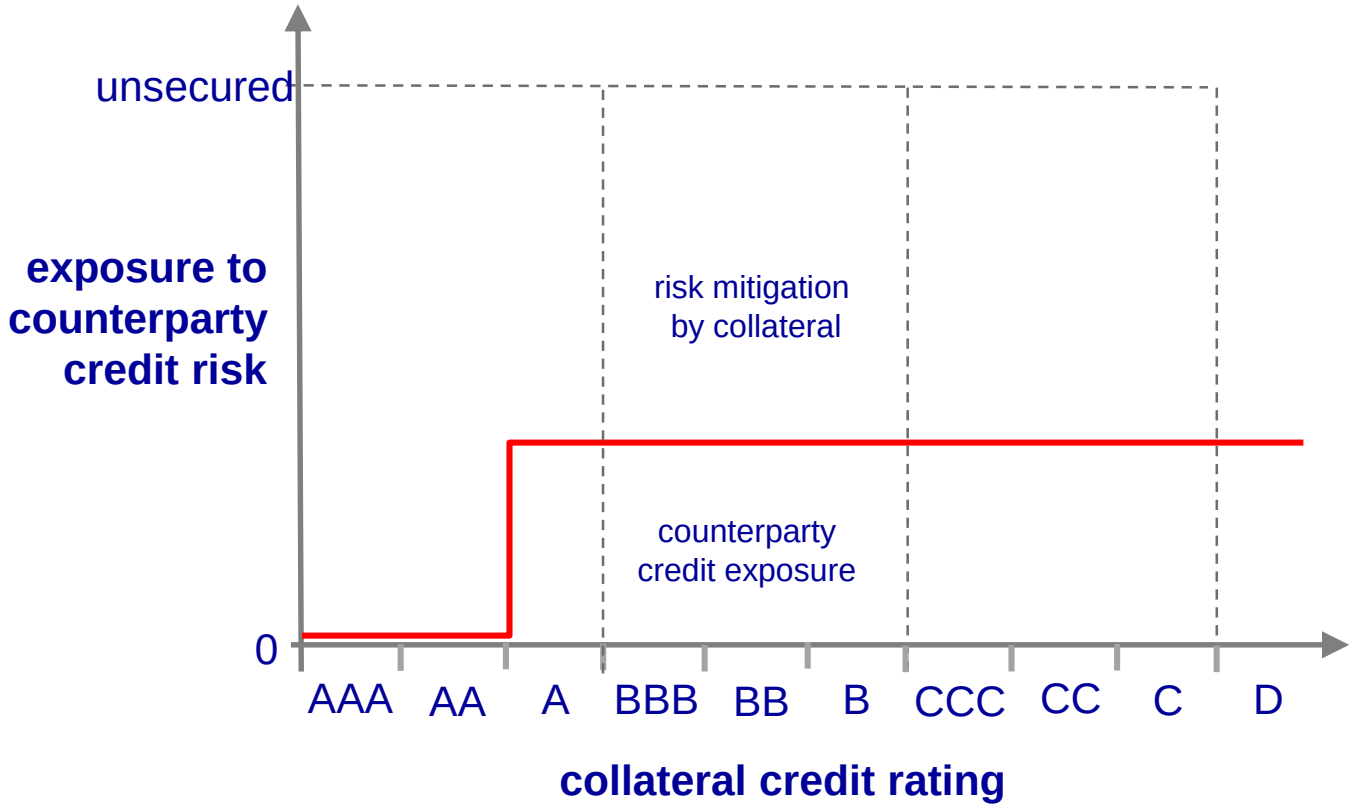
correlation between credit risk of seller and collateral issuer

combined credit risk on reverse repo



credit risk

- risk-free collateral is sometimes seen as complete substitute for counterparty credit risk



credit risk on repo

- hedging reduces but cannot eliminate risk
- hedging changes the character of risk
- hedging with collateral transforms credit risk into operational risk & legal risk

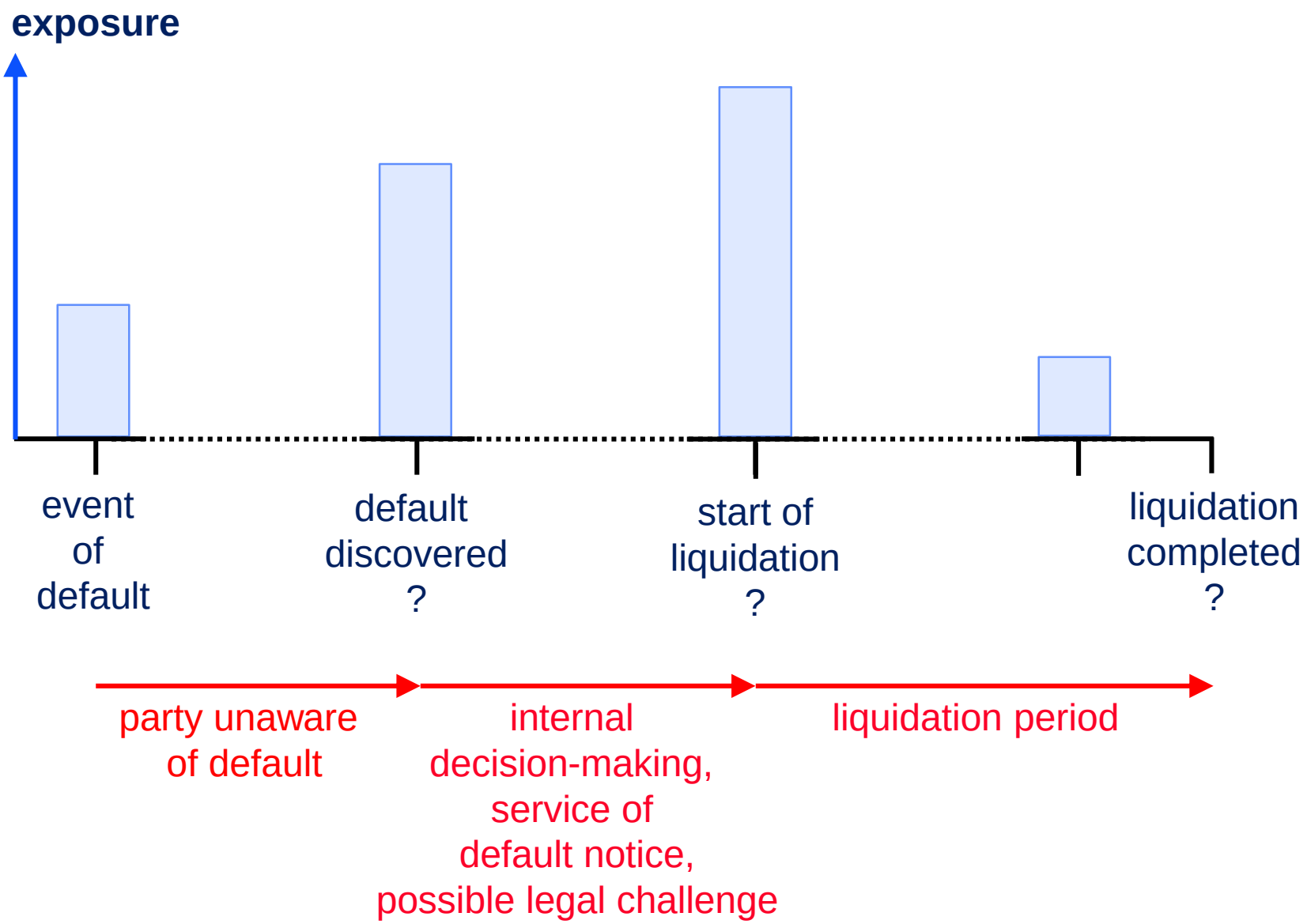
operational risks

- eligibility of collateral
- sufficiency of collateral
- secure custody of collateral
- disposal of collateral
- tax treatment

legal risks

- recharacterisation risk
- capacity and authority
- set-off in insolvency
- other insolvency issues
- governing law/conflict of laws

risk on repo


exposure
event of default
default discovered ?
start of liquidation ?
liquidation completed ?
party unaware of default
internal decision-making, service of default notice, possible legal challenge
liquidation period

risk on repo

HEALTH WARNING

- collateral has legal & operational risks
- collateral may generate unexpected losses
- collateral should be secondary defence (insurance)
- primary defence is counterparty creditworthiness
- repo is no substitute for credit risk management
- repo is not an excuse for accepting lower credits
- only do repo with counterparties with whom you would do unsecured business

risk on repo

business case for repo

- more business
  same counterparties
  same capital
  higher return on capital

risk on repo

business case for repo

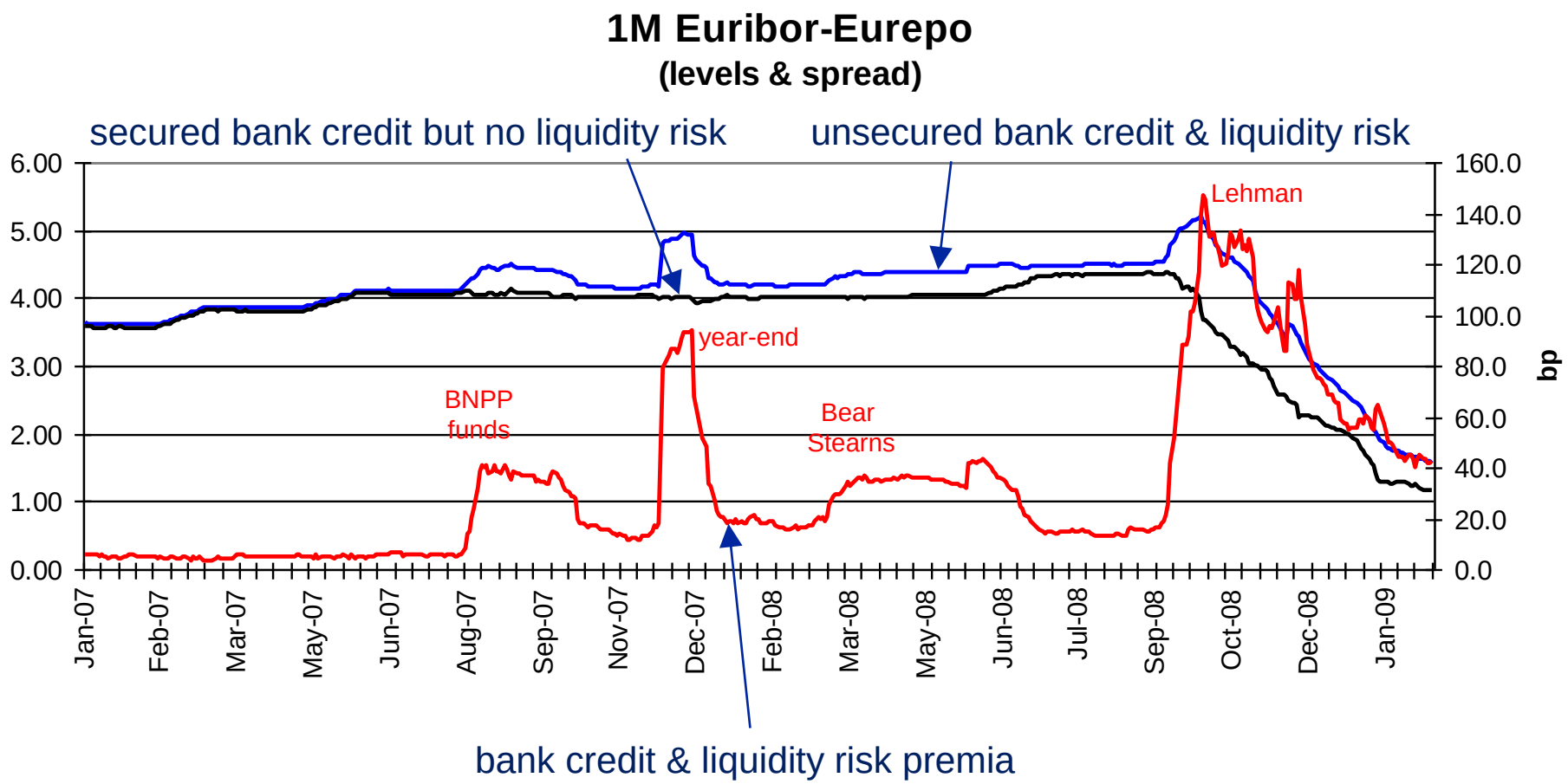
- more business
  same counterparties
  same capital
  higher return on capital
- same business
  same counterparties
  less capital
  higher return on capital

liquidity risk on repo

reverse repo

- collateral can be re-sold to get cash
- no/low liquidity risk --- depends on quality of collateral

risk on repo


1M Euribor-Eurepo
(levels & spread)
secured bank credit but no liquidity risk
unsecured bank credit & liquidity risk
Lehman
year-end
BNPP
funds
Bear
Stearns
bank credit & liquidity risk premia
bp
6.00
5.00
4.00
3.00
2.00
1.00
0.00
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan-07
Feb-07
Mar-07
May-07
Jun-07
Aug-07
Sep-07
Nov-07
Dec-07
Feb-08
Mar-08
May-08
Jun-08
Jul-08
Sep-08
Oct-08
Dec-08
Jan-09

Professional Repo & Collateral Management Course

The repo instrument: legal, economic, operational character

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

Coffee break

Types of repo: repurchase transactions v sell/buy-backs; floating-rate, open, evergreen, forward, term & synthetic repo; GC v specials; repo v securities lending

Richard Comotto, ICMA Centre at Reading University

Professional Repo & Collateral Management Course

types of repo

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

structures and market segments

- repurchase transaction v sell/buy-back
- types of repurchase transaction
- synthetic repo
- GC v specials
- repo v securities lending

Professional Repo & Collateral Management Course

repurchase transaction v sell/buy-back

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

repurchase transaction v sell/buy-back

- **repurchase transaction**
  - also known as classic repo
  - pension livrée in France
- **sell/buy-back**
  - also known as buy/sell-back or just sell/buys
  - gensaki in Japan, simultanea in Spain, PCT in Italy

repurchase transaction v sell/buy-back

there are in fact, three types of repo

- **repurchase transactions**
- **undocumented sell/buy-backs** (no written contract)
  - economically but not legally repo
  - economically and legally repo (eg former Italy & Spain)
- **documented sell/buy-backs**

repurchase transaction

term	1 week
collateral	3.5% GOV 10/10/26
nominal value	10,000,000
clean price	101.50
accrued interest	8 days
repo rate	2.10% (A/360)

repurchase transaction

term	1 week
collateral	3.5% GOV 10/10/26
nominal value	10,000,000
clean price	101.50
accrued interest	8 days
repo rate	2.10% (A/360)
market value	10,157,671.23
purchase price	10,157,671.23
repo interest	4,147.72
repurchase price	10,161,818.95

no haircut/initial margin

repurchase transaction

nominal value x clean price = clean value

$$10{,}000{,}000 \times \frac{101.50}{100} = 10{,}150{,}000.00$$

nominal value x coupon =accrued interest

$$10{,}000{,}000 \times \frac{3.5 \times 8}{100 \times 365} = 7{,}671.23$$

clean value + accrued interest = market value

10,150,000.00 + 7,671.23 = 10,157,671.23

NB coupon calculation uses bond market basis

repurchase transaction

clean price + accrued interest = dirty price

$$101.50 + \frac{3.5 \times 8}{365} = 101.5767123$$

nominal value x dirty price = market value

$$10{,}000{,}000 \times \frac{101.5767123}{100} = 10{,}157{,}671.23$$

repurchase transaction

repo interest

- assuming no initial margin or haircut

purchase price

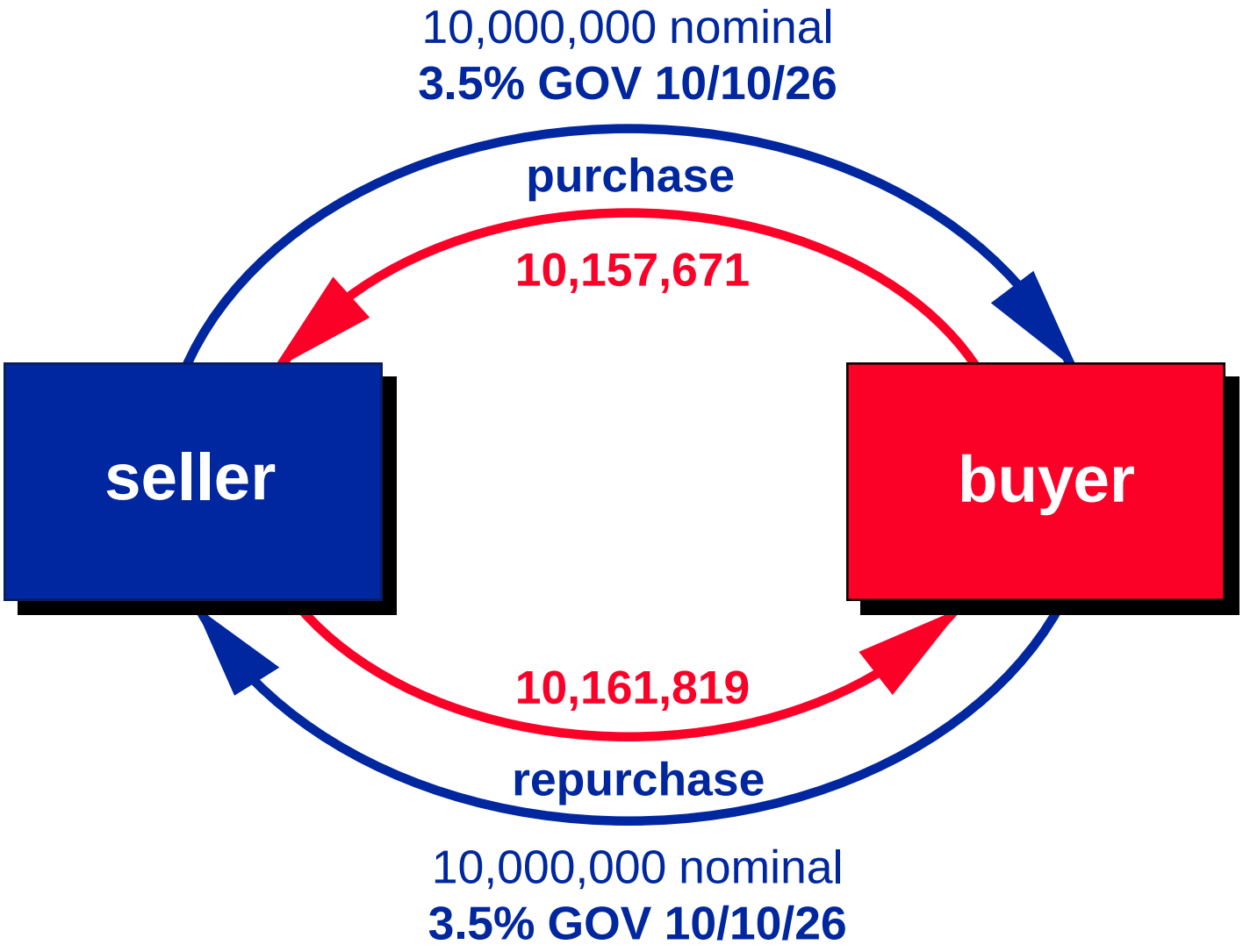
$$10{,}157{,}671.23 \times \frac{2.10 \times 7}{100 \times 360} = \text{repo interest } 4{,}147.72$$

purchase price + repo interest = repurchase price

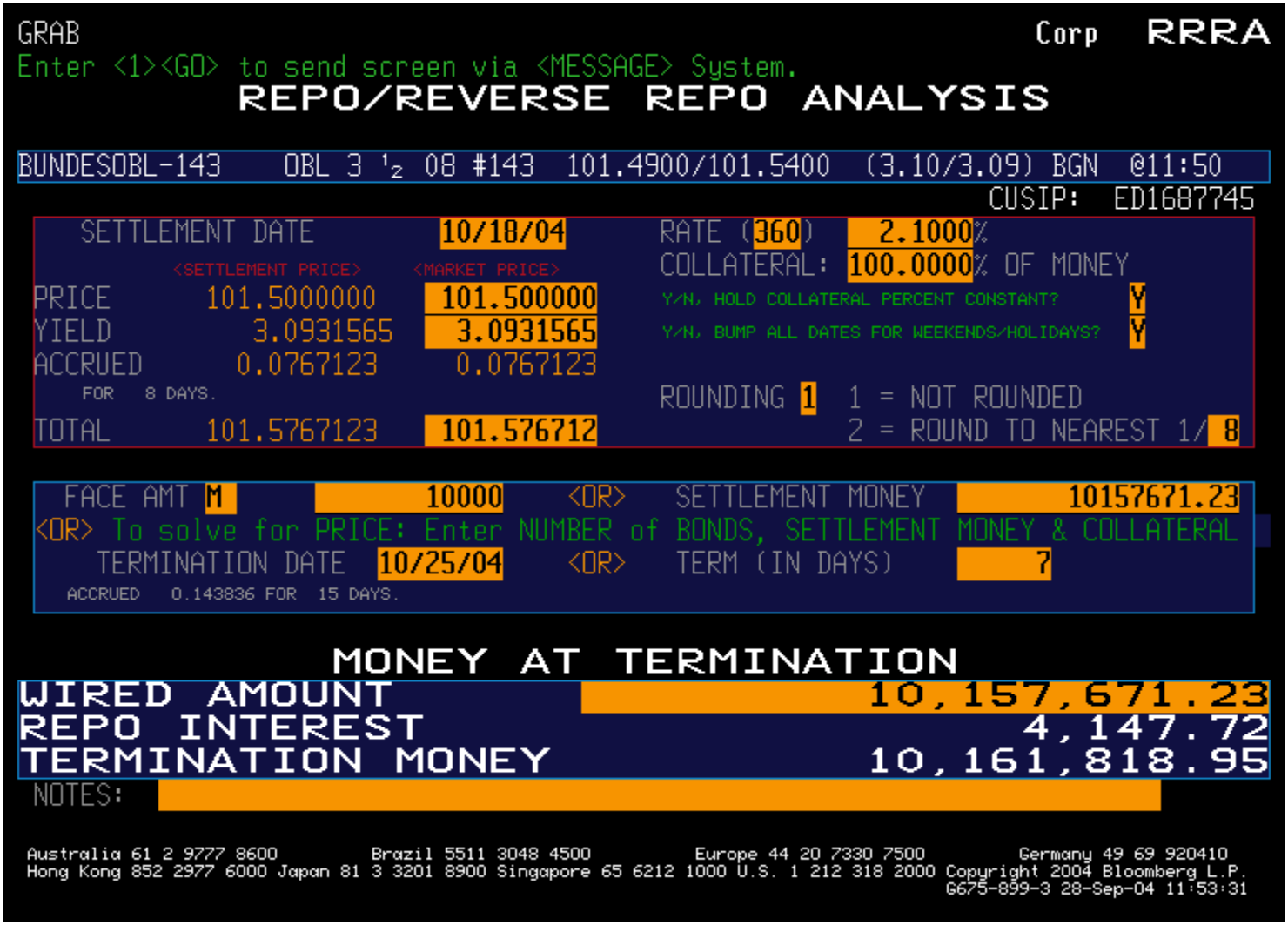
$$10{,}157{,}671.23 + 4{,}147.72 = 10{,}161818.95$$

NB repo return calculation uses money market basis

repurchase transaction



repurchase transaction



sell/buy-back

term	1 week
forward price	101.47435387
collateral	3.5% GOV 10/10/26
nominal value	10,000,000
clean price	101.50
accrued interest	8 days

sell/buy-back

term	1 week
forward price	101.47435387
collateral	3.5% OBL-1XX 10/10/XX
nominal value	EUR 10,000,000
clean price	101.50
accrued interest	8 days

accrued interest = 6,712 repo interest = 4,148

clean value forward price

$$\frac{10{,}000{,}000\left(\frac{101.50}{100}\right) - \left(10{,}000{,}000\left(\frac{3.5 \times 7}{100 \times 365}\right) - 10{,}157{,}671\left(\frac{2.1 \times 7}{100 \times 360}\right)\right)}{10{,}000{,}000} = 101.47435387$$

nominal value

sell/buy-back

term	1 week
forward price	101.47435387
collateral	3.5% GOV 10/10/26
nominal value	10,000,000
clean price	101.50
accrued interest	8 days
market value	10,157,671.23
purchase price	10,157,671.23
repurchase price	10,161,818.95

no haircut/initial margin

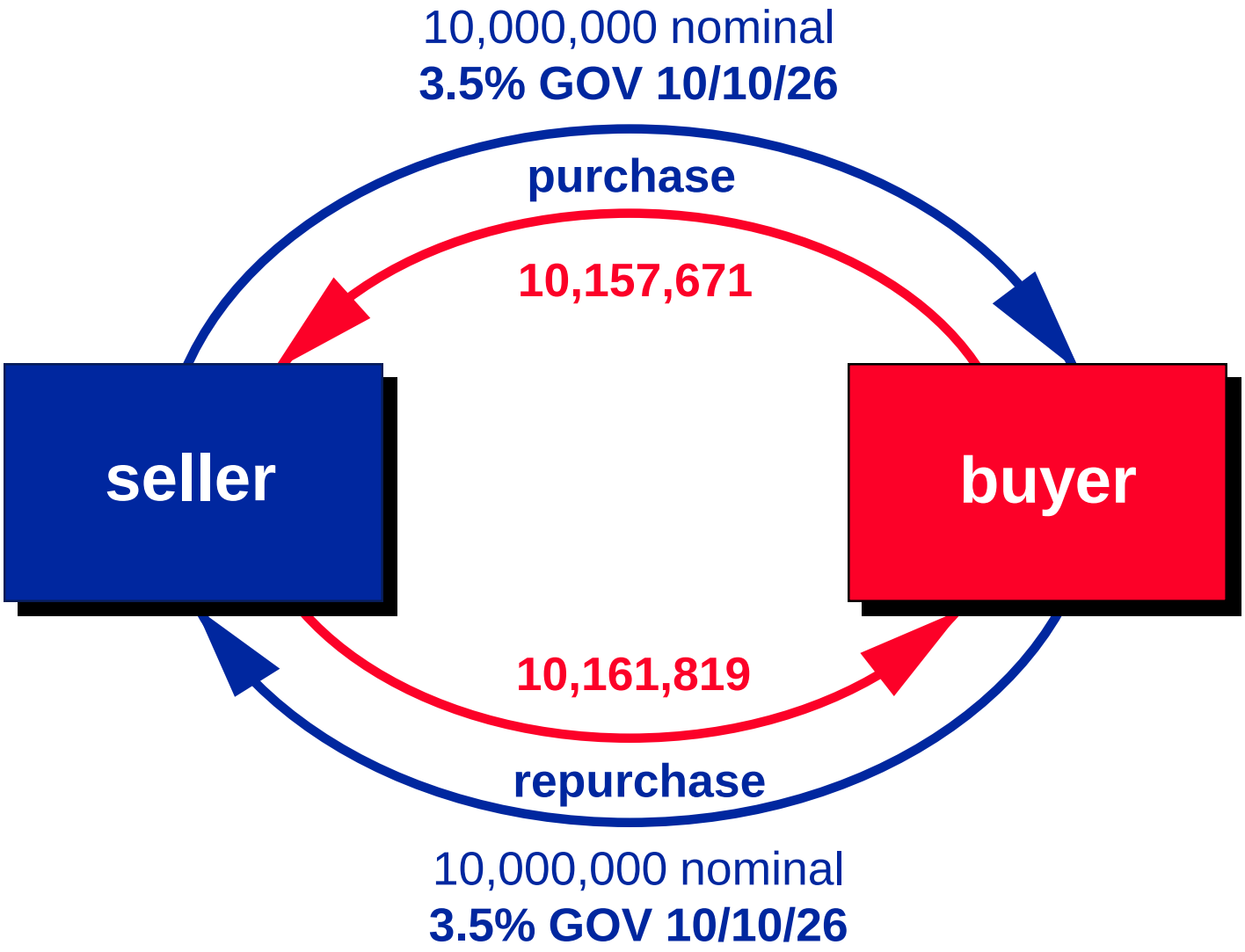
sell/buy-back

repurchase price - purchase price = repo interest

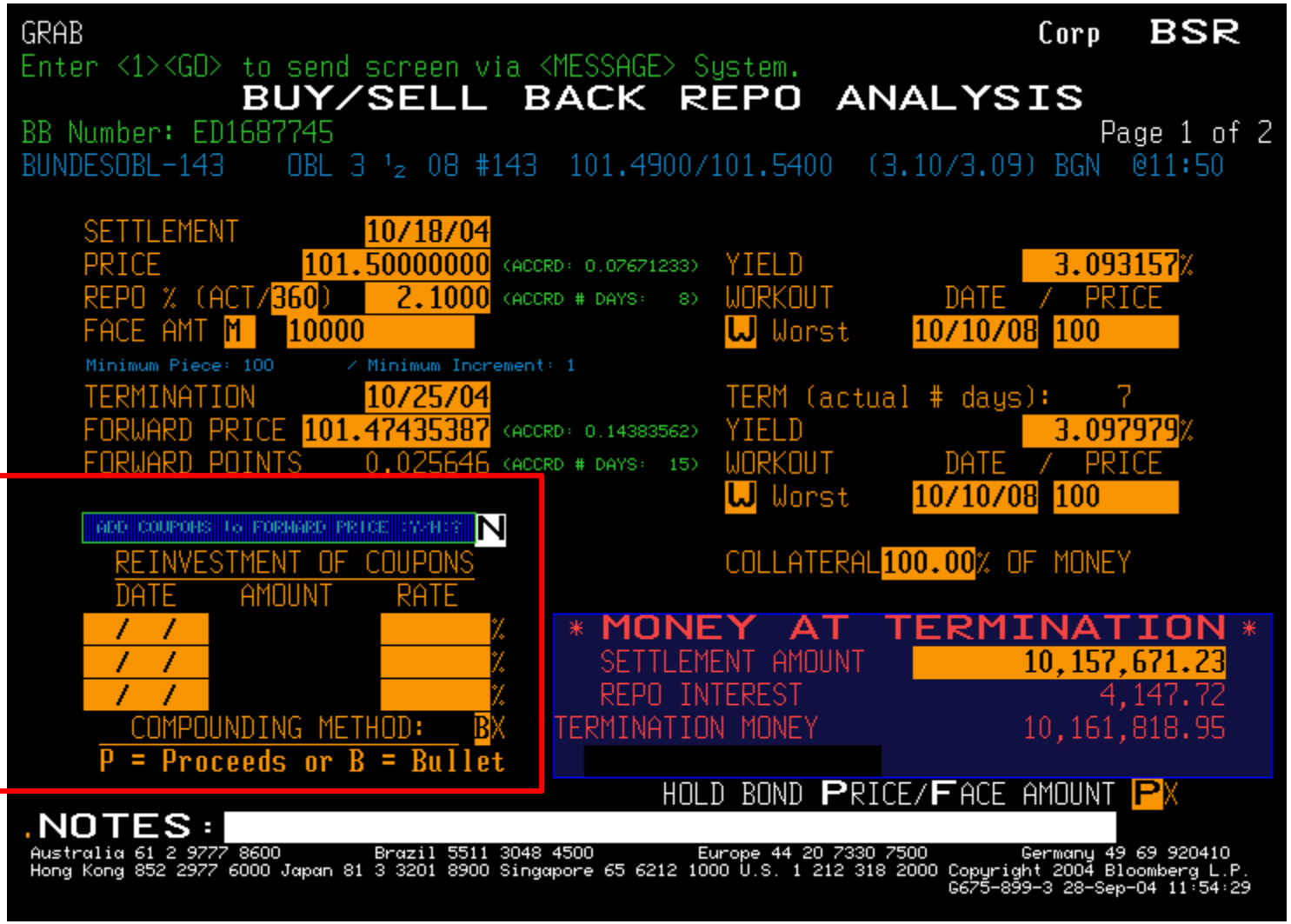
10,161,818.95 – 10,157,671.23 = EUR4,147.72

$$\left(\frac{\text{repo interest: } 4{,}147.72}{\text{repurchase price: } 10{,}157{,}671.23}\right)\frac{100 \times 360}{7} = \text{repo rate: } 2.10\%$$

sell/buy-back



sell/buy-back



NB These fields are parameters for the reinvestment of coupons

repurchase transaction v sell/buy-back

	repurchase transaction	sell/buy-back	
		undocumented	documented
collateral conveyance	title transfer	title transfer	
economic effect	secured loan	secured loan	
written contract	yes	no	
contract	one	two	
margin maintenance	variation margining or early termination	none	
coupon	compensatory payment	coupon deducted from repurchase price	
substitution	by replacement	no	
variants	by agreement	no	
cost	legal & operational	small	

sell/buy-back

- recognition of collateral in regulatory capital adequacy calculations requires:
  - documentation of rights of close-out & set-off
  - margin maintenance procedure

sell/buy-back

- recognition of collateral in regulatory capital adequacy calculations requires:
  - documentation of rights of close-out & set-off
  - margin maintenance procedure
- some countries & some types of firm would have problems adopting repurchase transactions:
  - legal problems --- especially variation margin, coupon & substitution, which can make repos look like secured loans
  - operational challenge --- traditional back-office systems cannot manage variation margining

sell/buy-back

- recognition of collateral in regulatory capital adequacy calculations requires:
  - documentation of rights of close-out & set-off
  - margin maintenance procedure
- some countries & some types of firm would have problems adopting repurchase transactions:
  - legal problems --- especially variation margin, coupon & substitution, which can make repos look like secured loans
  - operational challenge --- traditional back-office systems cannot manage variation margining
- solution
  - incorporation of sell/buy-backs into documentation (eg GMRA Buy/Sell-Back Annex)
  - introduces or triggers special operational features to avoid legal & operational problems of repurchase transactions

sell/buy-back

how do special operational features overcome legal problems of:

- variation margin
- compensatory payments
- substitution

sell/buy-back

1. to overcome legal problems of variation margin

- instead of variation margin

sell/buy-back

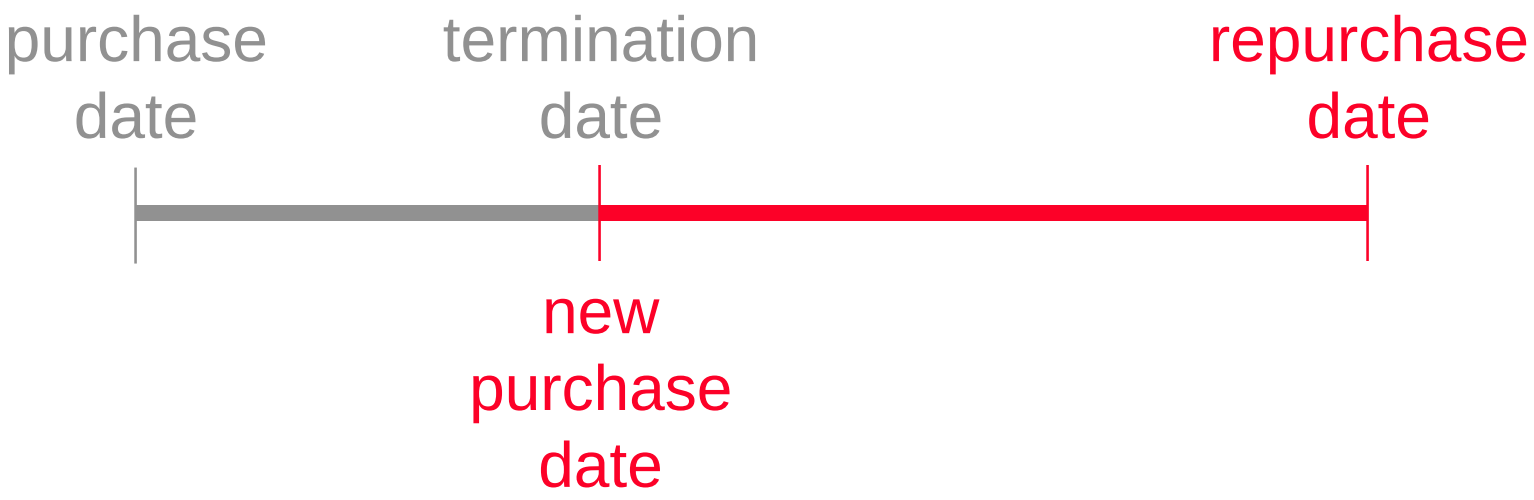
1. to overcome legal problems of variation margin

- instead of variation margin --- use early termination

sell/buy-back

1. to overcome legal problems of variation margin

- instead of variation margin --- use early termination & replacement



sell/buy-back

two approaches to early termination & replacement:

- Adjustment --- change collateral
- Repricing --- change cash

sell/buy-back

early termination & replacement -- adjusting collateral

	buyer		seller	
purchase date	collateral	+10	collateral	-10
	cash	-10	cash	+10

original transaction

option 1: not cleaning up accrued repo interest

sell/buy-back

early termination & replacement -- adjusting collateral

	buyer		seller	
purchase date	collateral	+10	collateral	-10
	cash	-10	cash	+10
termination	collateral	-9	collateral	+9
	cash	+10.1	cash	-10.1

original transaction

option 1: not cleaning up accrued repo interest

sell/buy-back

early termination & replacement -- adjusting collateral

	buyer		seller	
purchase date	collateral	+10	collateral	-10
	cash	-10	cash	+10
termination	collateral	-9	collateral	+9
	cash	+10.1	cash	-10.1
replacement	collateral	+10.1	collateral	-10.1
	cash	-10.1	cash	+10.1

original transaction

option 1: not cleaning up accrued repo interest

sell/buy-back

early termination & replacement -- adjusting collateral

	buyer		seller	
purchase date	collateral	+10	collateral	-10
	cash	-10	cash	+10
termination	collateral	-9	collateral	+9
	cash	+10.1	cash	-10.1
replacement	collateral	+10.1	collateral	-10.1
	cash	-10.1	cash	+10.1
operational flows	collateral	+1.1	collateral	-1.1

original transaction

option 1: not cleaning up accrued repo interest

sell/buy-back

early termination & replacement -- adjusting collateral

	buyer		seller		
purchase date	collateral	+10	collateral	-10	original transaction
	cash	-10	cash	+10	
termination	collateral	-9	collateral	+9	legal position = no margin
	cash	+10.1	cash	-10.1	
replacement	collateral	+10.1	collateral	-10.1	
	cash	-10.1	cash	+10.1	
operational flows	collateral	+1.1	collateral	-1.1	operational position ≡ margin

option 1: not cleaning up accrued repo interest

sell/buy-back

early termination & replacement -- adjusting collateral

	buyer		seller	
purchase date	collateral	+10	collateral	-10
	cash	-10	cash	+10
termination	collateral	-9	collateral	+9
	cash	+10.1	cash	-10.1
replacement	collateral	+10	collateral	-10
	cash	-10	cash	+10
operational flows	collateral	+1	collateral	-1
	cash	+0.1	cash	-0.1

original transaction

legal position
= no margin

operational position
≡ margin

option 2: clearing up accrued repo interest

sell/buy-back

early termination & replacement – repricing collateral

	buyer		seller	
purchase date	collateral	+10	collateral	-10
	cash	-10	cash	+10
termination	collateral	-9	collateral	+9
	cash	+10.1	cash	-10.1
replacement	collateral	+9	collateral	-9
	cash	-9	cash	+9
operational flows	cash	+1.1	cash	-1.1

original transaction

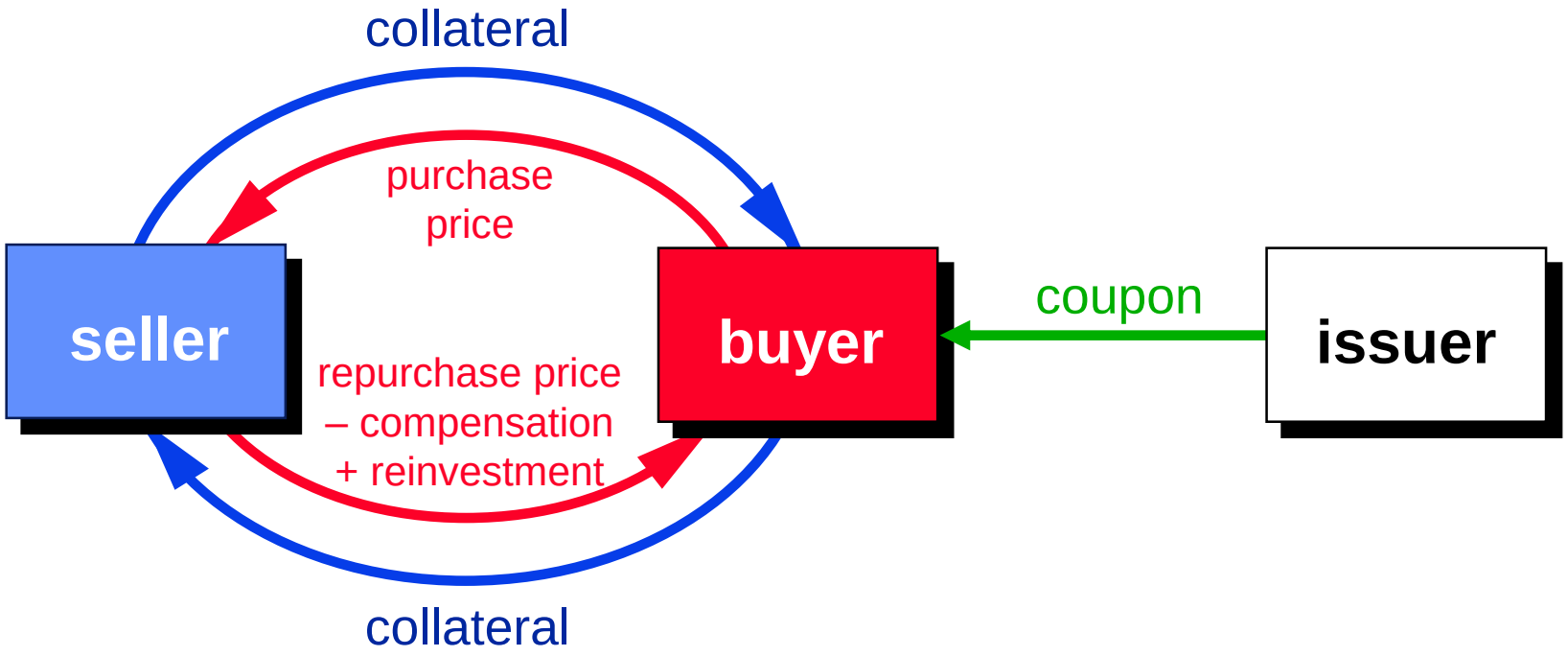
legal position
= no margin

operational position
≡ margin

sell/buy-back

to overcome legal problems of compensatory payment:

- instead of compensatory payment --- deduction from repurchase price



Note: repo interest is not shown.

sell/buy-back

3. to overcome legal problems of substitution:

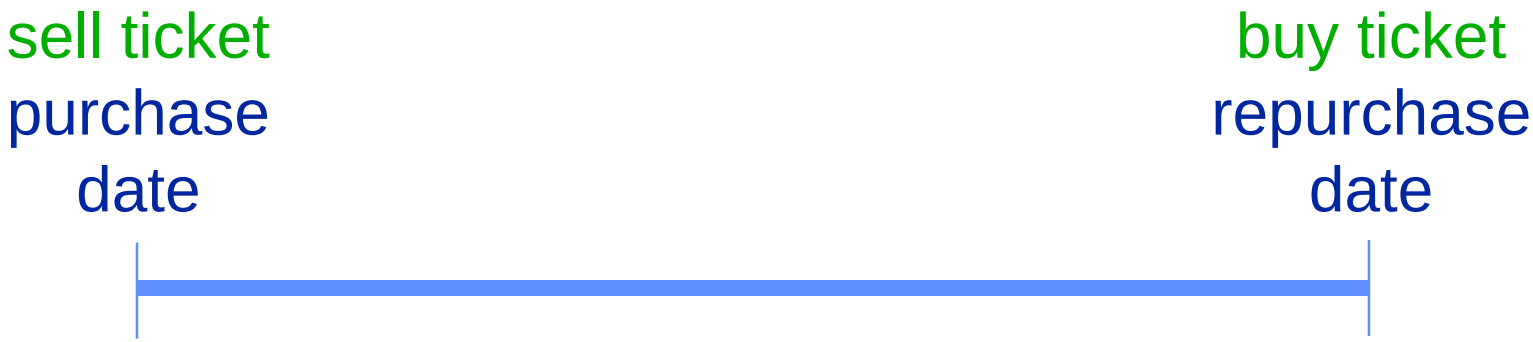
- instead of substitution --- early termination & replacement, with collateral being substituted through the replacement transaction

sell/buy-back

how does early termination & replacement overcome operational challenge of variation margin?

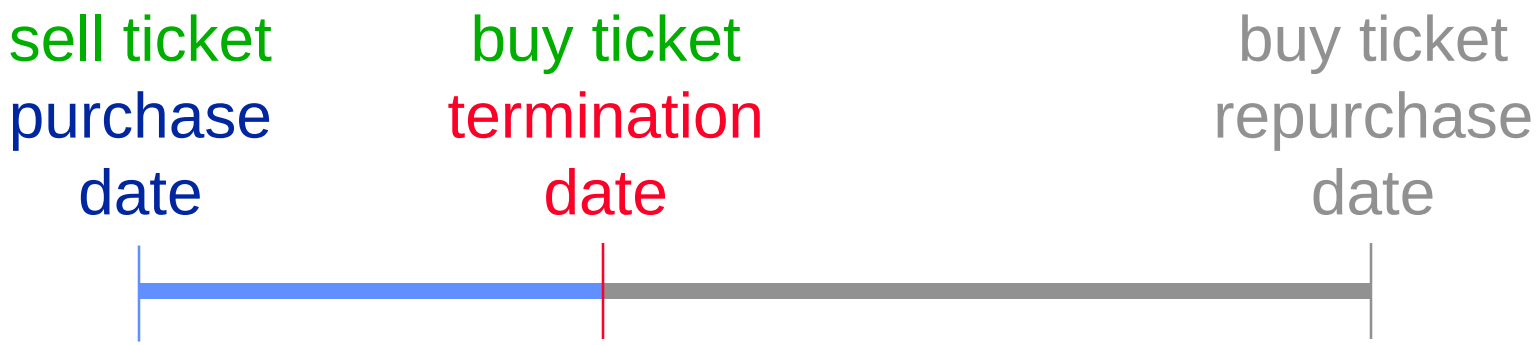
sell/buy-back

early termination & replacement



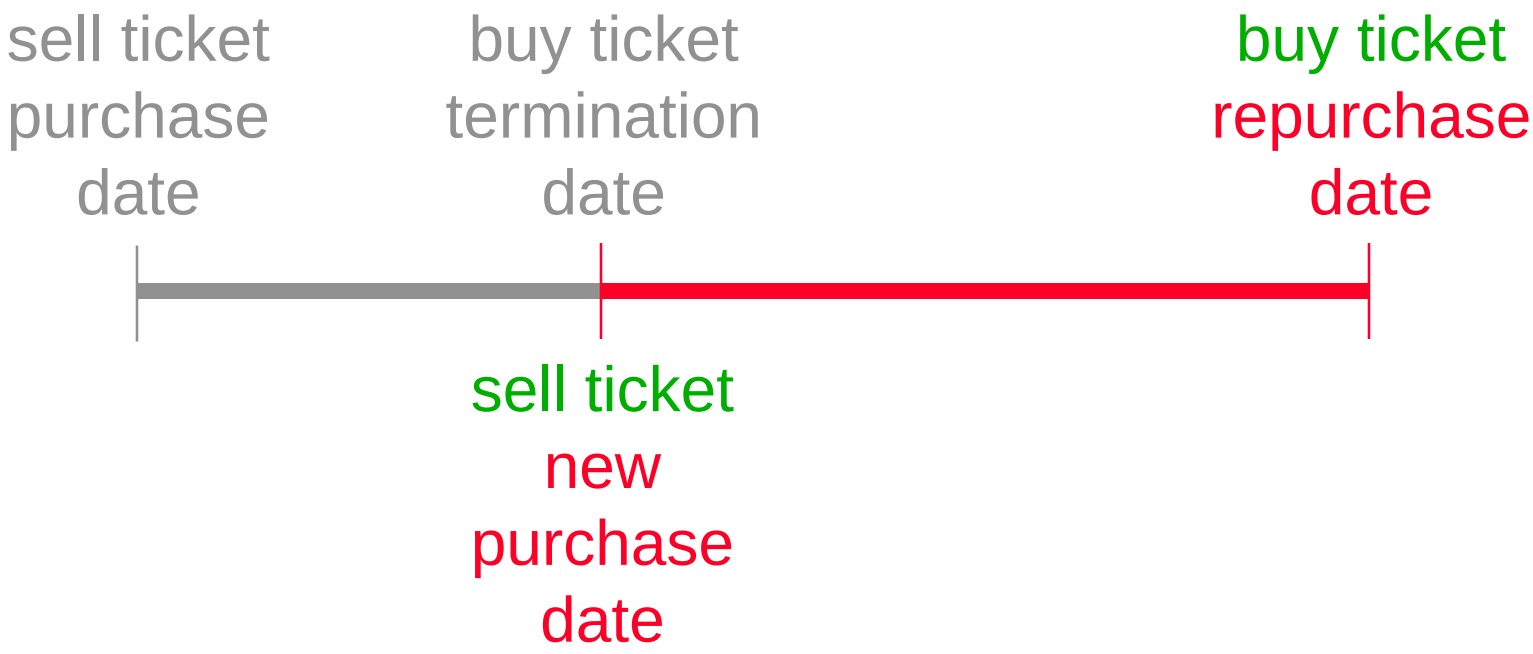
sell/buy-back

early termination & replacement



sell/buy-back

early termination & replacement



sell/buy-back

summary

- special operational features in Buy/Sell-Back Annex overcome legal problems with repurchase transactions because:
  - **variation margin** is legally substituted by buy/sell technique with same effect
  - **compensatory payments** are legally substituted by deductions from the repurchase price
  - **substitution** is legally achieved using buy/sell technique
- early termination & replacement also overcomes operational challenge of variation margin by:
  - using buy/sell technique

repurchase transaction v sell/buy-back

	repurchase transaction	sell/buy-back	
		undocumented	documented
collateral conveyance	title transfer	title transfer	title transfer
economic effect	secured loan	secured loan	secured loan
written contract	yes	no	yes
contract	one	two	one
margin maintenance	variation margining or by early termination	none	by early termination
coupon	compensatory payment	coupon deducted from repurchase price	coupon deducted from repurchase price
substitution	by replacement	no	by early termination
variants	by agreement	no	not in practice
cost	legal & operational	small	legal & operational

Professional Repo & Collateral Management Course

types of repurchase transaction

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

types of repurchase transaction

- fixed-rate repo
- floating-rate repo
- open repo
- forward repo

types of repurchase transaction

fixed-rate repo

- fixed repurchase date
- fixed repo rate
- return due at repurchase date

types of repurchase transaction

floating-rate repo

- fixed repurchase date
- repo rate linked to index, regularly updated
- return due at repurchase date
- passive interest rate risk management solution (alternative of overnight repo is operationally intensive)
- EONIA-linked repo:
  - do not compound but average
  - may use penultimate fixing for last 2 days
- term rate-linked repo (eg 1-month IBOR): when to pay return?
- term repo (over one year) are usually floating-rate

types of repurchase transaction

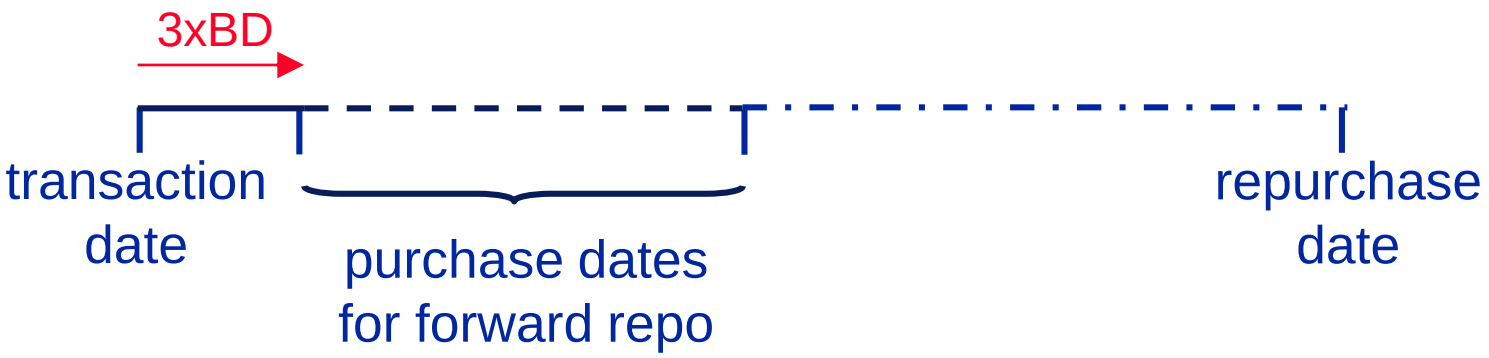
open repo (on demand, terminable on demand)

- provision ready for use in GMRA 3(d)-(e)
- no initial repurchase date: option of buyer or seller
- repo rate reset by agreement
- interest not compounded
- return due at later of repurchase date, month end
- avoids roll-over execution & settlement costs

types of repurchase transaction

forward repo

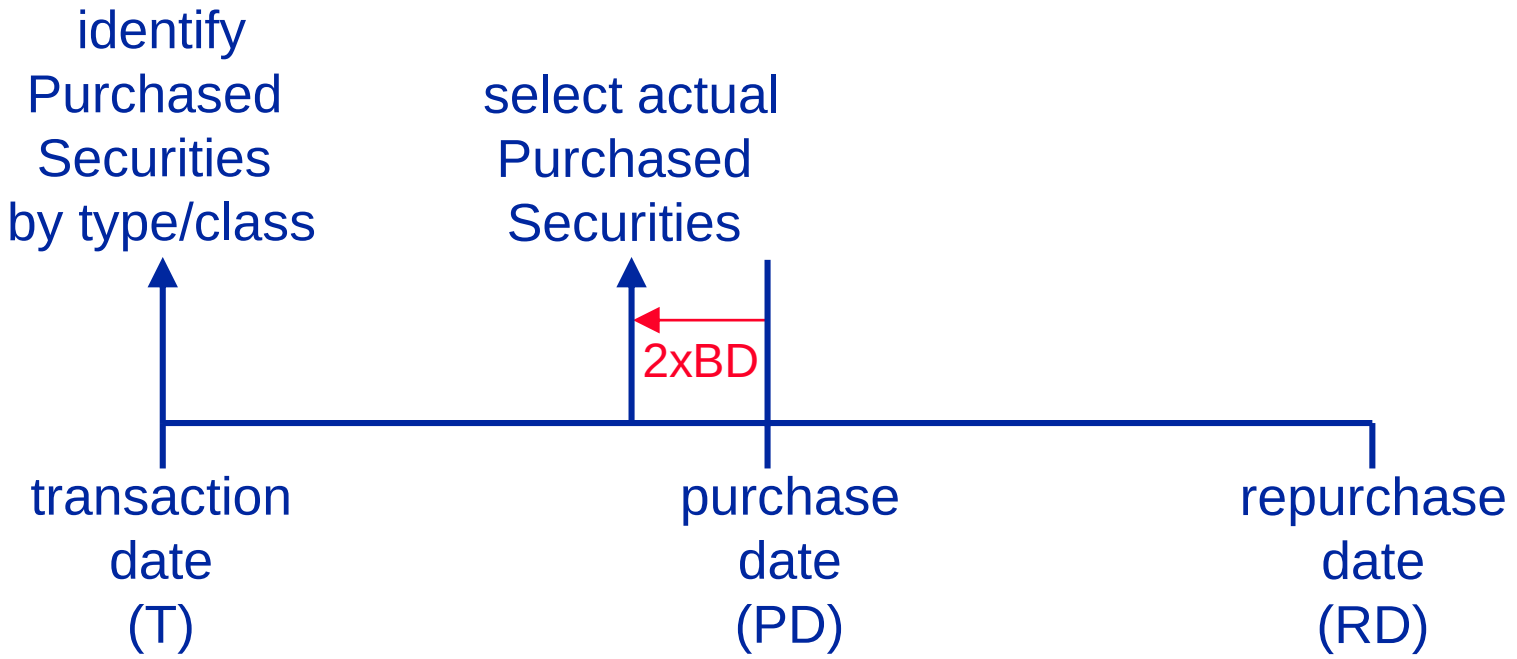
- described in GMRA Annex I, 2(b)
- later than conventional purchase date (T+2)
- default is T+3, but can be set later



types of repurchase transaction

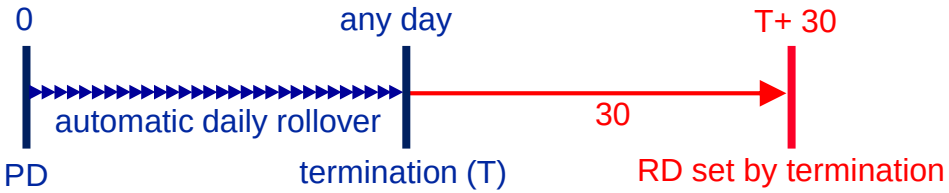
forward repo

- provision to agree only class/type of collateral at T & defer ISIN selection until PD-2
- remember to confirm this selection

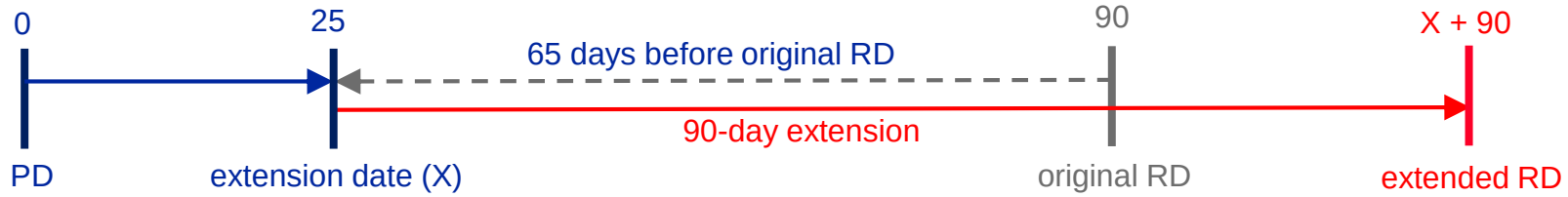


types of repurchase transaction

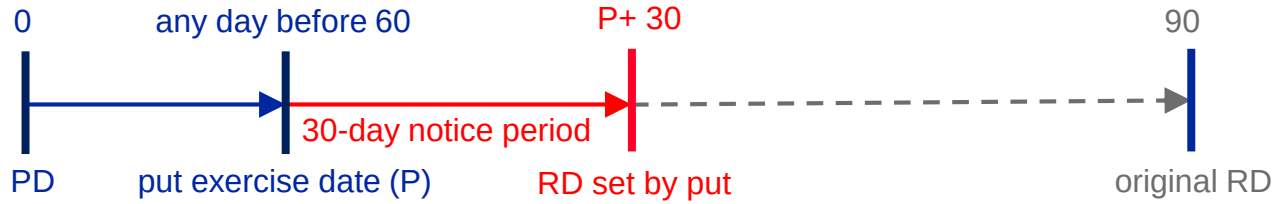
evergreen repo



extendible repo (eg 3-2-3 = 3 to original RD; 2 remaining term before option; 3 extension)



puttable repo



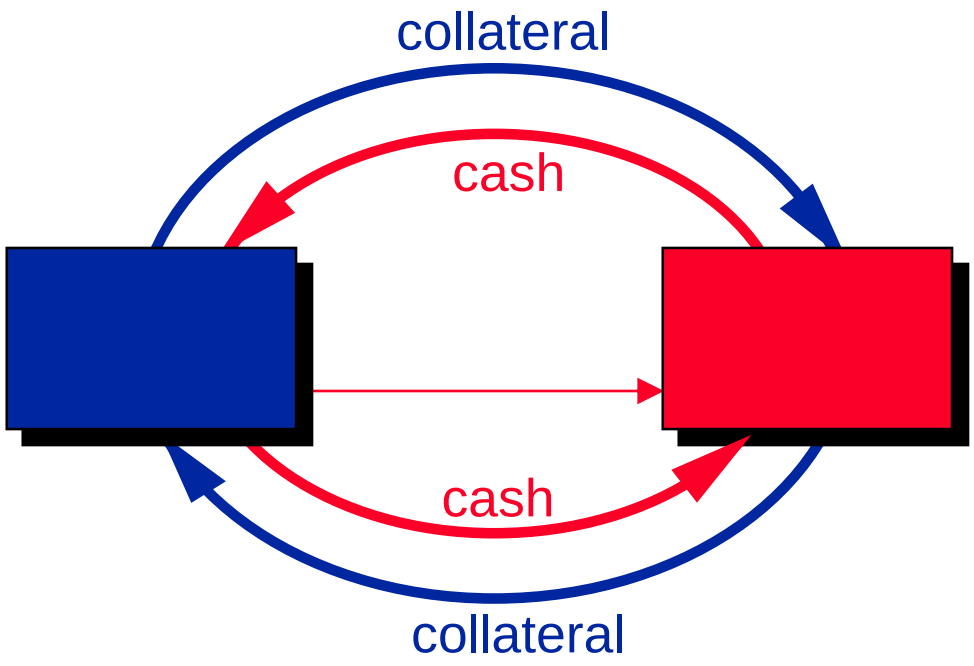
Professional Repo & Collateral Management Course

synthetic repo

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

synthetic repo

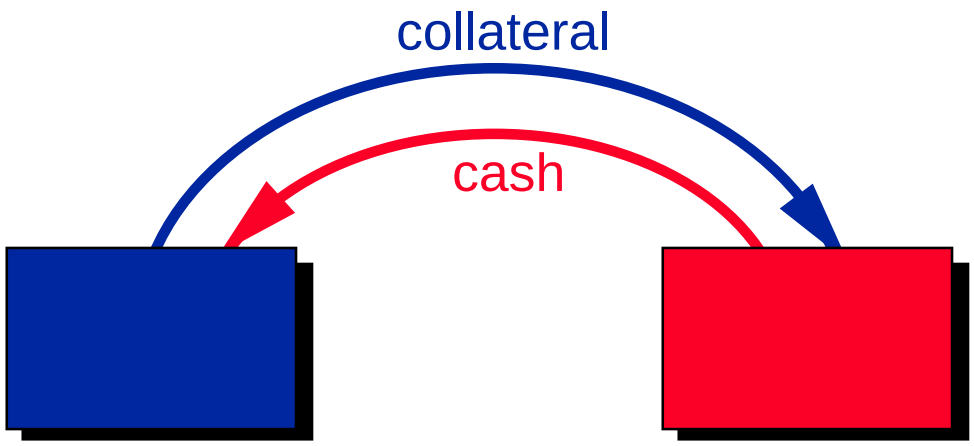
question: who has ownership; who has risk/return?



repo

synthetic repo

question: who has ownership; who has risk/return?



outright/cash transaction

synthetic repo

question: who has ownership, who has risk/return?

total return swap

- TRS pays total return = change in total value of reference asset
- over contract period
- if total return is positive, red pays blue
- if total return is negative, blue pays red

synthetic repo

question: who has ownership; who has risk/return?

total return swap

- TRS pays total return = change in total value of reference asset
- over contract period
- if total return is positive, red pays blue
- if total return is negative, blue pays red

synthetic repo

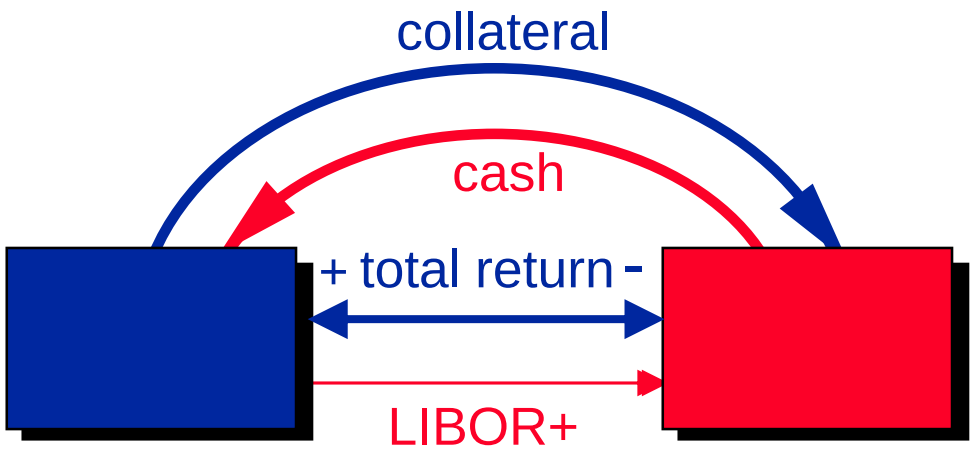
question: who has ownership; who has risk/return?

total return swap

- TRS pays total return = change in total value of reference asset
- over contract period
- if total return is positive, red pays blue
- if total return is negative, blue pays red

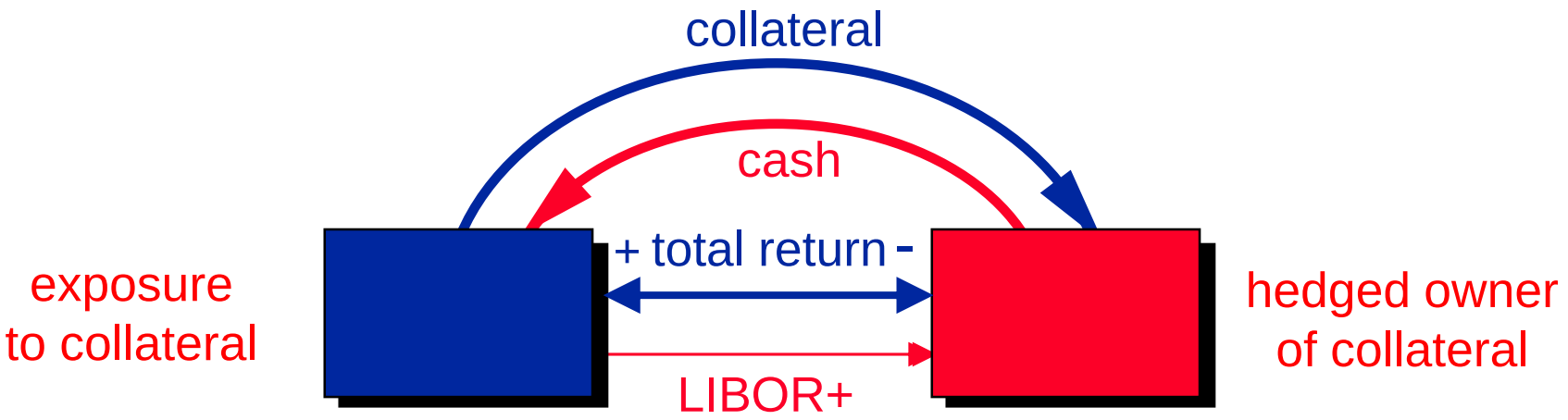
synthetic repo

question: who has ownership; who has risk/return?



synthetic repo

question: who has ownership; who has risk/return?



synthetic repo

synthetic repo

- repurchase by gentleman's agreement
- TRS can be substituted by other derivatives, eg futures, delta-one exchange-traded options, OTC option combos
- more common in equity

synthetic repo

why do synthetics?

- cash costs LIBOR+ rather than repo rate
- extra cost should be offset by balance sheet neutrality = capital saving but not under IFRS
- avoids need to recognise any loss on legacy assets: accounted as ‘failed sales’
- long-term trades, illiquid assets, leverage
- avoids poor infrastructure, operational cost, legal uncertainty, restrictions on repo
- only ISDA documentation needed
- preserves repo lines for liquidity management
- tax obstacles, tax arbitrage

Professional Repo & Collateral Management Course

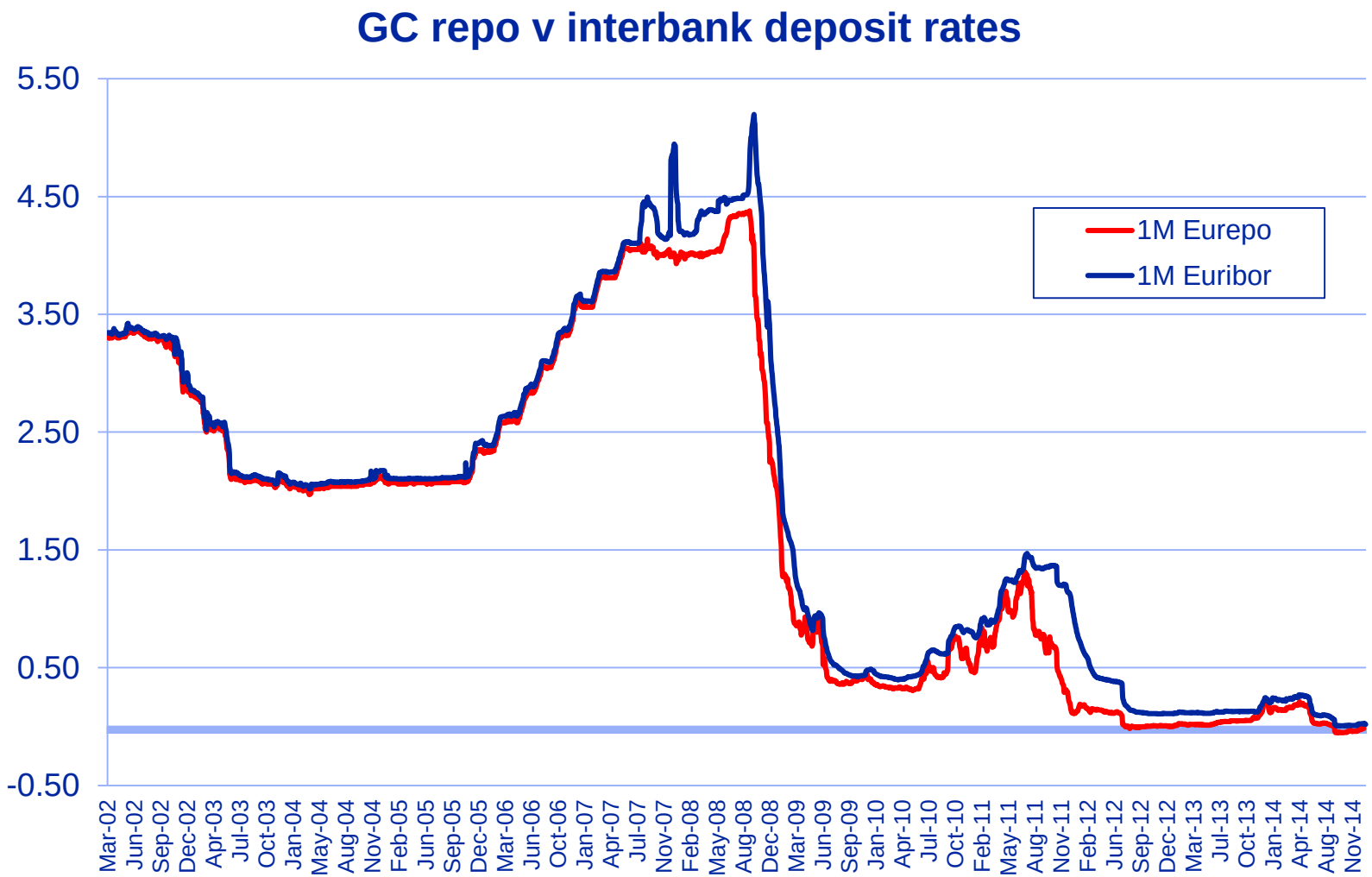
GC v specials

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

GC

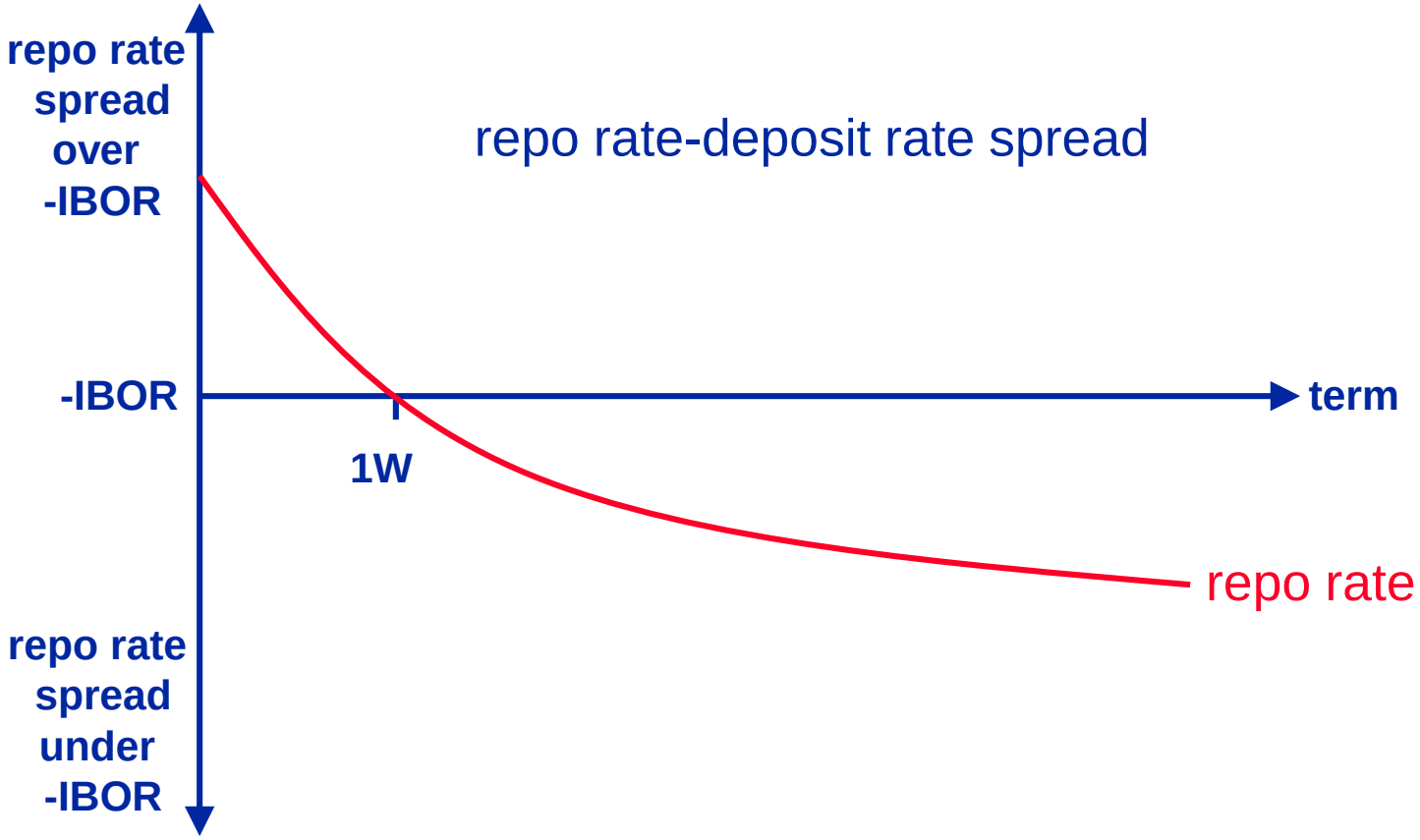
- GC = **general collateral**
- in bilateral transactions, GC is an unpublished variable list (basket) of security issues within each class of security, usually only government securities, of which each issue is equally acceptable as repo collateral --- at same repo rate = GC repo rate
- buyers should be indifferent between GC issues: GC issues should be substitutes
- basket emerges by tacit market consensus
- collateral is selected at end of negotiation
- seller has some choice about which issue to deliver
- driver is cash supply/demand --- GC repo is cash-driven
- GC repo is an alternative to unsecured lending of cash: another money market instrument: GC repo rate is therefore correlated with money market rates

GC


GC repo v interbank deposit rates
5.50
4.50
3.50
2.50
1.50
0.50
-0.50
1M Eurepo
1M Euribor
Mar-02
Jun-02
Sep-02
Dec-02
Apr-03
Jul-03
Oct-03
Jan-04
May-04
Aug-04
Nov-04
Feb-05
Jun-05
Sep-05
Dec-05
Mar-06
Jun-06
Oct-06
Jan-07
Apr-07
Jul-07
Nov-07
Feb-08
May-08
Aug-08
Dec-08
Mar-09
Jun-09
Sep-09
Jan-10
Apr-10
Jul-10
Oct-10
Feb-11
May-11
Aug-11
Nov-11
Feb-12
Jun-12
Sep-12
Dec-12
Mar-13
Jul-13
Oct-13
Jan-14
Apr-14
Aug-14
Nov-14

GC

very short-term GC repo rate can exceed interbank deposit rate



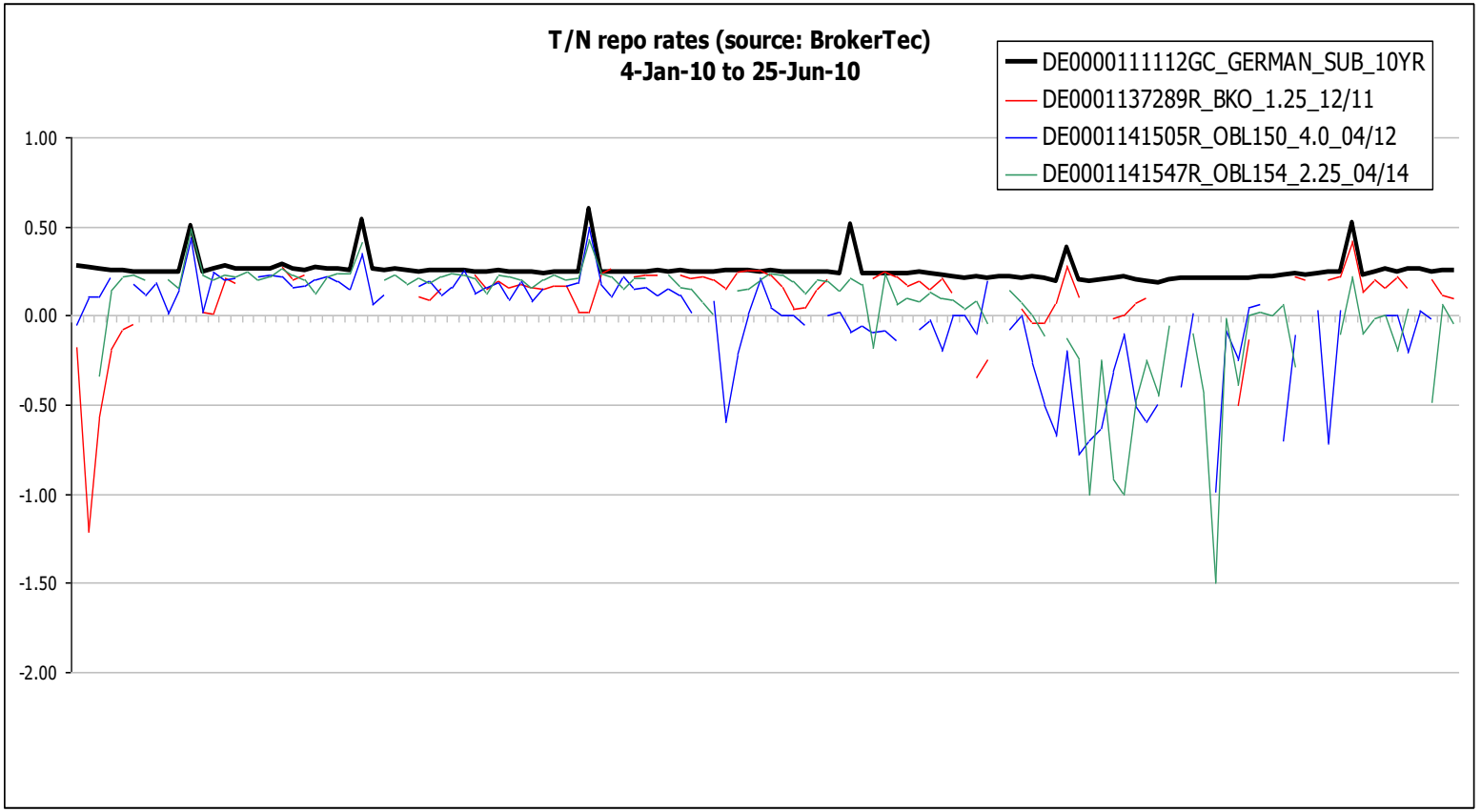
GC

GC is a term also used by automatic trading systems (ATS) & central counterparties (CCP) to describe standard baskets of security issues that are all given equal status in the collateral allocation process

specials

- **special** = single security issue trading in repo market below GC repo rate
- specials created by strong demand/scare supply of specific security issue --- security-driven repo
- specials buyer has to offer cheap cash to seller: special rates can be negative
- premium to GC rate = securities lending fee
- each special has unique repo rate
- collateral is selected at the start of negotiation
- special repo is alternative to securities lending: special repo is a capital market instrument

specials



GC-specials spread

specials

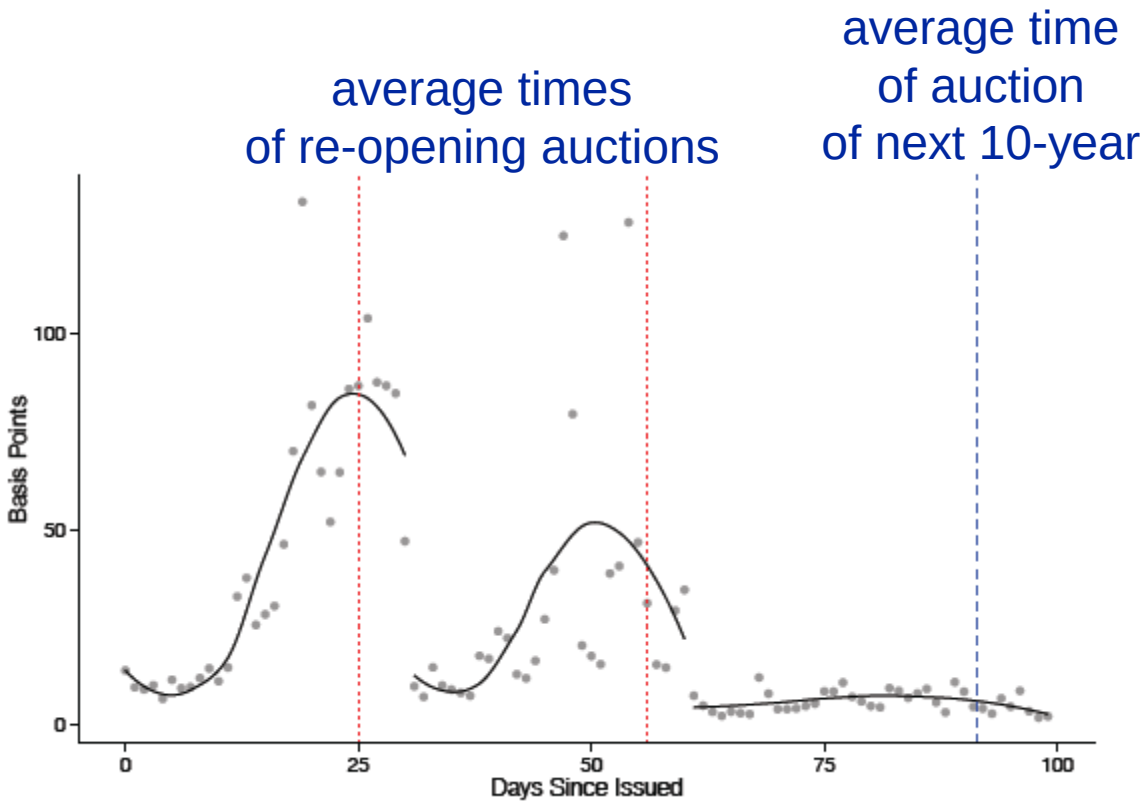
- special is a term also used by automatic trading systems (ATS) & central counterparties (CCP) to describe specific (non-GC) collateral

specials

what makes collateral go on special?

- excess demand
  - when bond becomes cheapest-to-deliver for futures and options
  - need for guaranteed delivery
  - when benchmark issues are borrowed to hedge auctions
  - short-selling
  - benchmarks --- most heavily traded
- scarce supply
  - small float due to gradually increasing purchases by buy-and-hold investors
  - safe haven hoarding by risk-averse investors
  - stripping coupons
  - market squeezes
  - distribution of supply
  - corporate actions
  - income payments & operational constraints on lenders
  - price-sensitive lenders

specials



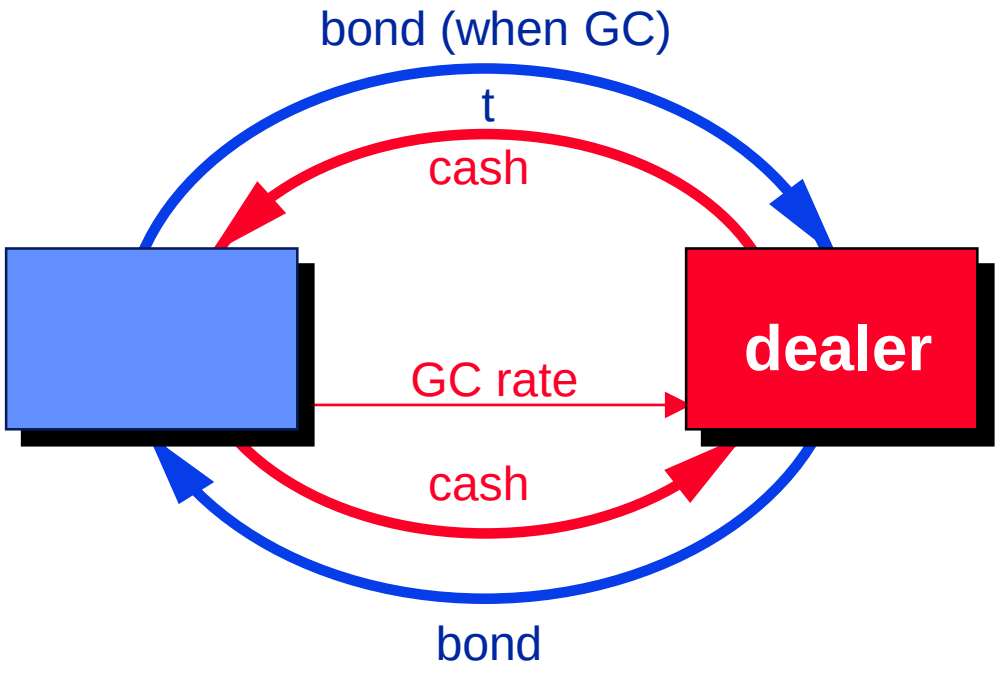
Average specialness spread on 10-year US Treasuries. (D'Amico et al 2013)

GC v specials

	GC	specials
price	cash-driven	securities-driven
collateral	• any of a group of substitutable securities within same class • liquid	• specific issue • very liquid
repo rate	• highest repo rate • common rate • correlated with unsecured rates • spread below LIBOR = reduced LGD	• below GC repo rate • unique rate • uncorrelated with other rates • spread below GC = securities borrowing fee
who selects collateral?	seller or tri-party agent	buyer
point of allocation	end of negotiation	start of negotiation
analogous to:	money market instruments	securities borrowing & lending

specials

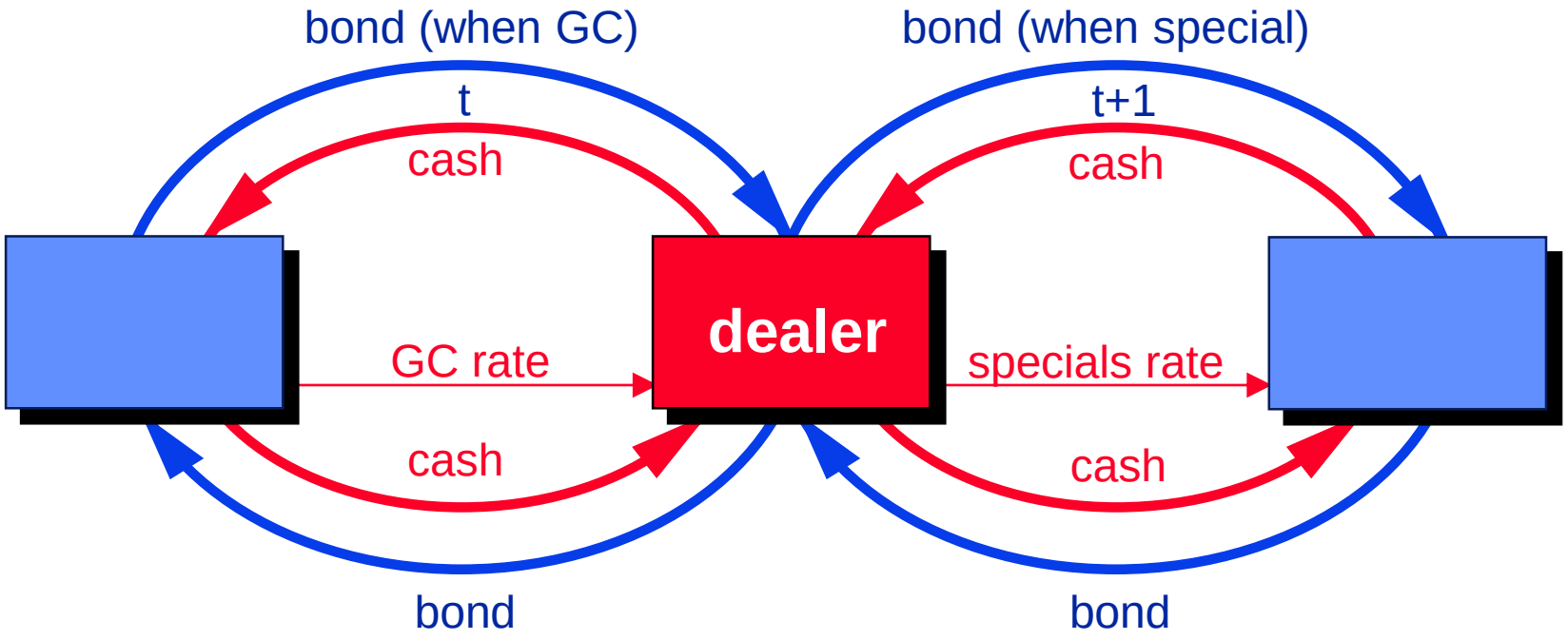
dealer reverses in bond when GC…



specials trading

specials

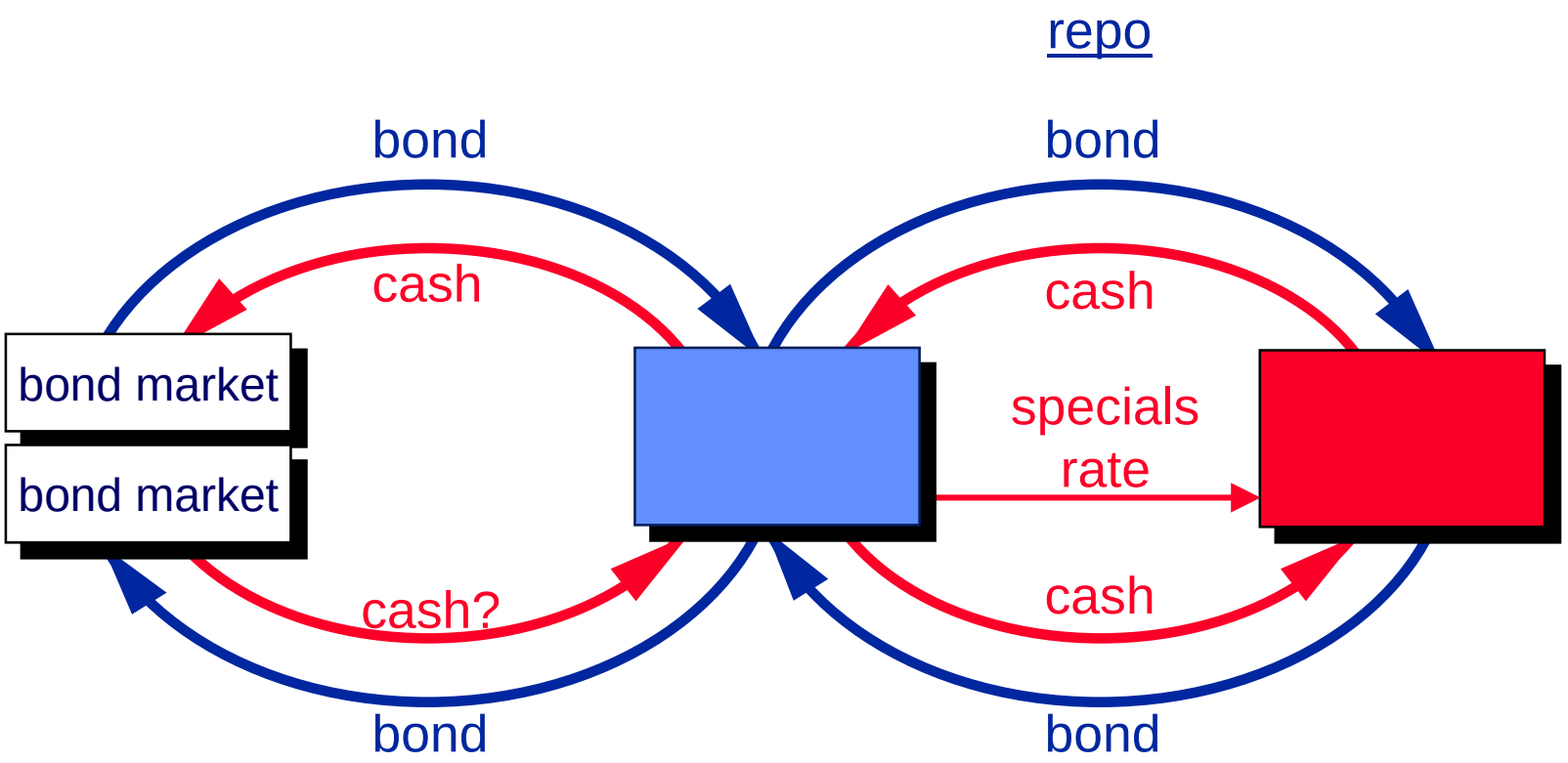
dealer reverses in bond when GC and repos it out when special



specials trading

specials

Why not buy a special in the cash market & repo it out for cheap cash?



specials

GC (ON)	5.00%
special (ON)	0.85%
specialness	4.15%

$$\text{value} = \text{EUR}100{,}000{,}000 \times \frac{4.15 \times 1}{100 \times 360} = \text{EUR}11{,}528$$

specials

- specialness = liquidity premium
- expected income gain = capital loss
- expected return is unchanged

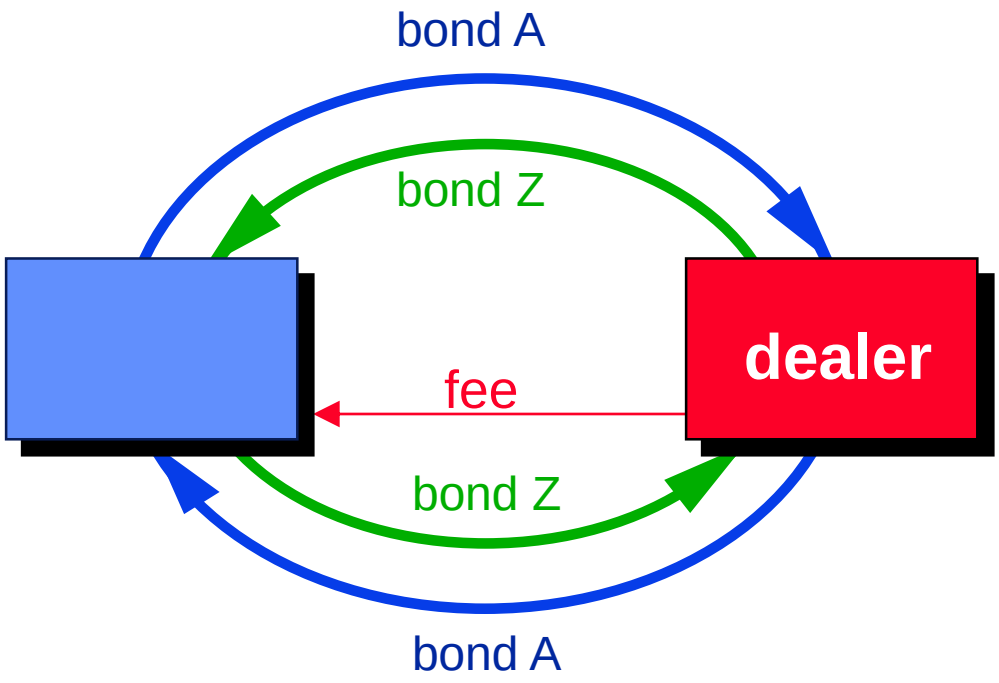
Professional Repo & Collateral Management Course

repo v securities lending

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

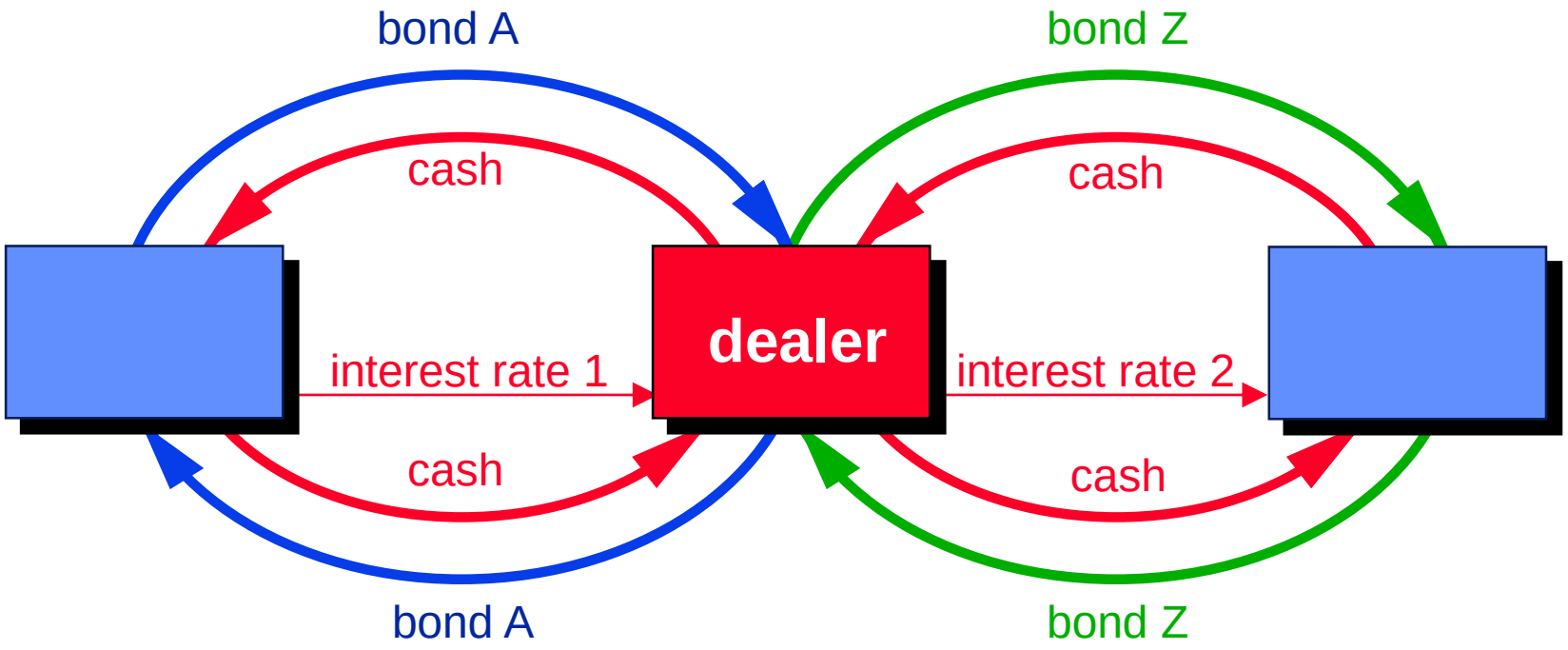
repo v securities lending

dealer borrows bond A through
securities borrowing transaction against bond Z



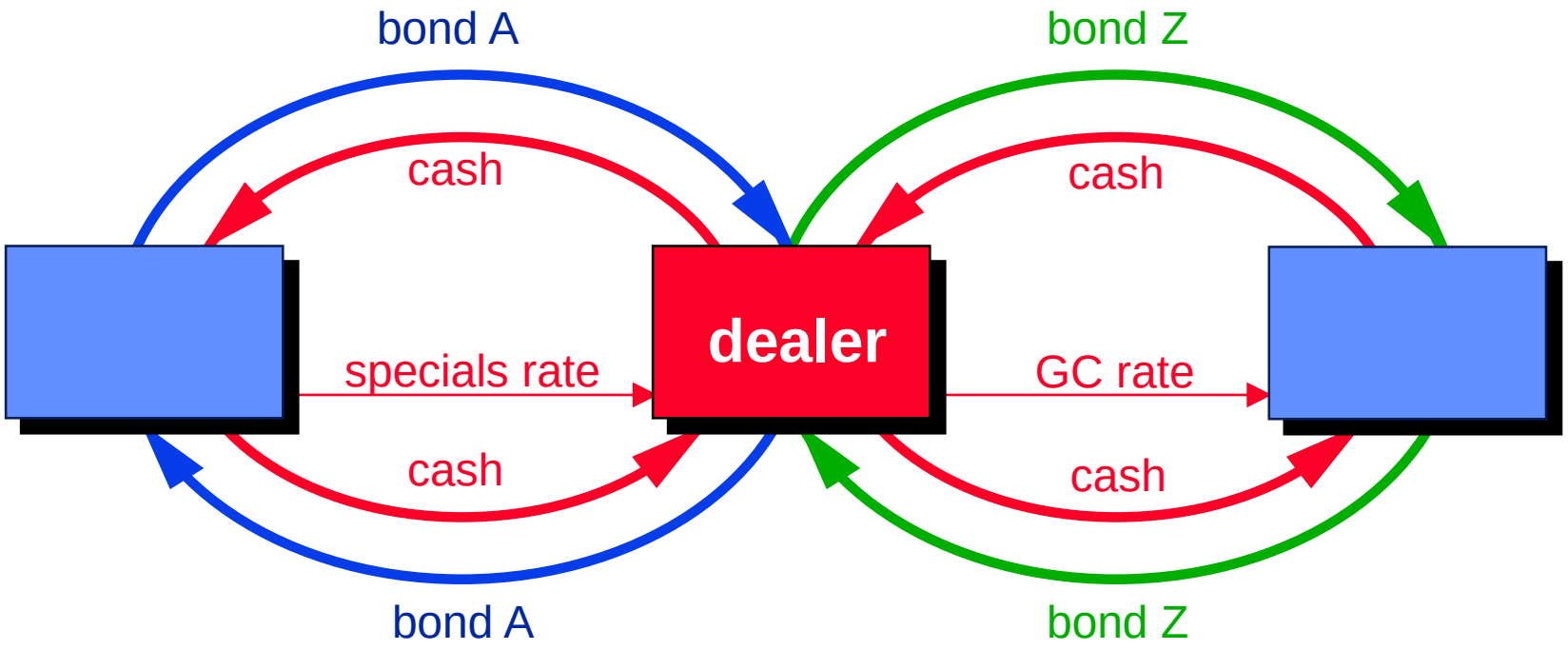
repo v securities lending

dealer borrows bond A through
reverse repo financed by repo of bond Z



repo v securities lending

dealer borrows bond A through
reverse repo financed by repo of bond Z



GC rate – specials rate = specialness spread = securities lending fee

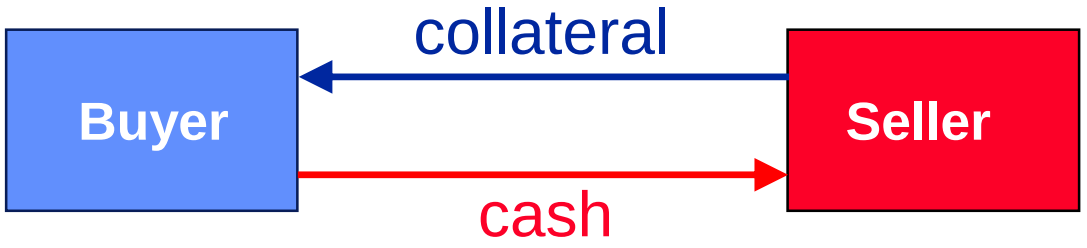
securities lending v repo

- securities lending is not always of specials or even securities-driven (except for securities borrower)
- repo is not always of GC or even cash-driven

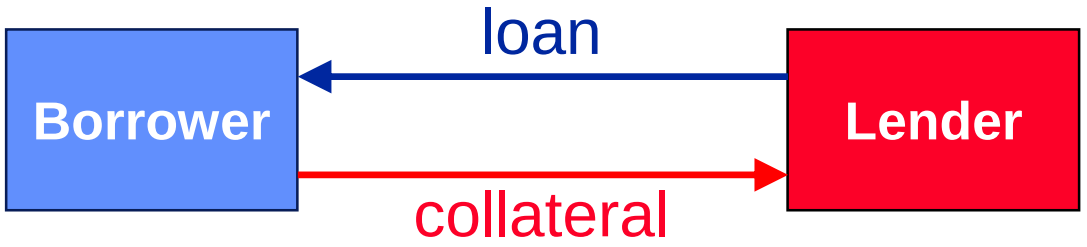
buying GC = cash-driven
buying specials = securities-driven

selling GC = cash-driven
selling specials = securities-driven

repo



securities lending



borrowing GC = securities-driven
borrowing specials = securities-driven

lending GC = cash or securities-driven
lending specials = securities-driven

securities lending v repo

- operational differences
- legal differences
- market differences

securities lending v repo

operational differences

repo	securities lending
securities v cash	securities v securities/cash
direct interest (repo rate)	indirect interest (reinvestment rate)
gross interest on cash	net interest (fee + rebate)
interest at maturity	fees/interest monthly

securities lending v repo

legal differences

repo	securities lending
title is sold	title is transferred/pledged
GMRA	GMSLA, OSLA, GESLA

securities lending v repo

market differences

repo	securities lending
bond-driven	equity-driven
finance-driven	short-driven
initial margin to cash-giver	initial margin to cash-taker
typically fixed term	typically open
plain vanilla	customised
large average deal size	small average deal size
investment banks	investors and custodians
two-way flows	one-way flows
collateral re-use common	collateral re-use rare
limited role for agents	major role for agents
collateral agreed deal by deal	collateral managed as portfolio
limited price tiering	price sensitive to counterparty

securities lending v repo

- **why use repo?**
  - you are cash-provider --- most initial margins/haircuts in repo favour buyer
  - fixed terms more common
  - large deal size possible
  - greater legal certainty in some jurisdictions become repo is recognised
  - repo documentation may already be in place
- **why use securities lending?**
  - easier to borrow equity
  - securities lending documentation may already be in place
  - some investors do not want cash: management resources, balance sheet
  - may be legal/regulatory prohibitions on repo
  - perception of lower risk than repo, eg indemnification by agent lender, initial margin is standard, type of counterparties
  - easier to run short positions given typical lender is not dealer
  - hides securities borrowing from other dealers

Professional Repo & Collateral Management Course

types of repo

Richard Comotto
ICMA Centre
University of Reading
United Kingdom

Lunch

The links between repos, bonds & derivatives

Khagendra X Gupta, Executive Director, European Rates Derivatives Strategy, J.P. Morgan

The links between repos, bonds & derivatives

Khagendra Gupta[AC]
(44-20) 7134-0486
Khagendra.x.gupta@jpmorgan.com
J.P. Morgan Securities plc

[AC] Indicates certifying analyst. See last page for analyst certification and important disclosures.

Calculating the forward price of a bond using repo rates

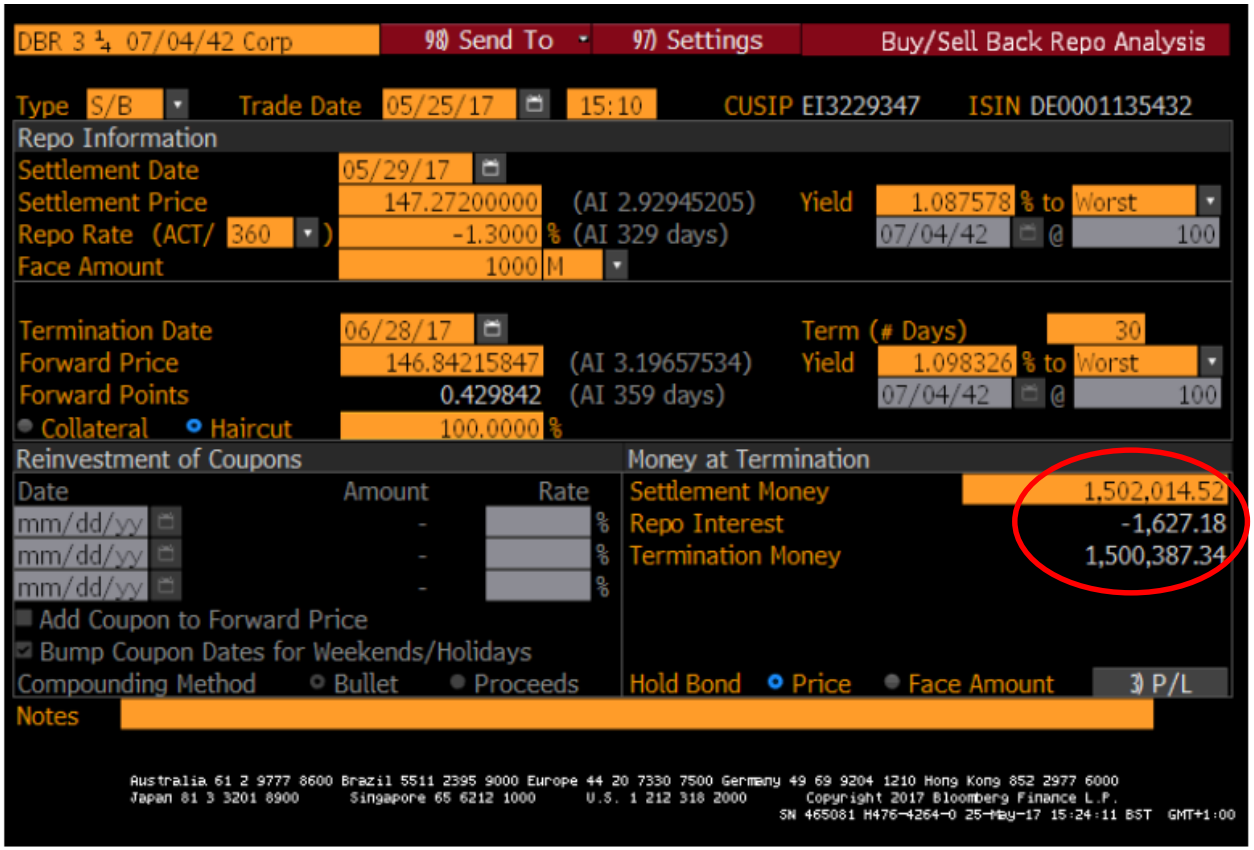
Spot clean price (DBR 3.25% Dec 42): 147.272
Accrued Interest: 2.929
Dirty price :
147.272+2.929 = 150.201

↓

Repo rate: -1.3%
1M (30 days) repo cost:
150.021*1.3%*30/360) = -0.1627

↓

Forward price:
150.201 + (-0.1627) = 150.0387

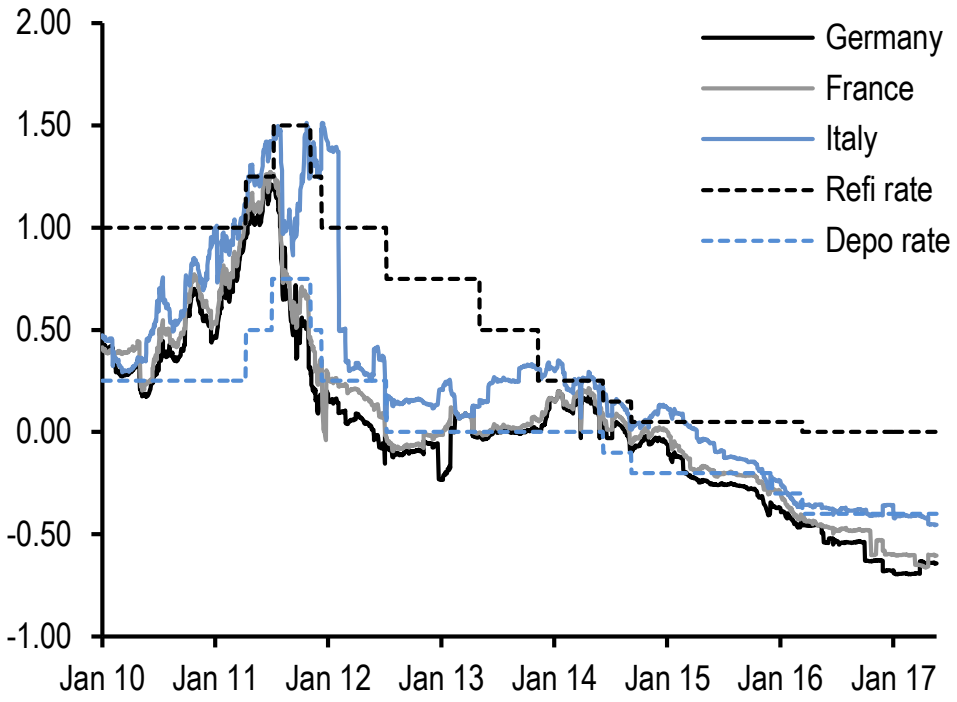


What other factor(s) could impact a bond's forward price?

Central bank policies are the biggest drivers of repo rates

Repo rates have declined over the last few years as the ECB has taken policy rates into negative territory

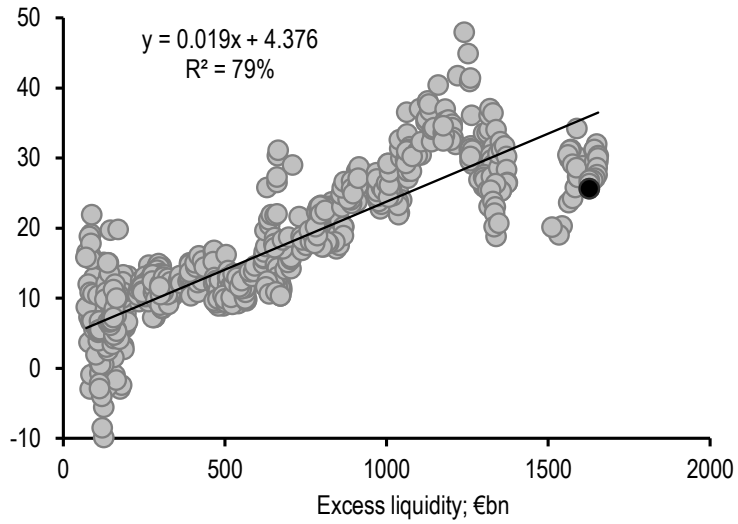
3M Generalized collateral repo rate for Germany, France, Italy, and ECB refi and deposit facility rates; since 1 Jan 2010; %



ECB's balance sheet expansion and high excess liquidity has pushed Euro area repo rates even lower

Repo specialness has increased broadly in sync with excess liquidity in the Euro area

Repo specialness* regressed against Euro area excess liquidity; since 1 Jan 2014; bp



* Repo specialness defined as: EONIA fixings – RFR index.
Source for RFR Index: MTS and BrokerTec platforms

Benchmark bonds generally trade special to GC repo rate

Current 3M repo specialness of various benchmark bonds; bp

	3M GC; %	Actual repo rate; %	Repo speicalness; bp
Germany			
2Y	-0.64	-0.85	21
5Y	-0.64	-0.64	0
10Y	-0.64	-1.15	51
30Y	-0.64	-1.15	51
US			
2Y	1.07	0.95	12
5Y	1.07	0.90	17
10Y	1.07	0.68	39
30Y	1.07	0.90	17

Bank balance sheet pressure also impacts repo funding costs

The changes to the PSPP lending facilities announced by the ECB at the December meeting did not prevent the development of funding pressure around year end with German RFR repo index EONIA specialness moving over 450bp

Statistics of German RFR repo index specialness to EONIA around month end, quarter end and year end; bp

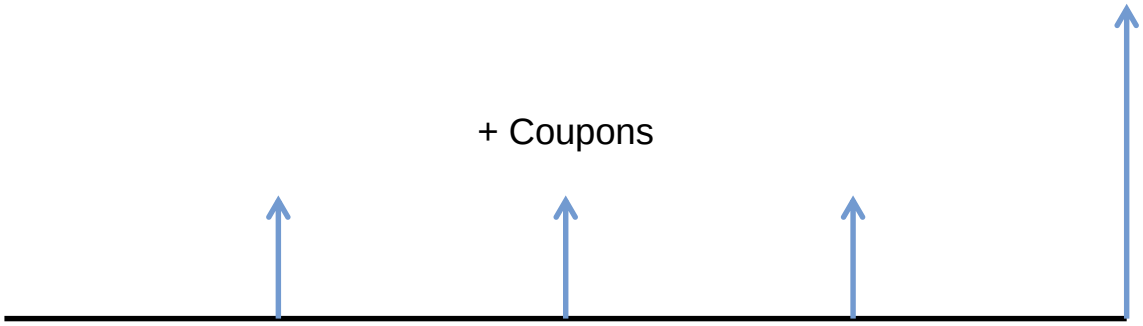
	RFR Germany Spread over EONIA					
	Fixing (ex lbd of each	Month End	Month end value ex quarter	Quarter End	Quarter End (ex year end)	Year End
Average 2013	-8	-13	-11	-16	-14	-22
Std dev 2013	2	4	2	4	1	-
Average 2014	-6	-15	-10	-26	-30	-14
Std dev 2014	4	13	6	16	17	-
Average 2015	-12	-16	-10	-28	-16	-65
Std dev 2015	4	15	3	21	3	-
Average 2016	-25	-65	-25	-146	-43	-455
Std dev 2016	13	118	10	179	14	-
Avg 2013-2015	-9	-15	-10	-24	-20	-34
Std dev	4	12	4	16	12	22
Avg 2013-2016	-13	-27	-14	-54	-26	-139
Std dev	10	64	9	105	16	183

Source for RFR index: MTS and BrokerTec platforms

Trading a bond – calculating carry

Buying a bond with a fixed coupon; how much do you actually earn in an unchanged yield scenario?

- Bond coupons
- However, using bond yield is a better approximation to account for pull-to-par feature



What about funding the position?
If funded position, then funding cost (generally via repo markets) should be accounted for as well. Carry is an important consideration for investors in setting up trades.

Bond carry is defined as, Bond coupon – funding cost.
This carry calculation is under the assumption that bond prices remain unchanged which means that bond yields are different at inception and maturity.
Another definition of carry: bond yields remain unchanged; carry defined as Forward yield – spot yield (see later)

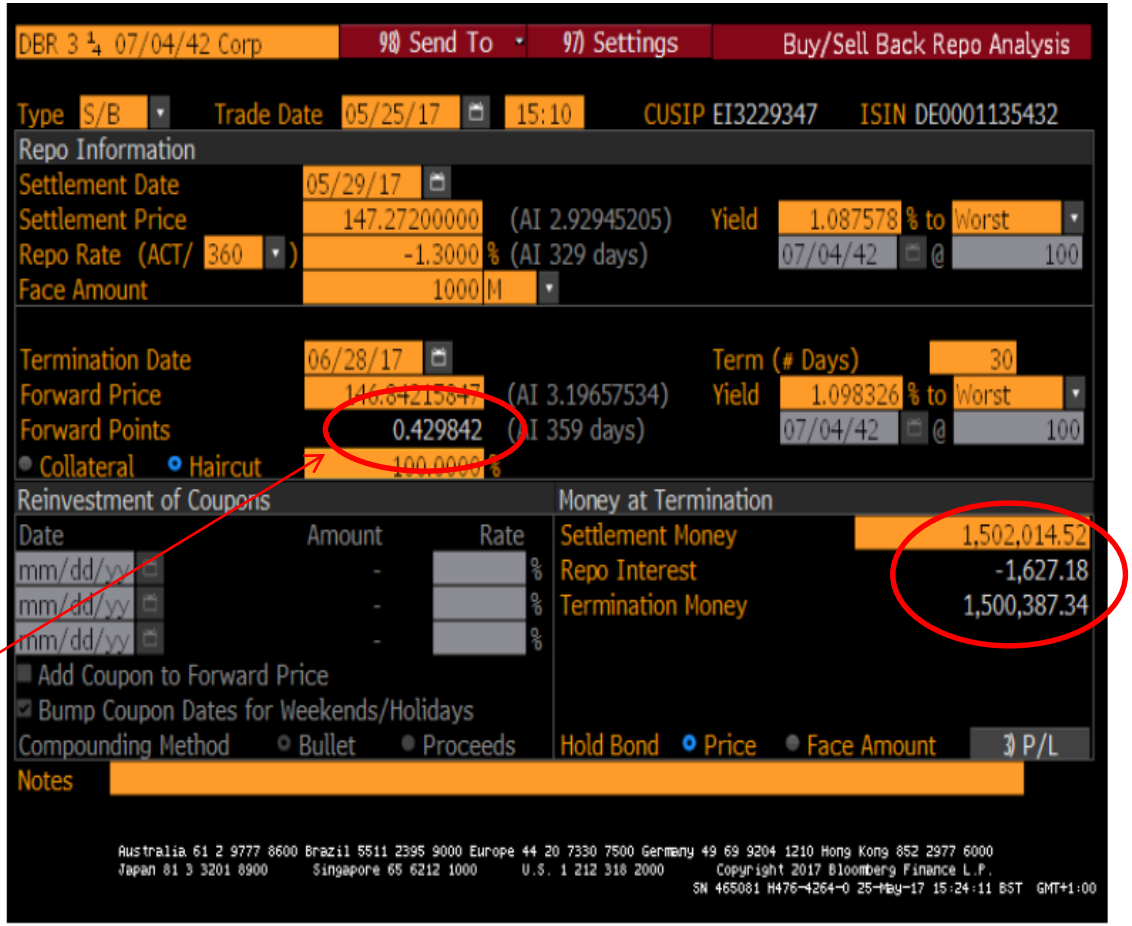
Calculating the forward price of a bond - revisited

Spot clean price (DBR 3.25 Dec42): 147.272
Accrued Interest: 2.929
Dirty price : 147.272+2.929 = 150.201

Coupon accrued: 3.25% * 30/365 = 0.267

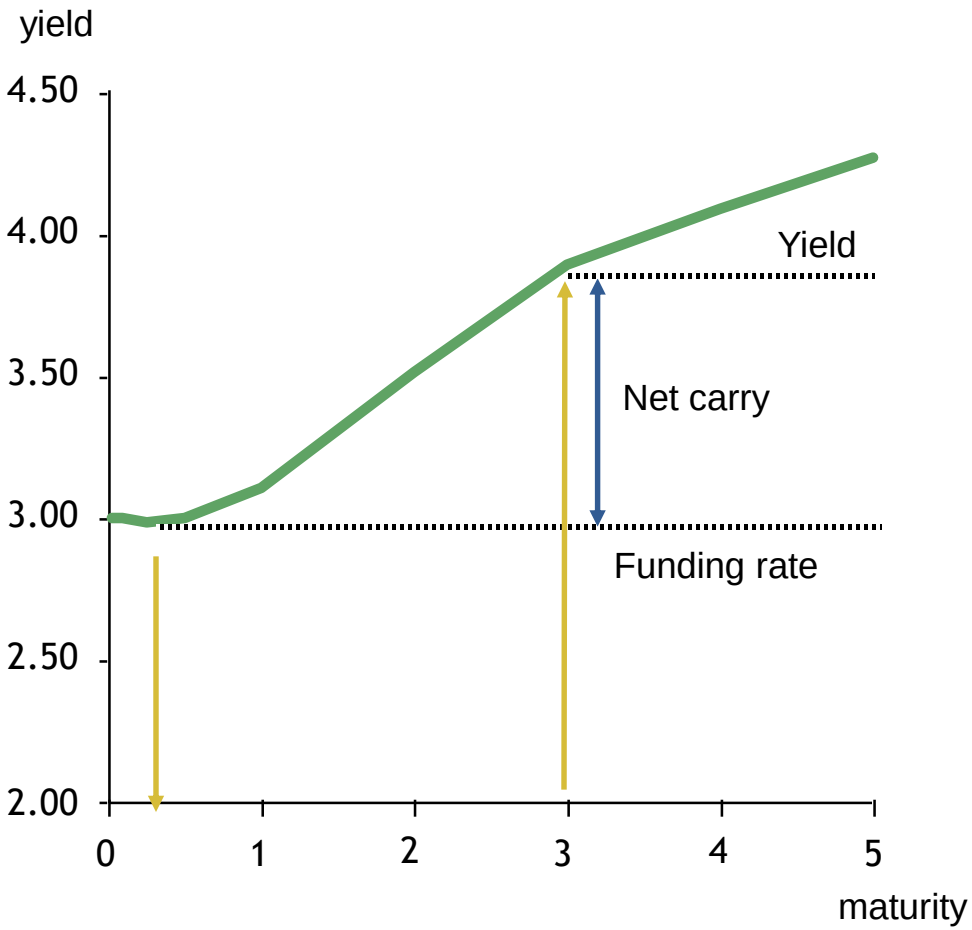
Repo rate: -1.3%1M (30 days) repo cost: 150.021*1.3%*30 /360) = -0.1627

Forward price:
150.201 – 0.267 + (-0.1627) =
150.201 – (0.4298) =
149.7716



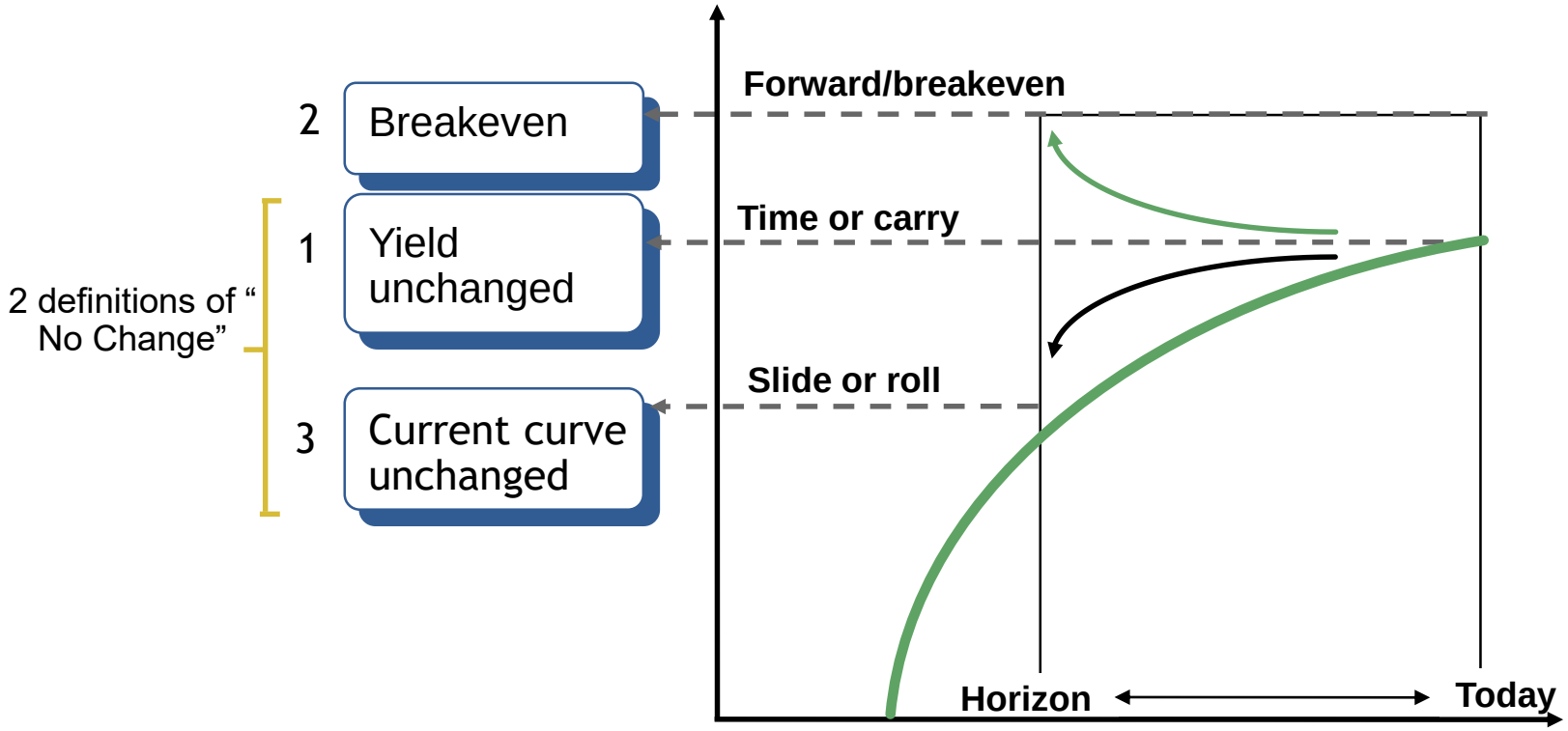
What if there is a coupon payment within the trade horizon?

Funded positions – performance versus deposits



- **Investor trades off yield pick-up/give-up against duration (risk)**
- **Positive curve implies bearish expectations**
  - **"earn time or carry" when long**
- **Negative curve implies bullish expectations**
  - **"costs time" when long**

Consider 3 basic scenarios...



P&L approximation

$$P\&L \approx Time - \Delta Yield \times Mod\ Dur_{,Fwd}$$

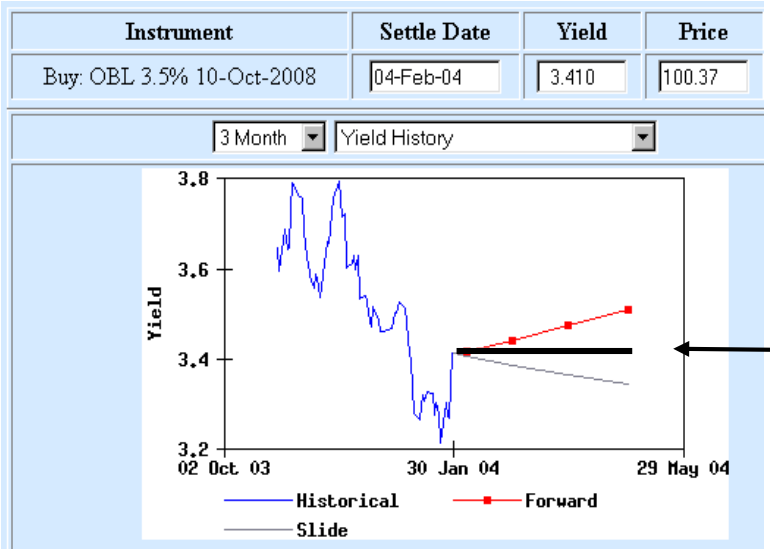
1. Yield unchanged: Time or carry

How much will I make if the yield is unchanged?

Time = (Yield - Funding Rate) × Holding period

"Time" captures the cost or benefit of carry over the holding period

- **Need to adjust yields and day-counts correctly**



No change in yield

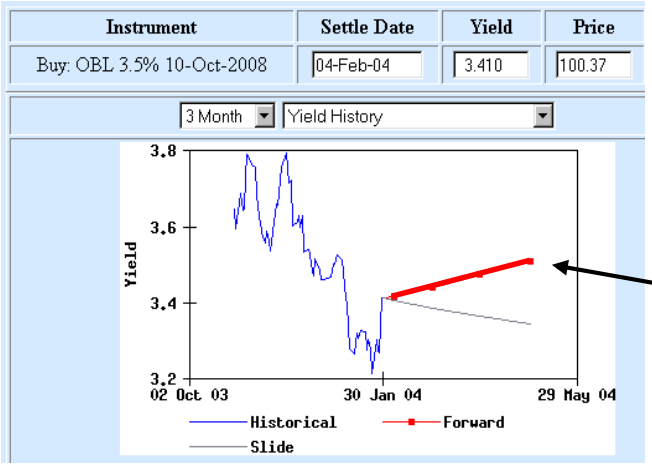
2. Breakeven: Forward yield

How must the yield move to breakeven after funding?

$$P\&L \approx Time - \Delta Yield \times Mod\ Dur_{,Fwd}$$

$$Time \approx (\ Forward\ Yield - Initial\ Yield\ ) \times Mod\ Dur_{,Fwd}$$

$$Forward\ Yield \approx \frac{Time}{Mod\ Dur_{,Fwd}} + Initial\ Yield$$

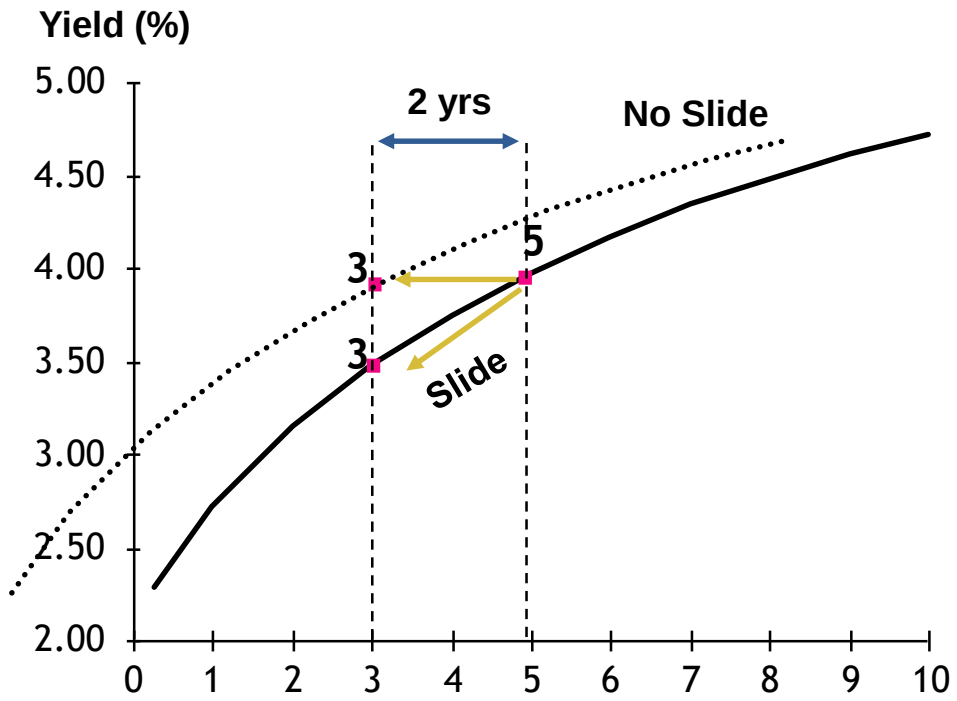


- Forward yield expresses this "Time" in terms of bp
  - NB: Must consider price sensitivity at the horizon

Forward yield curve

3. Yield curve unchanged: Slide or roll

Example: Slide of 5-year bond over next 2 years



- As a position matures, it slides down the term structure
- Assumption: shape and level of the yield curve remain unchanged
  - in a positive curve will give a capital gain
  - this is not the “market expectation”

Example

Calculate the 3-month Time, Forward yield and Slide yield on the position below:

	Yield (ann)	Mod Dur	3mo Repo(act/360)
5yr T-note	3.05%	4.2yr	1.13%
4yr T-note	2.89%		

(Assumptions: same rate convention, linearly interpolated slide, Mod Dur shortens by 0.2yrs)

Time = (Yield - Funding rate) × Holding period

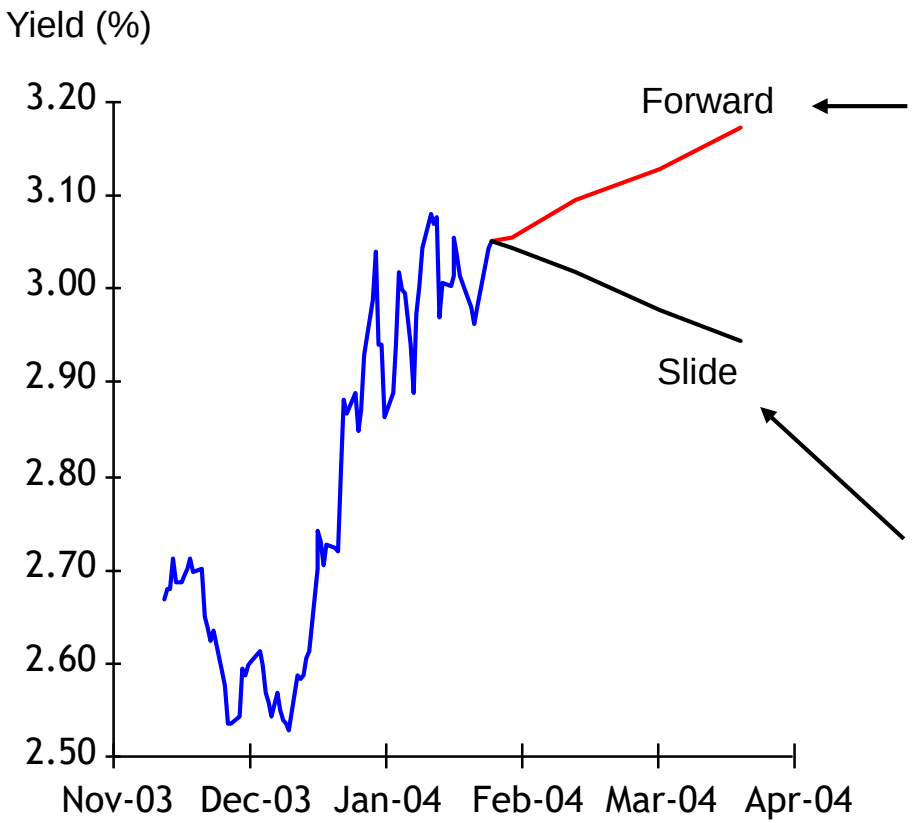
= (3.05% - 1.13%) × 0.25 = 0.48% = 48 ticks

Forward yield ≈ Time + Initial yield ≈ 0.48% / 4 + 3.05% = 3.17%

Slide = (3.05% - 2.89%) × 0.25 = 0.04%

Mod Dur,Fwd

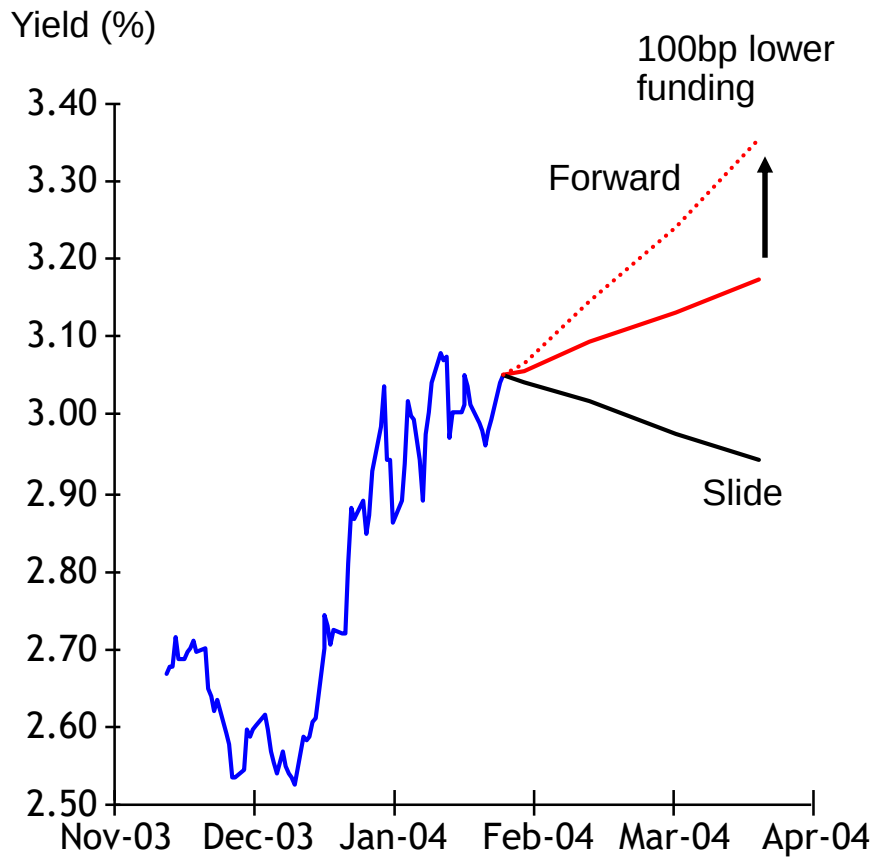
Analyzing a funded position



- **Funding rate is lower than bond yield**
  - **Positive Time**
  - **Forward yield is above spot**
  - **Long position will make money unless yields rise**

- **Upward sloping curve**
  - **Slide is positive**
  - **If curve unchanged, long position will make money**

Changing the funding rate makes a big difference

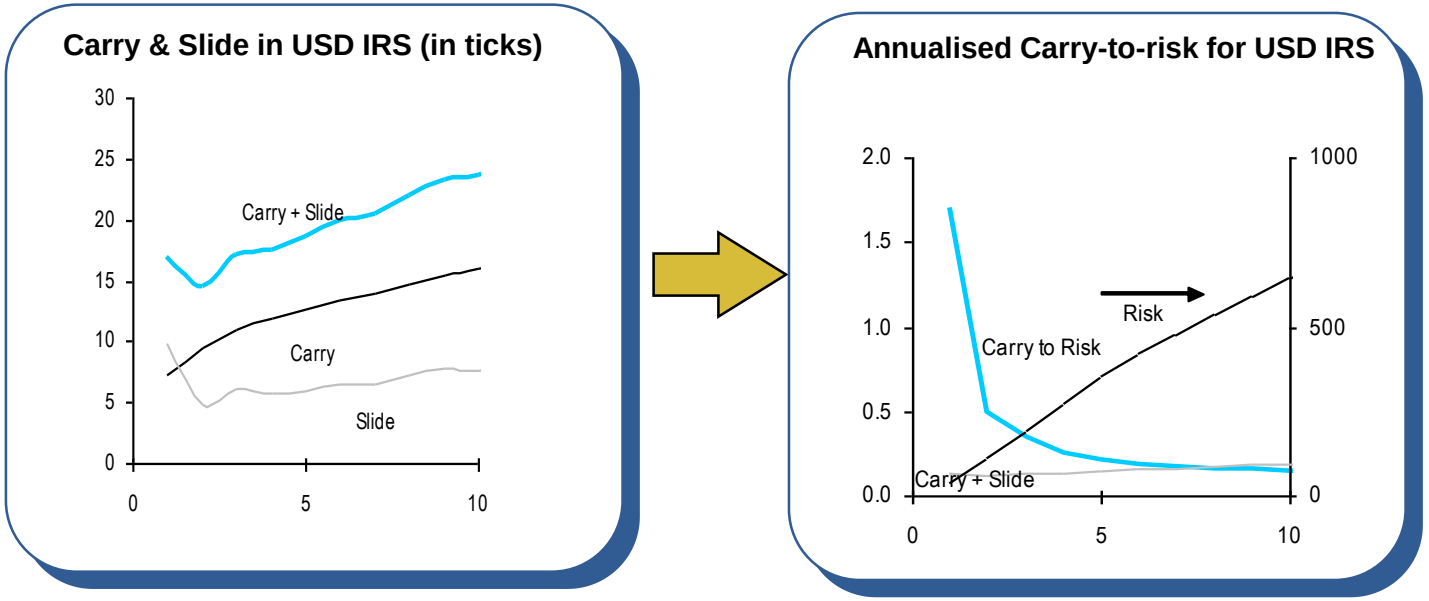


- "Expensive" bonds are often cheaper to fund
  - trade "special" on repo, not so expensive in forward space
- How fast will a bond have to cheapen to lose money?
  - implied breakeven may provide good protection

Implicit cost of funding is a key part of relative value analysis

Is carry a good way to position in a stable rates environment?

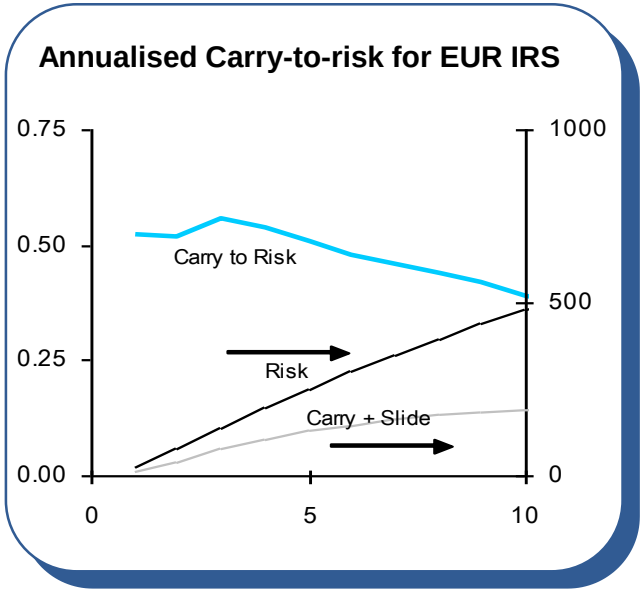
- Yes, but…
- Carry does not take into account the volatility of yield curves
- Need a measure of carry per unit of risk

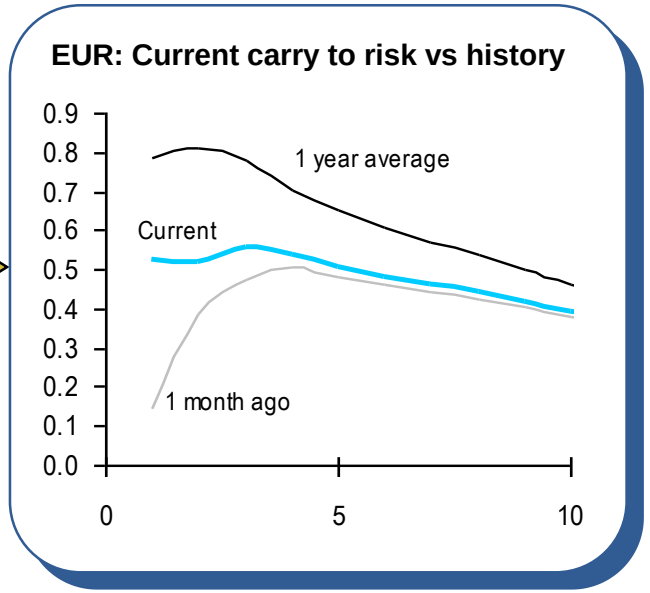


Carry adjusted for volatility of yields a good indicator of where to position in a stable rates environment

Carry to Risk is just a snapshot; the dynamics will change over time

- Can compare carry-to-risk vs historical value
- Gives a measure of how much risk-adjusted-carry has changed over time

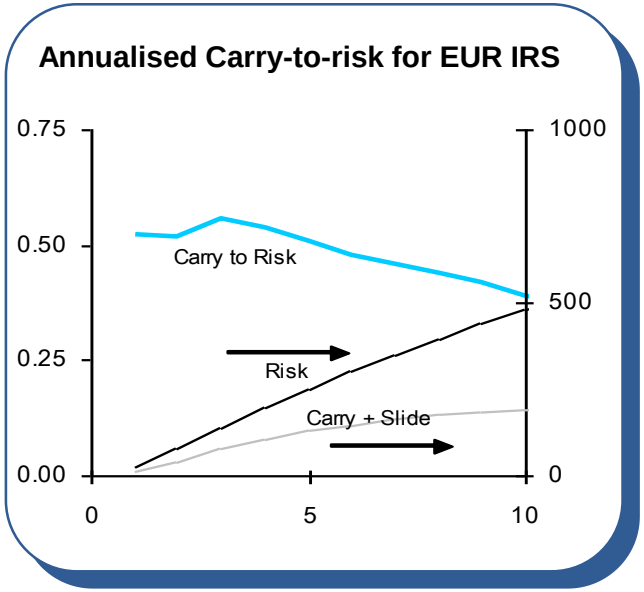


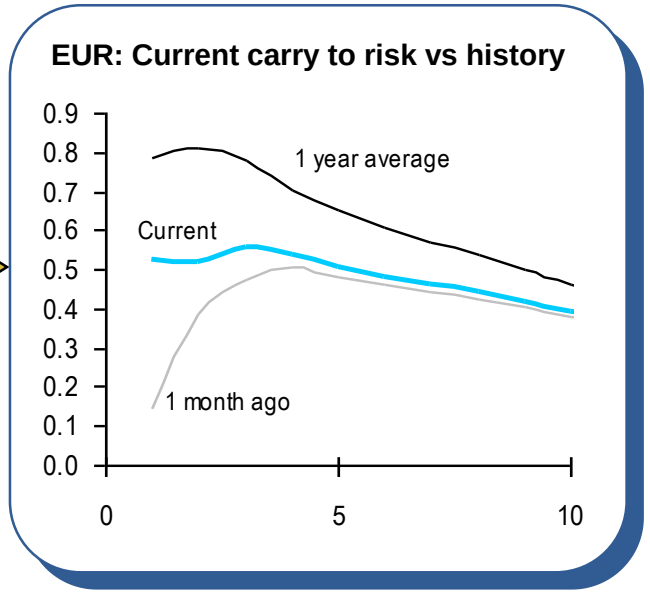


We must understand how the carry dynamics change

Carry to Risk is just a snapshot; the dynamics will change over time

- Can compare carry-to-risk vs historical value
- Gives a measure of how much risk-adjusted-carry has changed over time





We must understand how the carry dynamics change

Understanding bond futures

Important concepts in bond futures

- **Conversion factor** (Forward price of the bond at delivery if yielding the notional coupon – generally 6%)
- **Invoice price** (Futures Settlement Price x Conversion Factor$_i$ + Accrued Interest $_i$)
- **Implied repo rate** – Cost of funding as implied by the futures market

IRR = *[invoice price/ purchase price -1] x [$^{360}/_{days}$] , or*

= *[(FutPrice x Cfac + AI_d)/ (BondPrice+AI_0) -1] x [$^{360}/_{days}$]*

- **Futures net basis** – an indication of the difference between *implied* repo rate and *actual* repo rate

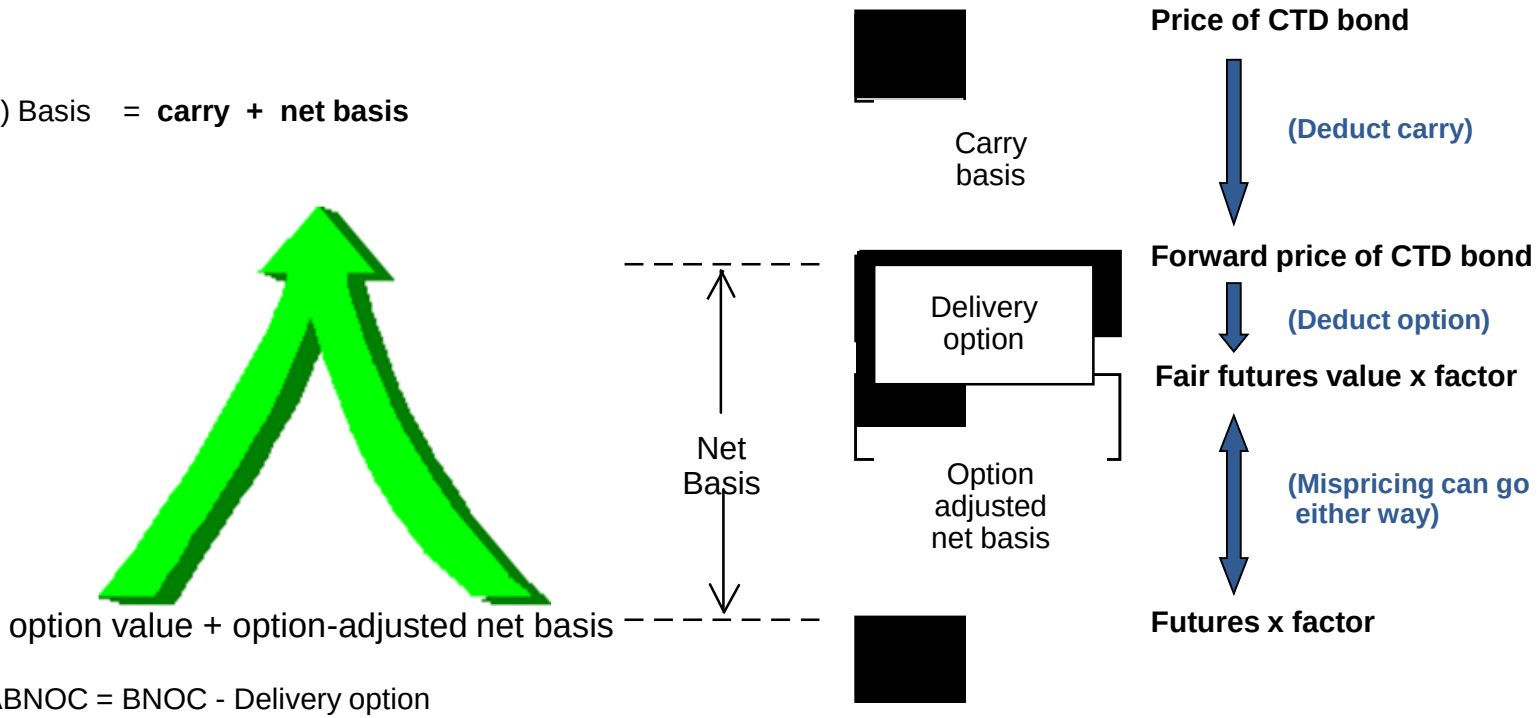
Trading the futures basis: conceptual framework

(Gross) Basis = **bond (spot) - futures x factor**

Net Basis (BNOC) = **bond (fwd) - futures x factor**

so,

(Gross) Basis = **carry + net basis**



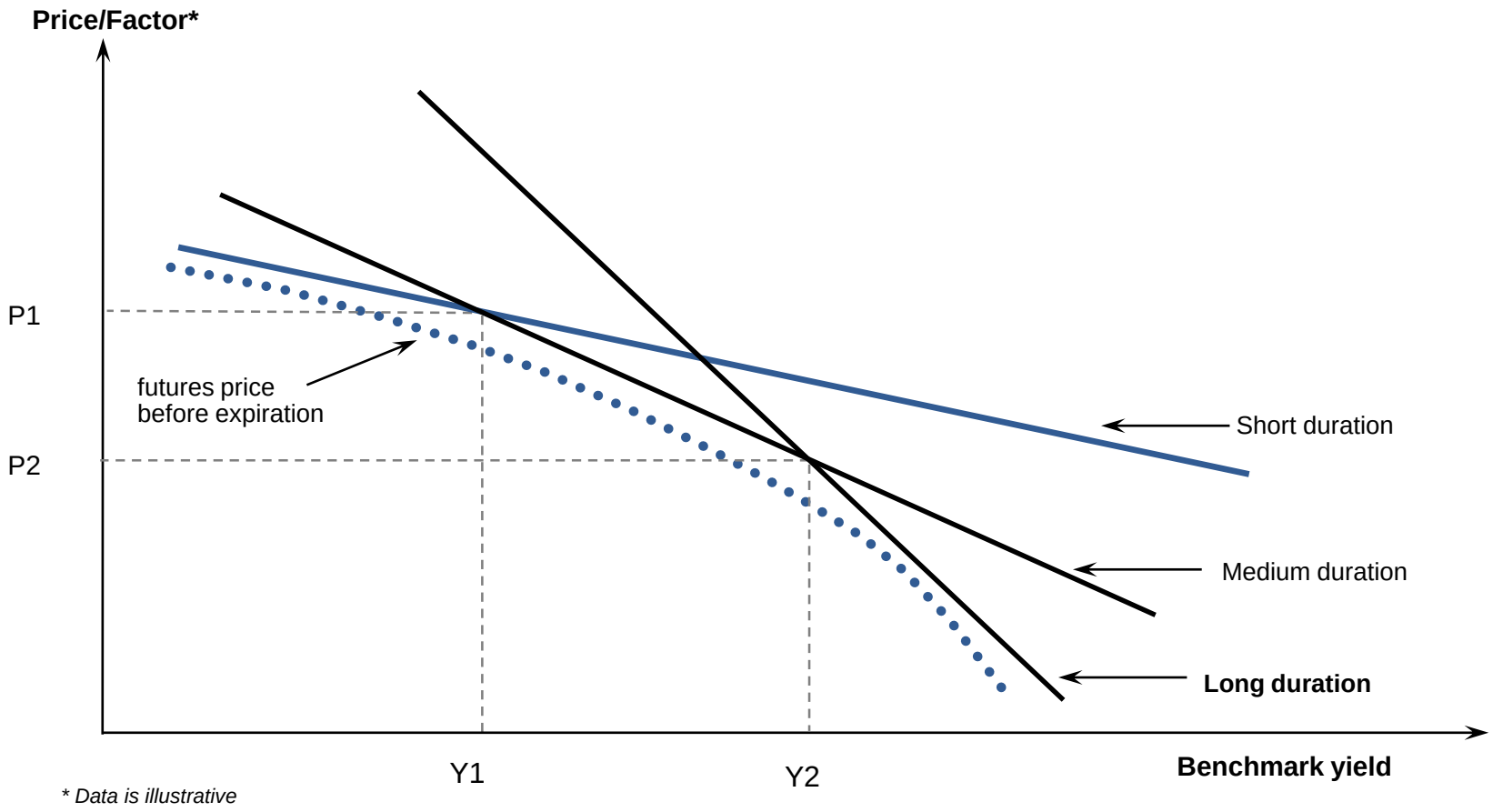
OABNOC = BNOC - Delivery option

OABNOC < 0
Futures is rich: market price of delivery option is cheap to fair value

OABNOC >0
Futures is cheap: market price delivery option is rich to fair value

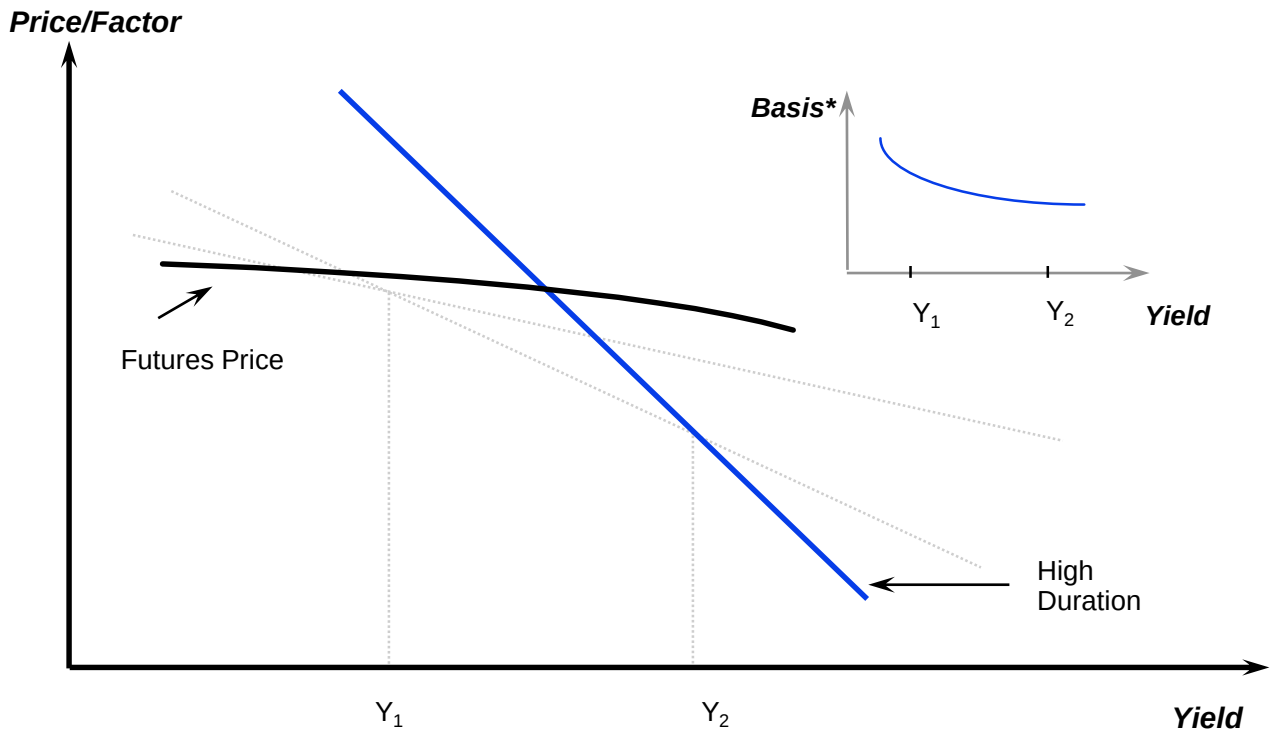
Cash/futures price relationships

Futures price adjusted for conversion factor and cash prices (linearized)



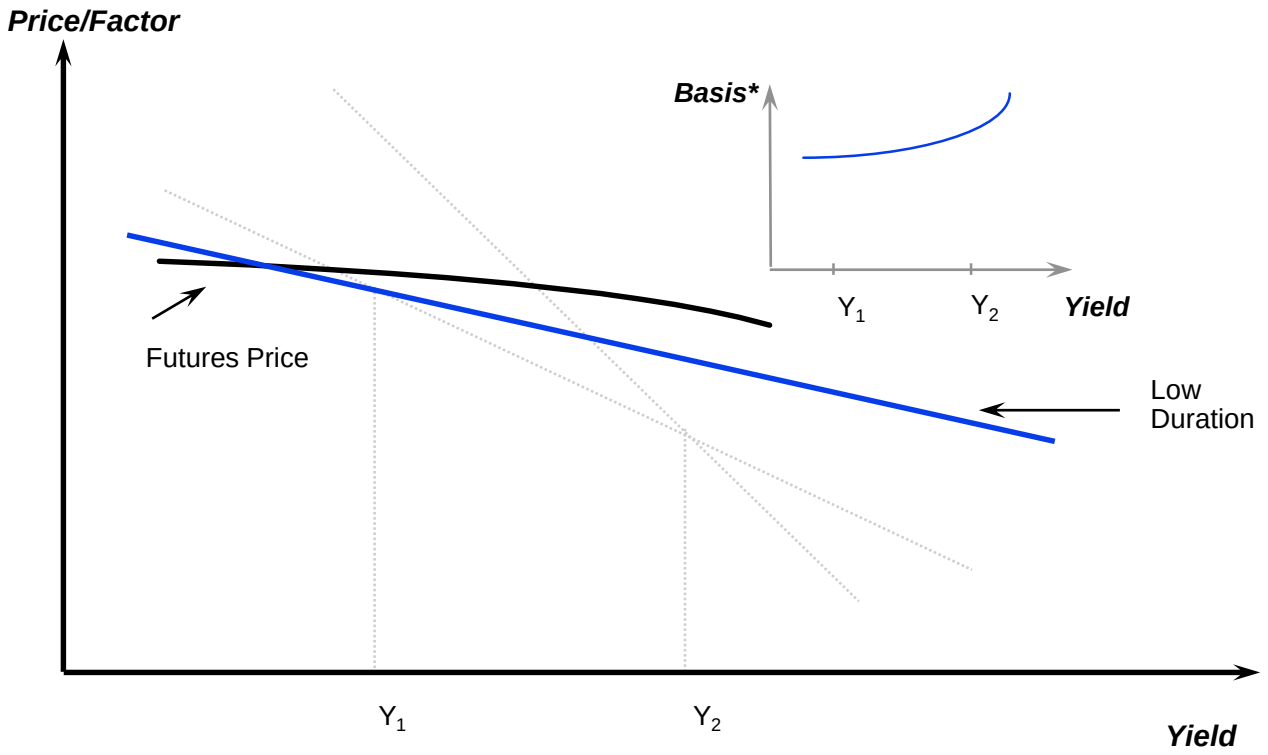
** Data is illustrative*

Basis of high duration bond is like a call option



* Basis = Price - Factor x Futures

Basis of low duration bond is like a put option

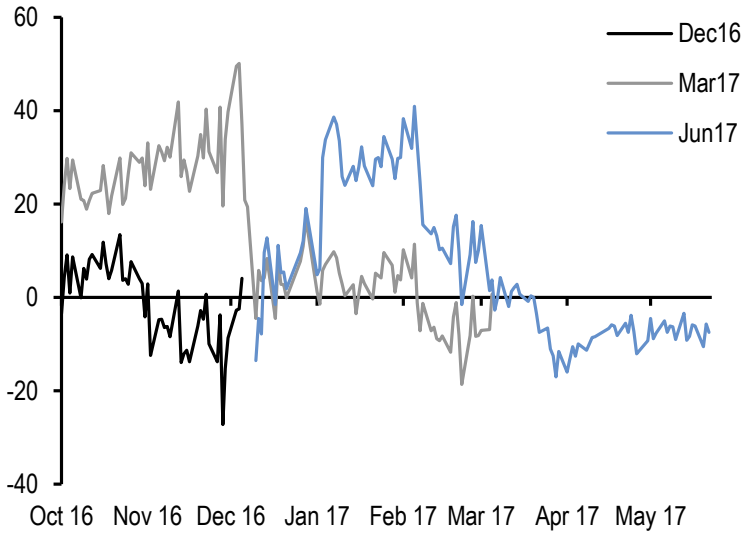


* Basis = Price - Factor x Futures

Trading futures basis as an arbitrage opportunity

CTD net basis of bond future will converge to zero at expiry

Dec16, Mar17, and Jun17 Buxl net basis; since 1 Oct 2016; cents



Buying the basis involves:

- Buying the bond (CTD) in the repo market
- Selling futures against it

At futures expiry,

- Deliver the bond

Net basis is a measure of relative value and akin to arbitrage opportunity

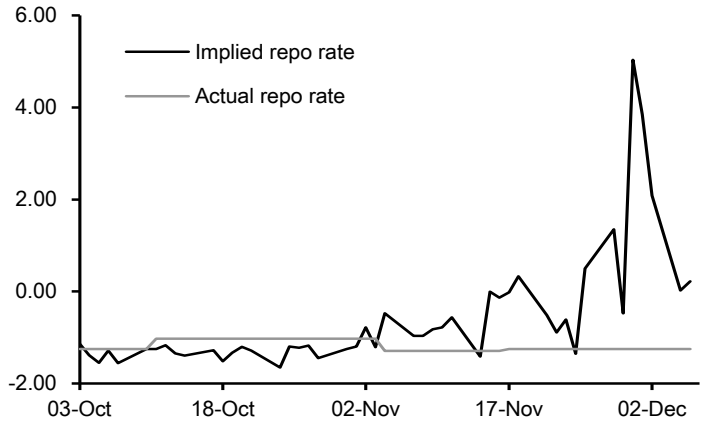
What's the catch?

- Locking the repo rate till delivery that was used to calculate the net basis
- Term repo market is illiquid

Trading futures roll to position for repo scarcity

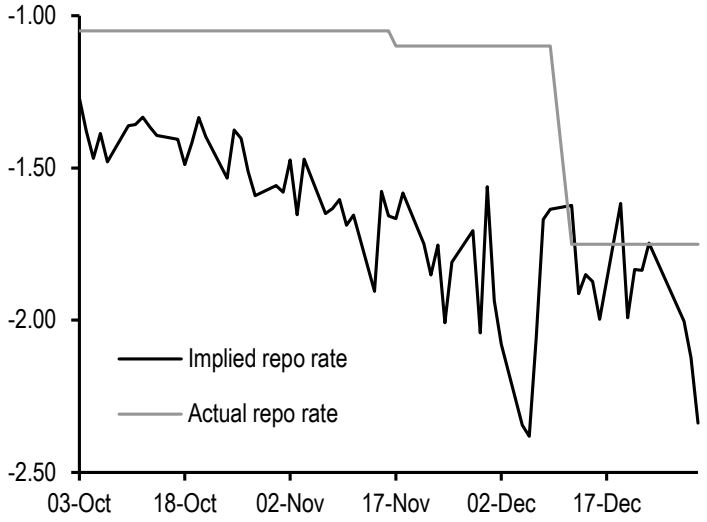
In the Dec16/Mar17 roll, investors bought the calendar spread in anticipation of bond scarcity…

Dec16 Buxl actual and implied repo rate; 1 Oct 2016 – 10 Dec 2016; %



…which resulted in significant cheapening of the back contract

Mar17 Buxl actual and implied repo rate; 1 Oct 2016 – 1 Jan 2017; %



Futures swap spread differential is also a reflection of repo

A part of the futures swap spread differential between the front and back bond futures CTD, especially in cases where the CTD is the same, can be explained by difference in term repo for the CTDs

J.P.Morgan futures asset swap spread report

Euro Futures Swap Spread Report

Buxl				Spot				Fwd at 12 Jun 17; Fut PVBP beta = 300.6 Futures price = 165.36; Invoice SS = 34.3						Fwd at 11 Sep 17; Fut PVBP beta = 299.4 Futures price = 163.68; Invoice SS = 32.6					
CTD	Type	Mat	Cpn	Mid	Yield	SS	PVBP	Repo (Imp.)		Yld	SS	Fact.	Basis	BNoC	Repo (Imp.)		Yld	SS	Fact.	Basis	BNoC
	DBR	JUL39	4.25	163.84	1.012	43.0	2676	-0.47		1.017	42.9				-0.71		1.044	42.3			
	DBR	JUL40	4.75	175.95	1.037	41.7	2917	-0.48		1.041	41.7				-0.65		1.068	41.1			
MU	DBR	JUL42	3.25	146.12	1.130	34.3	2744	-1.30	-0.19	1.136	34.2	0.882632	16	-8	-1.30	-1.32	1.169	31.6	0.883261	154	1
	DBR	JUL44	2.50	129.90	1.201	28.5	2696	-1.30	-79.91	1.207	28.5	0.754721	510	490	-0.85	-14.00	1.231	26.7	0.755949	617	510
	DBR	AUG46	2.50	130.93	1.233	26.3	2877	-1.30	-123.14	1.238	26.3	0.744349	784	765	-0.85	-20.80	1.262	25.2	0.745560	890	782

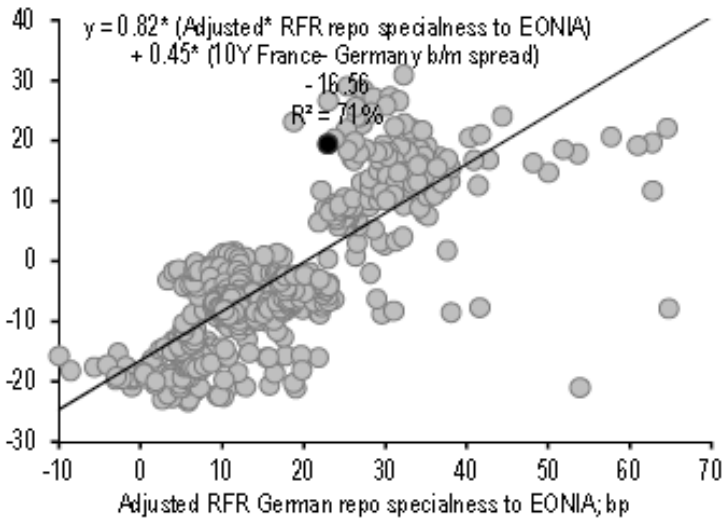
Bund				Spot				Fwd at 12 Jun 17; Fut PVBP beta = 134.0 Futures price = 160.80; Invoice SS = 46.7						Fwd at 11 Sep 17; Fut PVBP beta = 146.7 Futures price = 162.67; Invoice SS = 41.2					
CTD	Type	Mat	Cpn	Mid	Yield	SS	PVBP	Repo (Imp.)		Yld	SS	Fact.	Basis	BNoC	Repo (Imp.)		Yld	SS	Fact.	Basis	BNoC
	DBR	MAY24	1.50	110.74	-0.038	51.3	741	-0.73		-0.033	51.3				-0.68		-0.008	51.4			
	DBR	AUG24	1.00	107.20	0.002	50.4	752	-0.79		0.008	50.3				-1.10		0.052	48.8			
	DBR	FEB25	0.50	103.19	0.086	48.6	784	-0.73		0.091	48.6				-1.15		0.137	46.9			
	DBR	AUG25	1.00	106.93	0.152	48.2	848	-0.76		0.157	48.1				-1.35		0.211	45.7			
M	DBR	FEB26	0.50	102.33	0.230	46.5	874	-1.18	-0.34	0.238	46.2	0.636105	4	-4	-1.65		0.299	43.1			
U	DBR	AUG26	0.00	97.07	0.322	43.2	892	-1.30	-62.49	0.331	42.8	0.585882	286	281	-1.28	-1.29	0.376	41.2	0.594455	37	0
	DBR	FEB27	0.25	98.54	0.403	40.8	944	-1.30	-89.42	0.411	40.5	0.586859	418	410	-1.20	-5.77	0.455	39.1	0.594839	178	135
	WI	AUG27	0.00																		

Swap spreads: repo specialness as a driver of swap spreads

Swap spreads generally widen if the specialness of the underlying bond increases

Schatz swap spread have exhibited a strong relationship to repo specialness

Front Schatz OIS swap spreads regressed against a) adjusted* RFR** German repo specialness to EONIA; b) 10Y France/Germany benchmark spread; Mar16 – Mar17; bp



*Excluding year-end effect from 23 December 2016 to 6 January 2017

** RFR Index source: Broker Tec and MTS trading platforms.

Conclusion

Repo rates have a large role to play in the bond and fixed income derivatives market

- Calculating bond carry
- Futures basis trades
- Swap spreads

Buying/selling a bond in our trade recommendation is also dependent on the availability of the bond in the repo market. It is sometimes the case that shorting a bond via repo could be very punitive

Disclosures

Analyst Certification: The research analyst(s) denoted by an "AC" on the cover of this report certifies (or, where multiple research analysts are primarily responsible for this report, the research analyst denoted by an "AC" on the cover or within the document individually certifies, with respect to each security or issuer that the research analyst covers in this research) that: (1) all of the views expressed in this report accurately reflect his or her personal views about any and all of the subject securities or issuers; and (2) no part of any of the research analyst's compensation was, is, or will be directly or indirectly related to the specific recommendations or views expressed by the research analyst(s) in this report. For all Korea-based research analysts listed on the front cover, they also certify, as per KOFIA requirements, that their analysis was made in good faith and that the views reflect their own opinion, without undue influence or intervention.

Company-Specific Disclosures: Important disclosures, including price charts and credit opinion history tables, are available for compendium reports and all J.P. Morgan–covered companies by visiting https://jpmm.com/research/disclosures, calling 1-800-477-0406, or e-mailing research.disclosure.inquiries@jpmorgan.com with your request. J.P. Morgan's Strategy, Technical, and Quantitative Research teams may screen companies not covered by J.P. Morgan. For important disclosures for these companies, please call 1-800-477-0406 or e-mail research.disclosure.inquiries@jpmorgan.com.

Analysts' Compensation: The research analysts responsible for the preparation of this report receive compensation based upon various factors, including the quality and accuracy of research, client feedback, competitive factors, and overall firm revenues.

Other Disclosures

J.P. Morgan ("JPM") is the global brand name for J.P. Morgan Securities LLC ("JPMS") and its affiliates worldwide. J.P. Morgan Cazenove is a marketing name for the U.K. investment banking businesses and EMEA cash equities and equity research businesses of JPMorgan Chase & Co. and its subsidiaries.

Options related research: If the information contained herein regards options related research, such information is available only to persons who have received the proper option risk disclosure documents. For a copy of the Option Clearing Corporation's Characteristics and Risks of Standardized Options, please contact your J.P. Morgan Representative or visit the OCC's website at http://www.optionsclearing.com/publications/risks/riskstoc.pdf

Legal Entities Disclosures

U.S.: JPMS is a member of NYSE, FINRA, SIPC and the NFA. JPMorgan Chase Bank, N.A. is a member of FDIC. **U.K.**: JPMorgan Chase N.A., London Branch, is authorised by the Prudential Regulation Authority and is subject to regulation by the Financial Conduct Authority and to limited regulation by the Prudential Regulation Authority. Details about the extent of our regulation by the Prudential Regulation Authority are available from J.P. Morgan on request. J.P. Morgan Securities plc (JPMS plc) is a member of the London Stock Exchange and is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority. Registered in England & Wales No. 2711006. Registered Office 25 Bank Street, London, E14 5JP. **South Africa**: J.P. Morgan Equities South Africa Proprietary Limited is a member of the Johannesburg Securities Exchange and is regulated by the Financial Services Board. **Hong Kong**: J.P. Morgan Securities (Asia Pacific) Limited (CE number AAJ321) is regulated by the Hong Kong Monetary Authority and the Securities and Futures Commission in Hong Kong and/or J.P. Morgan Broking (Hong Kong) Limited (CE number AAB027) is regulated by the Securities and Futures Commission in Hong Kong. **Korea**: This material is issued and distributed in Korea by or through J.P. Morgan Securities (Far East) Limited, Seoul Branch, which is a member of the Korea Exchange(KRX) and is regulated by the Financial Services Commission (FSC) and the Financial Supervisory Service (FSS). **Australia**: J.P. Morgan Australia Limited (JPMAL) (ABN 52 002 888 011/AFS Licence No: 238188) is regulated by ASIC and J.P. Morgan Securities Australia Limited (JPMSAL) (ABN 61 003 245 234/AFS Licence No: 238066) is regulated by ASIC and is a Market, Clearing and Settlement Participant of ASX Limited and CHI-X. **Taiwan**: J.P.Morgan Securities (Taiwan) Limited is a participant of the Taiwan Stock Exchange (company-type) and regulated by the Taiwan Securities and Futures Bureau. **India:** J.P. Morgan India Private Limited (Corporate Identity Number - U67120MH1992FTC068724), having its registered office at J.P. Morgan Tower, Off. C.S.T. Road, Kalina, Santacruz - East, Mumbai – 400098, is registered with Securities and Exchange Board of India (SEBI) as a 'Research Analyst' having registration number INH000001873. J.P. Morgan India Private Limited is also registered with SEBI as a member of the National Stock Exchange of India Limited (SEBI Registration Number - INB 230675231/INF 230675231/INE 230675231), the Bombay Stock Exchange Limited (SEBI Registration Number - INB 010675237/INF 010675237) and as a Merchant Banker (SEBI Registration Number - MB/INM000002970). Telephone: 91-22-6157 3000, Facsimile: 91-22-6157 3990 and Website: www.jpmipl.com. For non local research reports, this material is not distributed in India by J.P. Morgan India Private Limited. **Thailand**: This material is issued and distributed in Thailand by JPMorgan Securities (Thailand) Ltd., which is a member of the Stock Exchange of Thailand and is regulated by the Ministry of Finance and the Securities and Exchange Commission and its registered address is 3rd Floor, 20 North Sathorn Road, Silom, Bangrak, Bangkok 10500. **Indonesia**: PT J.P. Morgan Securities Indonesia is a member of the Indonesia Stock Exchange and is regulated by the OJK a.k.a. BAPEPAM LK. **Philippines**: J.P. Morgan Securities Philippines Inc. is a Trading Participant of the Philippine Stock Exchange and a member of the Securities Clearing Corporation of the Philippines and the Securities Investor Protection Fund. It is regulated by the Securities and Exchange Commission. **Brazil**: Banco J.P. Morgan S.A. is regulated by the Comissao de Valores Mobiliarios (CVM) and by the Central Bank of Brazil. **Mexico**: J.P. Morgan Casa de Bolsa, S.A. de C.V., J.P. Morgan Grupo Financiero is a member of the Mexican Stock Exchange and authorized to act as a broker dealer by the National Banking

Disclosures

and Securities Exchange Commission. **Singapore:** This material is issued and distributed in Singapore by or through J.P. Morgan Securities Singapore Private Limited (JPMSS) [MCI (P) 202/03/2017 and Co. Reg. No.: 199405335R], which is a member of the Singapore Exchange Securities Trading Limited and/or JPMorgan Chase Bank, N.A., Singapore branch (JPMCB Singapore) [MCI (P) 089/09/2016], both of which are regulated by the Monetary Authority of Singapore. This material is issued and distributed in Singapore only to accredited investors, expert investors and institutional investors, as defined in Section 4A of the Securities and Futures Act, Cap. 289 (SFA). This material is not intended to be issued or distributed to any retail investors or any other investors that do not fall into the classes of "accredited investors," "expert investors" or "institutional investors," as defined under Section 4A of the SFA. Recipients of this document are to contact JPMSS or JPMCB Singapore in respect of any matters arising from, or in connection with, the document. **Japan**: JPMorgan Securities Japan Co., Ltd. and JPMorgan Chase Bank, N.A., Tokyo Branch are regulated by the Financial Services Agency in Japan. **Malaysia**: This material is issued and distributed in Malaysia by JPMorgan Securities (Malaysia) Sdn Bhd (18146-X) which is a Participating Organization of Bursa Malaysia Berhad and a holder of Capital Markets Services License issued by the Securities Commission in Malaysia. **Pakistan**: J. P. Morgan Pakistan Broking (Pvt.) Ltd is a member of the Karachi Stock Exchange and regulated by the Securities and Exchange Commission of Pakistan. **Saudi Arabia**: J.P. Morgan Saudi Arabia Ltd. is authorized by the Capital Market Authority of the Kingdom of Saudi Arabia (CMA) to carry out dealing as an agent, arranging, advising and custody, with respect to securities business under licence number 35-07079 and its registered address is at 8th Floor, Al-Faisaliyah Tower, King Fahad Road, P.O. Box 51907, Riyadh 11553, Kingdom of Saudi Arabia. **Dubai**: JPMorgan Chase Bank, N.A., Dubai Branch is regulated by the Dubai Financial Services Authority (DFSA) and its registered address is Dubai International Financial Centre - Building 3, Level 7, PO Box 506551, Dubai, UAE.

Country and Region Specific Disclosures

U.K. and European Economic Area (EEA): Unless specified to the contrary, issued and approved for distribution in the U.K. and the EEA by JPMS plc. Investment research issued by JPMS plc has been prepared in accordance with JPMS plc's policies for managing conflicts of interest arising as a result of publication and distribution of investment research. Many European regulators require a firm to establish, implement and maintain such a policy. Further information about J.P. Morgan's conflict of interest policy and a description of the effective internal organisations and administrative arrangements set up for the prevention and avoidance of conflicts of interest is set out at the following link https://www.jpmorgan.com/jpmpdf/1320678075935.pdf. This report has been issued in the U.K. only to persons of a kind described in Article 19 (5), 38, 47 and 49 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005 (all such persons being referred to as "relevant persons"). This document must not be acted on or relied on by persons who are not relevant persons. Any investment or investment activity to which this document relates is only available to relevant persons and will be engaged in only with relevant persons. In other EEA countries, the report has been issued to persons regarded as professional investors (or equivalent) in their home jurisdiction. **Australia:** This material is issued and distributed by JPMSAL in Australia to "wholesale clients" only. This material does not take into account the specific investment objectives, financial situation or particular needs of the recipient. The recipient of this material must not distribute it to any third party or outside Australia without the prior written consent of JPMSAL. For the purposes of this paragraph the term "wholesale client" has the meaning given in section 761G of the Corporations Act 2001. **Germany:** This material is distributed in Germany by J.P. Morgan Securities plc, Frankfurt Branch which is regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht. **Hong Kong:** The 1% ownership disclosure as of the previous month end satisfies the requirements under Paragraph 16.5(a) of the Hong Kong Code of Conduct for Persons Licensed by or Registered with the Securities and Futures Commission. (For research published within the first ten days of the month, the disclosure may be based on the month end data from two months prior.) J.P. Morgan Broking (Hong Kong) Limited is the liquidity provider/market maker for derivative warrants, callable bull bear contracts and stock options listed on the Stock Exchange of Hong Kong Limited. An updated list can be found on HKEx website: http://www.hkex.com.hk. **Japan:** There is a risk that a loss may occur due to a change in the price of the shares in the case of share trading, and that a loss may occur due to the exchange rate in the case of foreign share trading. In the case of share trading, JPMorgan Securities Japan Co., Ltd., will be receiving a brokerage fee and consumption tax (shouhizei) calculated by multiplying the executed price by the commission rate which was individually agreed between JPMorgan Securities Japan Co., Ltd., and the customer in advance. Financial Instruments Firms: JPMorgan Securities Japan Co., Ltd., Kanto Local Finance Bureau (kinsho) No. 82 Participating Association / Japan Securities Dealers Association, The Financial Futures Association of Japan, Type II Financial Instruments Firms Association and Japan Investment Advisers Association. **Korea:** This report may have been edited or contributed to from time to time by affiliates of J.P. Morgan Securities (Far East) Limited, Seoul Branch. **Singapore:** As at the date of this report, JPMSS is a designated market maker for certain structured warrants listed on the Singapore Exchange where the underlying securities may be the securities discussed in this report. Arising from its role as designated market maker for such structured warrants, JPMSS may conduct hedging activities in respect of such underlying securities and hold or have an interest in such underlying securities as a result. The updated list of structured warrants for which JPMSS acts as designated market maker may be found on the website of the Singapore Exchange Limited: http://www.sgx.com.sg. In addition, JPMSS and/or its affiliates may also have an interest or holding in any of the securities discussed in this report – please see the Important Disclosures section above. For securities where the holding is 1% or greater, the holding may be found in the Important Disclosures section above. For all other securities mentioned in this report, JPMSS and/or its affiliates may have a holding of less than 1% in such securities and may trade them in ways different from those discussed in this report. Employees of JPMSS and/or its affiliates not involved in the preparation of this report may have investments in the securities (or derivatives of such securities) mentioned in this report and may trade them in ways different from those discussed in this report. **Taiwan**: This material is issued and distributed in Taiwan by J.P. Morgan Securities (Taiwan) Limited. According to Paragraph 2, Article 7-1 of Operational Regulations Governing Securities Firms Recommending Trades in Securities to Customers (as amended or supplemented) and/or other applicable laws or regulations, please note that the recipient of this material is not permitted to engage in any activities in connection with the material which may give rise to conflicts of interests, unless otherwise disclosed in the "Important Disclosures" in this material. **India:** For private circulation only, not for sale. **Pakistan:** For private circulation only, not for sale. **New Zealand:** This material is issued and distributed by JPMSAL in New Zealand only to persons whose principal business is the investment of money or who, in the course of and for the purposes of their business, habitually invest money. JPMSAL does not issue or distribute this material to members of "the public" as determined in accordance with section 3 of the Securities Act 1978. The recipient of this material must not distribute it to any third party or outside New Zealand without the prior written consent of JPMSAL. **Canada:** The information contained herein is not, and under no circumstances is to be construed as, a prospectus, an advertisement, a public offering, an offer to sell securities described herein, or solicitation of an offer to buy securities described herein, in Canada

Disclosures

or any province or territory thereof. Any offer or sale of the securities described herein in Canada will be made only under an exemption from the requirements to file a prospectus with the relevant Canadian securities regulators and only by a dealer properly registered under applicable securities laws or, alternatively, pursuant to an exemption from the dealer registration requirement in the relevant province or territory of Canada in which such offer or sale is made. The information contained herein is under no circumstances to be construed as investment advice in any province or territory of Canada and is not tailored to the needs of the recipient. To the extent that the information contained herein references securities of an issuer incorporated, formed or created under the laws of Canada or a province or territory of Canada, any trades in such securities must be conducted through a dealer registered in Canada. No securities commission or similar regulatory authority in Canada has reviewed or in any way passed judgment upon these materials, the information contained herein or the merits of the securities described herein, and any representation to the contrary is an offence. **Dubai:** This report has been issued to persons regarded as professional clients as defined under the DFSA rules. **Brazil**: Ombudsman J.P. Morgan: 0800-7700847 / ouvidoria.jp.morgan@jpmorgan.com.

General: Additional information is available upon request. Information has been obtained from sources believed to be reliable but JPMorgan Chase & Co. or its affiliates and/or subsidiaries (collectively J.P. Morgan) do not warrant its completeness or accuracy except with respect to any disclosures relative to JPMS and/or its affiliates and the analyst's involvement with the issuer that is the subject of the research. All pricing is indicative as of the close of market for the securities discussed, unless otherwise stated. Opinions and estimates constitute our judgment as of the date of this material and are subject to change without notice. Past performance is not indicative of future results. This material is not intended as an offer or solicitation for the purchase or sale of any financial instrument. The opinions and recommendations herein do not take into account individual client circumstances, objectives, or needs and are not intended as recommendations of particular securities, financial instruments or strategies to particular clients. The recipient of this report must make its own independent decisions regarding any securities or financial instruments mentioned herein. JPMS distributes in the U.S. research published by non-U.S. affiliates and accepts responsibility for its contents. Periodic updates may be provided on companies/industries based on company specific developments or announcements, market conditions or any other publicly available information. Clients should contact analysts and execute transactions through a J.P. Morgan subsidiary or affiliate in their home jurisdiction unless governing law permits otherwise.

"Other Disclosures" last revised April 22, 2017.

Pricing repo

Michael Manna, Head of Fixed Income Financing Trading, EMEA & Asia Pacific, Barclays

Barclays

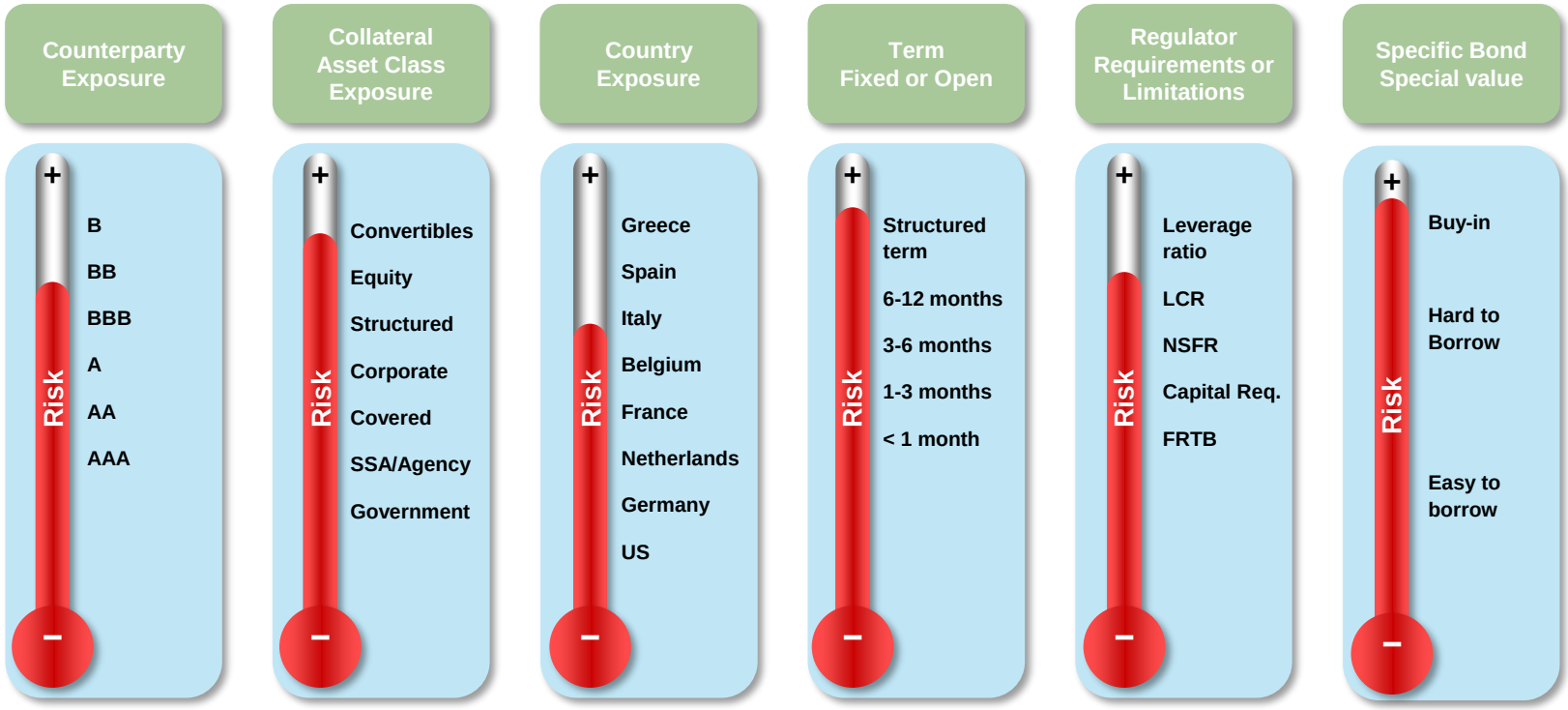
ICMA Professional Repo Market & Collateral Management Course 2017

Demystifying Repo Pricing

1 June 2017
Michael Manna, Managing Director
Head of Fixed Income Financing Trading, EMEA

Repo Pricing: Art or Science?

What Determines the Repo Rate?



In addition to the attributes above, new regulation will add; binding constraints, change the way banks measure & report risk and force banks to rethink how they price the financial resources they provide to clients, which will influence how repo trades are priced

A Bit of Background Before we go Further…..

Eonia	**Euro Over Night Index Average** - The weighted average rate of interest of unsecured overnight EUR trades for one particular day provided by a panel of contributing banks.
Euronia	**Euro Over Night Index Average** - The weighted average rate of interest of unsecured overnight EUR trades for one particular day provided by brokers (WMBA member firms).
Sonia	**Sterling Over Night Index Average** - The weighted average rate of interest of **unsecured** overnight trades for one particular day provided by brokers (WMBA member firms).
Ronia	**Repo Over Night Index Average** - The weighted average rate of interest of **secured** (vs Gilts) overnight GBP trades for one particular day.

What is GC vs. a “Special” & How is it Priced?

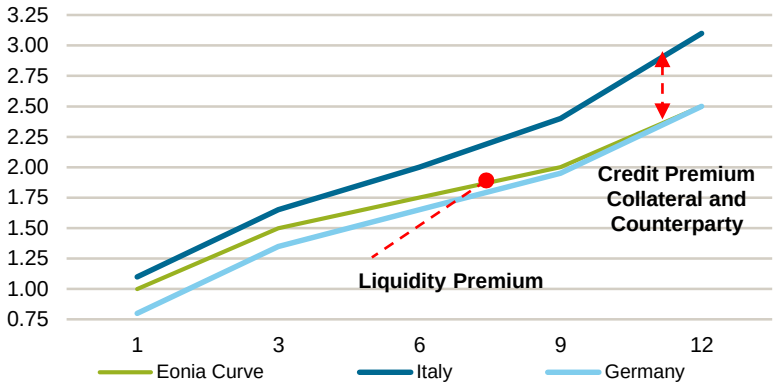
General Collateral

- GC, “general collateral” is the term used to describe the collateral pledged in a repo financing transaction
- The collateral pledged must comply with a cash lender’s stipulation regarding what type of collateral will be accepted
  - Profile primarily based on rating and country of domicile
- The GC curve will trade relative to an interest rate curve (e.g. Eonia Sonia, OIS)
  - The GC curve will price in both liquidity and risk premium (counterparty and collateral)

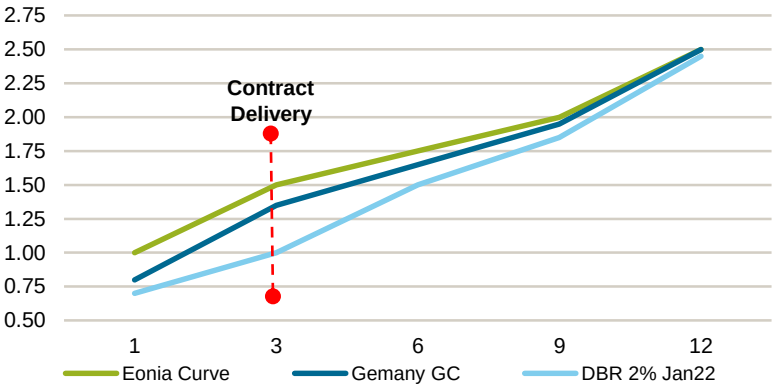
Specials / Specifics
One mans GC is another man’s special

- “Specific” is the term used to describe a unique security request
- “Special” is the term used to describe the value of the security
- Example: the 1 month GC market is 0.25 –0.20%
  - “I need the DBR .50% 15Feb25 for 1mo”, quoted market could be 0.20–0.10%
- What makes a bond special?
  - More demand than supply
    - Guaranteed delivery situation (e.g. delivery for a contract)
    - Event driven: auction, corporate action
  - Issue size
  - Distribution of supply / bonds are ‘boxed’
  - A bonds lender has a minimum return to lend threshold, “ I’ll only lend if can make a 20bp return”

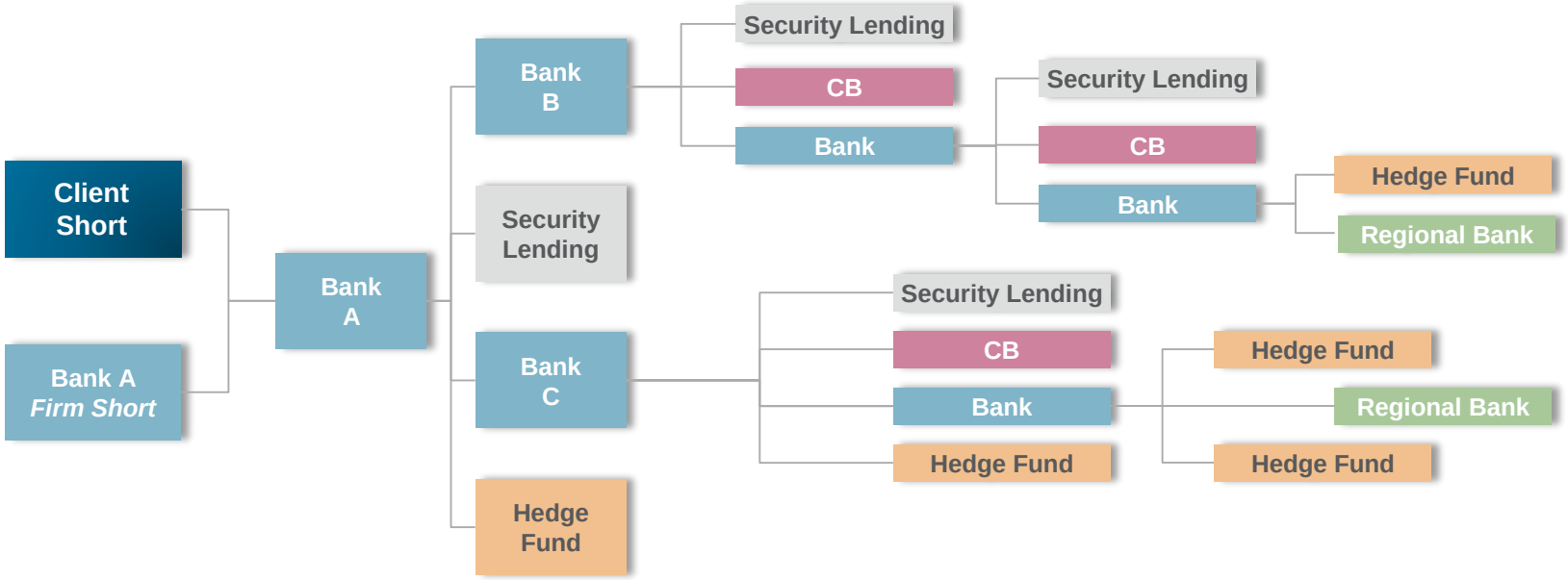
General Curve



Specials Curve



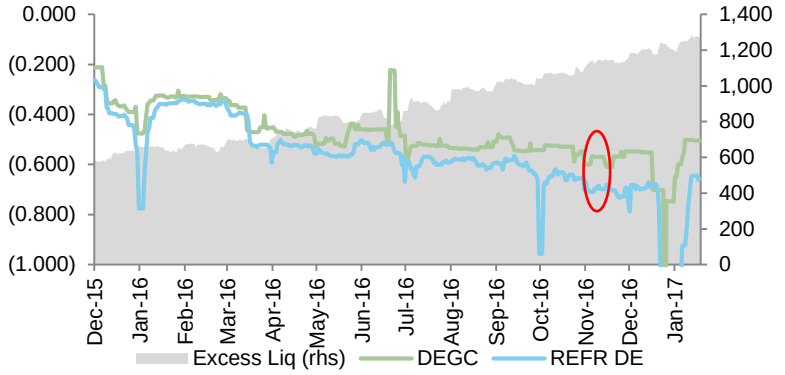
The Flow of “Specials”: A Complex Web



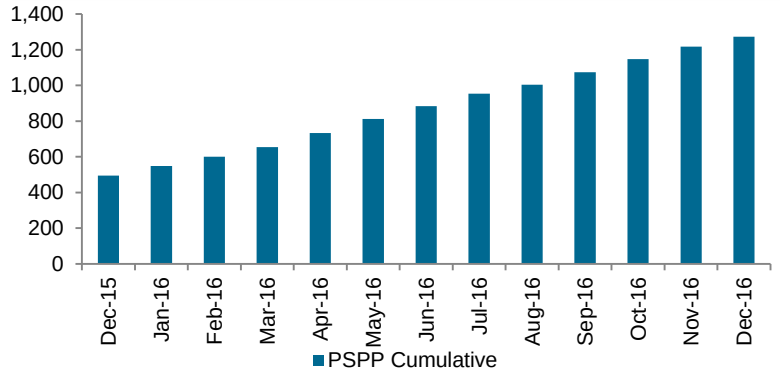
- At times, covering a short position may require navigating a complex web of relationships. The more connected counterparties become the better the liquidity is for finding bonds to cover short positions
- Regulation could sever or greatly reduce the capacity and / or the connection points resulting in;
  - Bonds becoming more difficult to source which leads to bonds becoming more expensive, impacting the returns of the underlying trades and cash market liquidity
  - Borrowing costs could also increase because of a trade’s RWA or Balance Sheet return metrics

2016: GC Starts Turning *Special*?

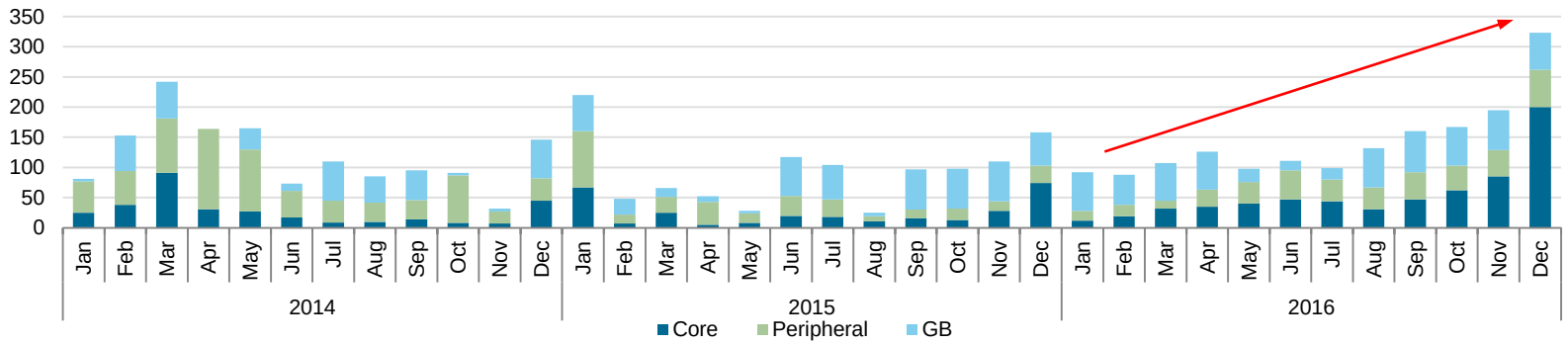
Rising Impact from Specials[1]



PSPP Cumulative Holdings (€mm)[2]



Number of Bonds Trading >10bps Through GC[3]



1. ECB , Bloomberg, and Barclays Data; 2. ECB; 3. Barclays Data

Repo Specials: *If you're keen on the Subject…….*

A ECB Working Paper Series
The Importance of being special: repo marker during the crisis
By Stefano Corradin and Angela Maddaloni

Extract
5. Explorative analysis of specialness

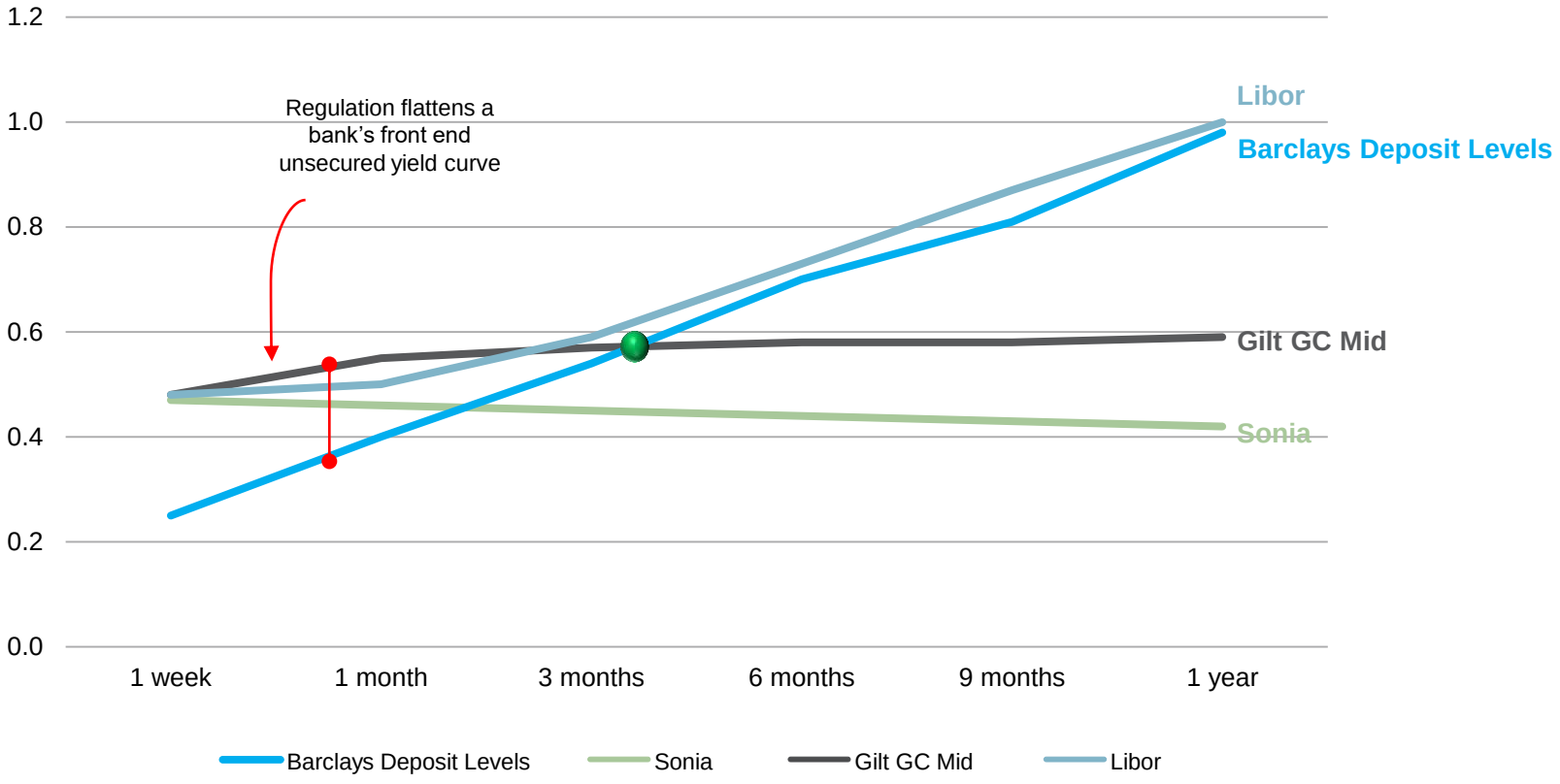
We estimate daily OLS panel regressions with bond and time fixed effects. Standards errors are clustered at the bond and time level.17

Our basic pooled fixed –effects panel regression specification is:

$$S_{i,t} = \beta_1 S_{i,t-1} + \beta_2 X_{i,t-1} + \beta_3 \bar{X}_{i,t} + \alpha_i + \gamma_t + \theta + \varepsilon_{i,t},$$

The Secured vs. Unsecured Paradox

Funding markets in Europe have become segmented. When it comes to secured vs. unsecured funding there are obvious anomalies. It's hard to isolate all of the reasons, however 2 factors which are influencing the landscape are: (1) new regulation: specifically LCR which impacts a banks' appetite for short term unsecured funding. (2) Lack of fungibility between the secured and unsecured markets (i.e. adoption of repo as an investment product)



** Data as of the 3rd Feb 2014.*

Cash and Repo Market Relationship

The Cash & Repo Market Relationship

Both repo transactions and bond positions represent cash flows. How one influences the other can be observed in cost of carry and forward break-even analysis. This type of analysis becomes particularly relevant when considering relative value trading strategies

UKT 0.50% 1/21: Purchase & Finance @ .50%

BOND COST OF CARRY

TREASURY UKT1 ½ 01/22/21 103.014/103.063 (0.858/0.847) BARX

SETTLEMENT DATE	4/ 4/16	FIX (PRICE or 2=YIELD) 2		COMPOUNDING METHOD
PRICE	103.063000	ACCRUED INTEREST	0.300824	2 [1= CD COMPOUND
YIELD	0.84731			2= PROCEEDS
WORKOUT DATE	1/22/21	-VALUE 100.000		3= SCIENTIFIC]

CHOOSE: BUSINESS OR CALENDAR DAYS C

COST OF CARRY

REPO RATE 0.5 1 = REPO or 2 = REVERSE 1 BASIS-ACT/365

TERMINATION DATE	REPO EQUIV	B. P. SPREAD	PRICE PICK UP	NET P & L FOR 1000 (M)FACE	BREAKEVEN PRICE /YIELD
NEXT DAY (4/ 5/16)	0.848	34.8	0.0010	9.85	103.060295/ 0.847512
30 DAYS (5/ 4/16)	0.848	34.8	0.0296	295.77	102.981852/ 0.853609

2)INFLATION ASSUMPTION

UKT 0.50% 1/26: Sell Shat & Cover @ .10%

BOND COST OF CARRY

TREASURY UKT1 ½ 07/22/26 99.277/99.358 (1.576/1.568) BARX

SETTLEMENT DATE	4/ 4/16	FIX (PRICE or 2=YIELD) 2		COMPOUNDING METHOD
PRICE	99.358000	ACCRUED INTEREST	0.189560	2 [1= CD COMPOUND
YIELD	1.56773			2= PROCEEDS
WORKOUT DATE	7/22/26	-VALUE 100.000		3= SCIENTIFIC]

CHOOSE: BUSINESS OR CALENDAR DAYS C

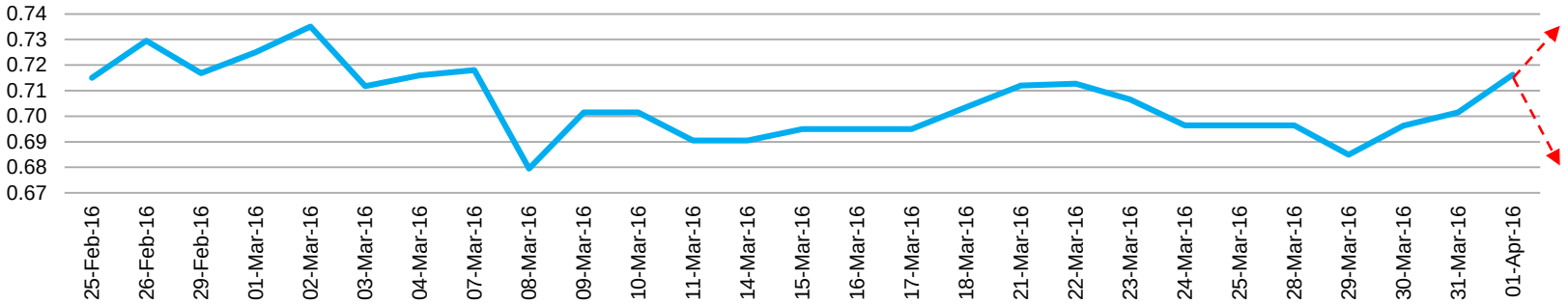
BOND BORROW

1 = REGULAR or 2 = FED. 1

TERMINATION DATE	B. P. SPREAD	PRICE PICK UP	NET P & L FOR 500 (M)FACE	BREAKEVEN PRICE /YIELD
NEXT DAY (4/ 5/16)	146.0	-0.0040	-19.91	99.362132/ 1.567303
30 DAYS (5/ 4/16)	146.0	-0.1195	-597.29	99.482035/ 1.554990

**** CALENDAR DAYS USED ****

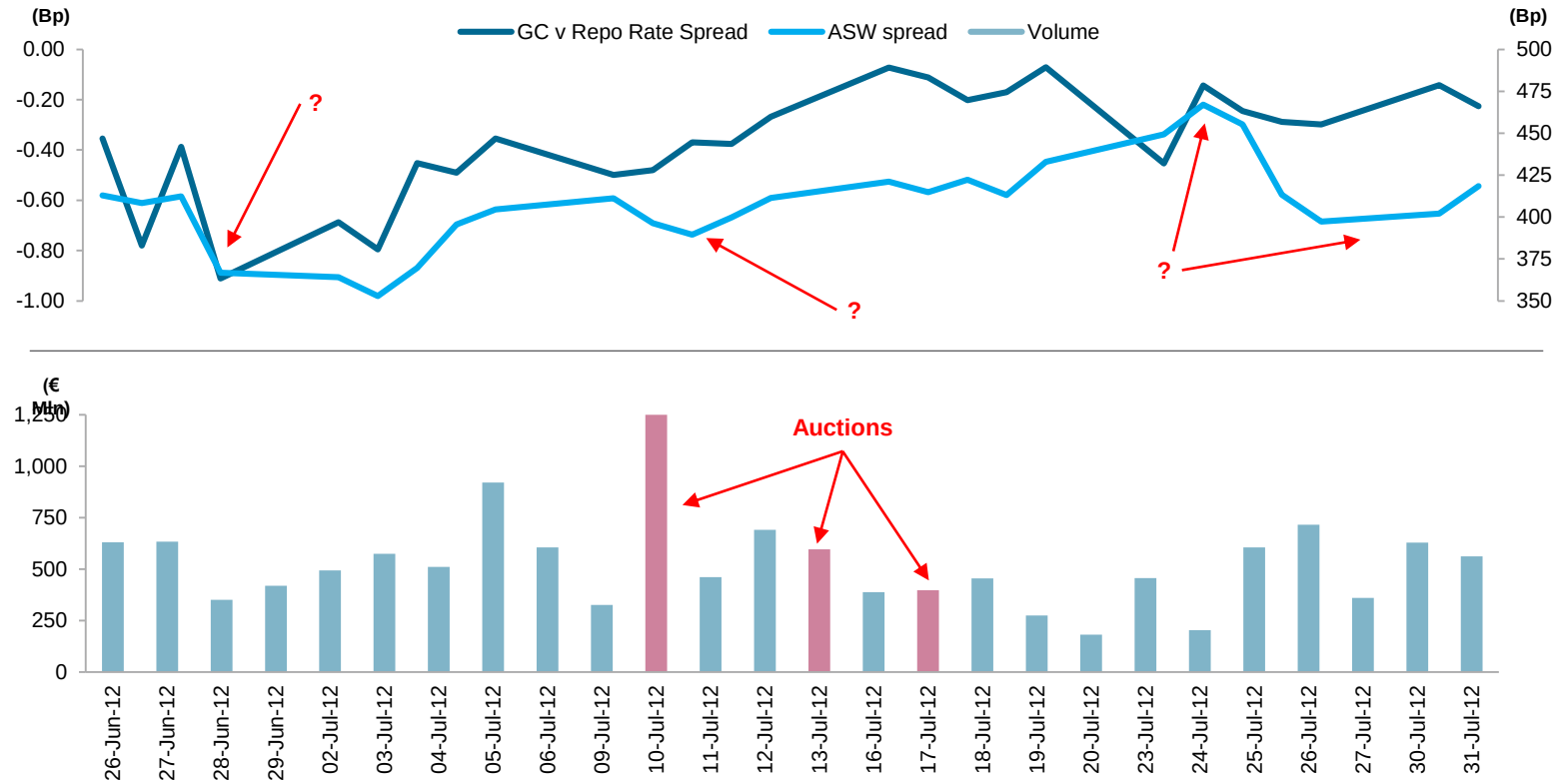
Shape of the Curve but What about the Carry?



The Cash & Repo Market Relationship

Understanding which factors have an influence on the relationships isn't always clear

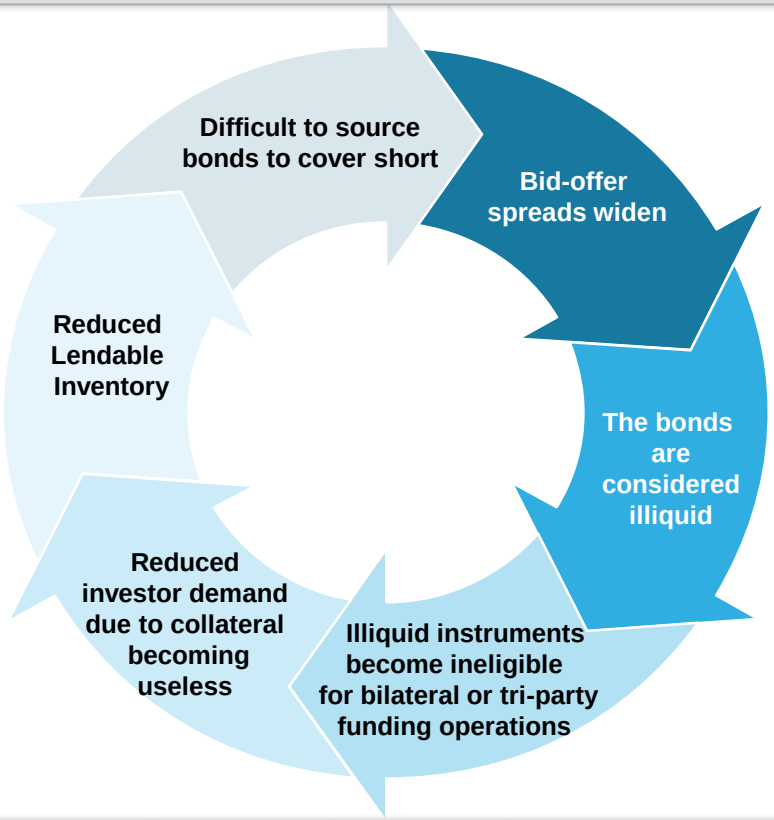
BTP 4.75% August 2023



Source: MTS & Barclays.

The Cash & Repo Market Relationship

Does the repo market impact pricing and liquidity in the cash market or does the cash market impact price and liquidity in the repo market?
The simple bi-partisan answer is, liquidity is the main attribute needed for the healthy functioning of both markets.



How could regulation impact the cycle?
Add to that question, what happens if you have QE?

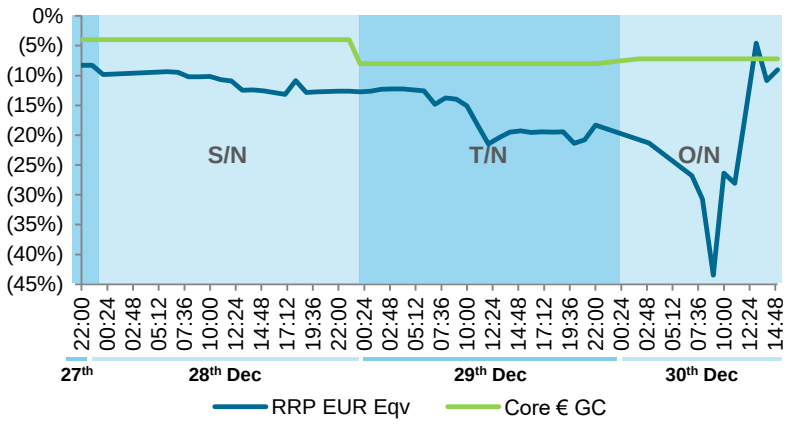
2016: What Happened at Year End?

Where's the smoking gun(s)?

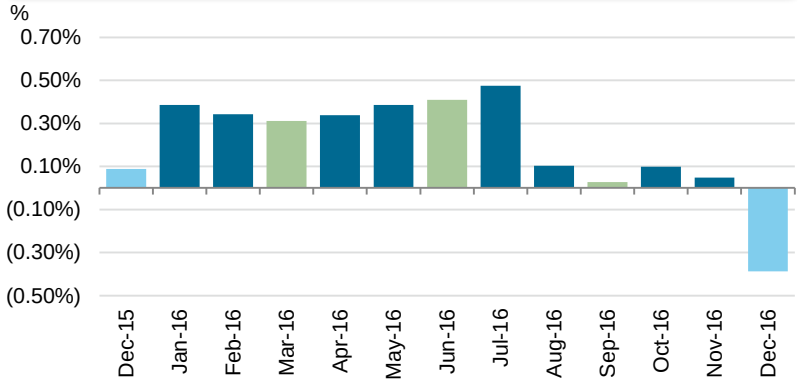
Not one but a number of factors may have contributed to the price action we experienced:

1. **Balance sheet constraints & Management**
2. **Cash hunting for a home**
3. **Lack of 'safe assets'**
4. **X-CCY basis**
5. **Cash market positioning**
6. **Levy/Tax policies influencing behaviour**

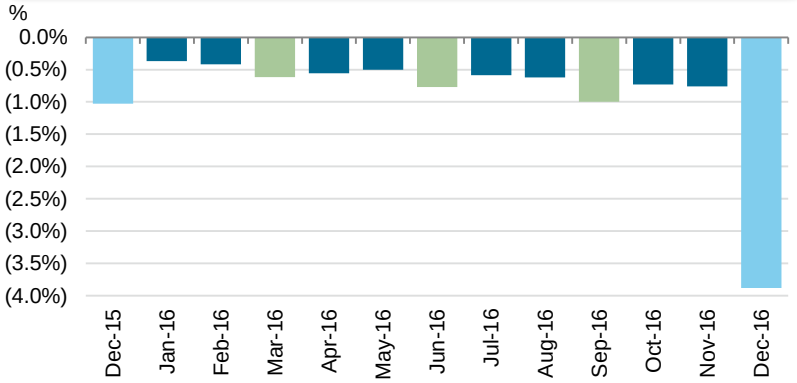
Was FX basis a factor?[1]



Money Fund £ Weighted Average Rate[2]



Money Fund € Weighted Average Rate[2]



1. Barclays and Bloomberg Data; 2.. Craine Data

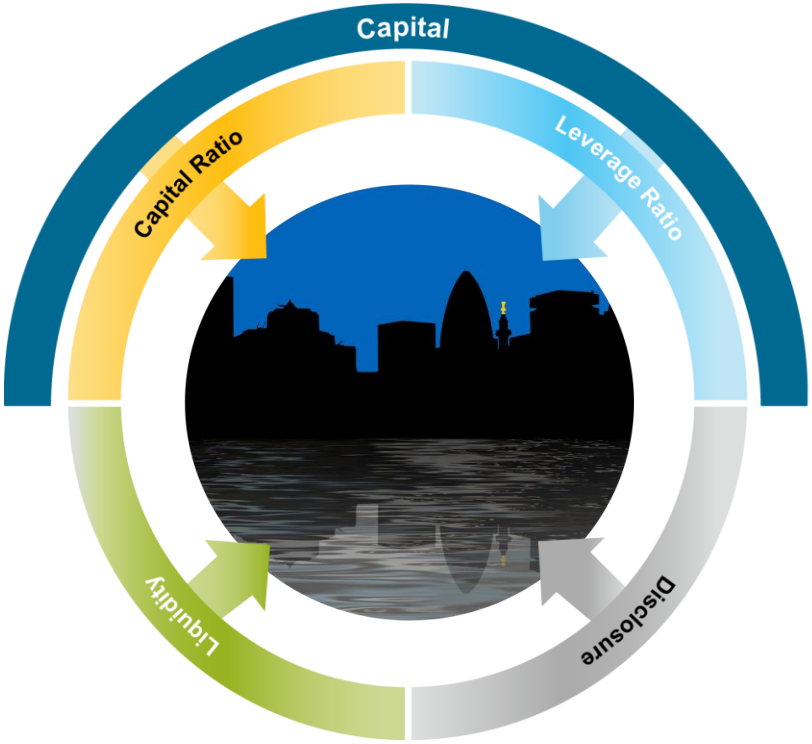
The sections we just covered was an overview of repo pricing in the academic sense.
Now we'll explore how new regulation has fundamentally changed the way we measure our PnL and price repo transactions.

Regulation & the Impact on Repo Pricing

No Need to Wait ….
Already Rules Begin to Influence Secured Funding Activity

Banks are unlikely to wait until 2019 to become fully compliant. In efforts to achieve early compliance one could say the banks are already beginning to control the amount and cost of leverage they are providing and influencing the "velocity of collateral".

- **Capital – Is the binding constraint which sizes the capacity and drives business metrics (i.e. return on capital)**
  - **Leverage Ratio – Repo not only contributes on an accounting based measure but also a 'risk add-on' has been adopted to capture credit risk**
  - **Capital Ratio – A risk based measure of activity, taking into account counterparty credit & market risk in SFTs**
    - **This will influence haircut policies and thus deem certain trades un-commercial for both banks and non-banks**
- **Liquidity – Rule based approach, prevents Matched Books becoming too skewed towards volatile and / or less liquid assets given LCR avoiding the *"cliff effect"***
- **Disclosure – Enhanced transparency by the banks, moving towards a more uniformed basis for reporting. For example, the adoption of an average view of the leverage vs. point-in-time view**



* *Manmohan Singh, IMF.*

Risk Weighted Approach (RWA) “Capital Ratio”?

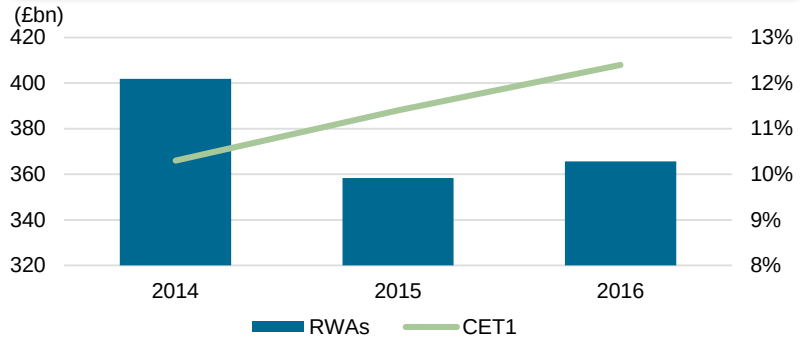
Attempts to measure the quality of assets/transactions supported by available capital. The amount of Market, Credit, and Operational risk appetite is ‘sized’ by our capital. In other words combining the value of these risks a bank needs to answer the question, “Does my capital base support these activities?”

What risks are being measured?

- **Market Risk** is the risk of the Group’s earnings or capital being reduced due to volatility of trading book positions or an inability to hedge the banking book balance sheet.
- **Credit Risk** is the risk of suffering financial loss should any of the Group’s customers, clients or market counterparties fail to fulfil their contractual obligations to the Group.
- **Operational Risk** is defined as the risk of direct or indirect impacts resulting from human factors, inadequate or failed internal processes and systems or external events.

- The amount of capital a bank holds must be sufficient to buffer against losses created by these risks.
- The “A” in RWA is misleading. It measures not only assets on the balance sheet but the credit & market risk exposure associated with assets & liabilities for on & off balance sheet activities.
- Calculation: $\frac{\text{CET1}}{\text{RWA}}$
- Barclays Minimum Target by 2019 is 10.8%[1]
  - CRD IV CET1 4.5%
  - Pillar 2A CET1 2.3%
  - Capital Conservation Buffer [2] (CCB) 2.5%
  - G-SIB[3] CET1 1.5% (subject to change)

Barclay RWAs and CET1



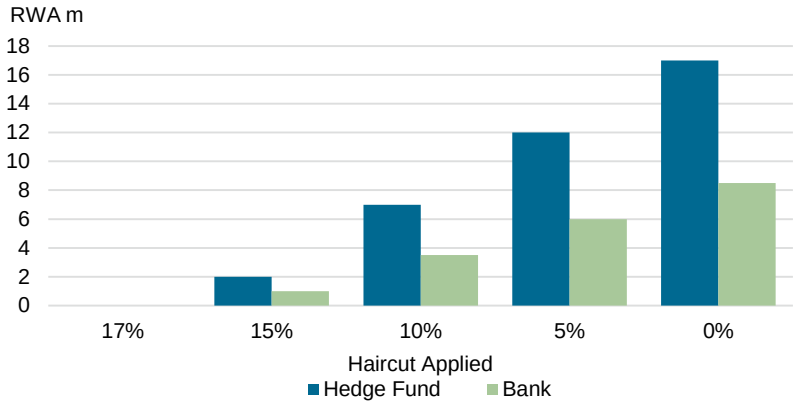
1. https://www.home.barclays/content/dam/barclayspublic/docs/InvestorRelations/ResultAnnouncements/2016FYResults/20170223_Barclays_2016_FI_Investor_Presentation.pdf
2. http://www.bankofengland.co.uk/pra/Documents/publications/reports/prastatement0316.pdf
3. *G-SIFI - Globally Systemically Important Financial Institutions. G-SIB is also used, Globally Systemically Important Banks. See annex for full list.*

Risk Weighted Approach (RWA): Simple Example

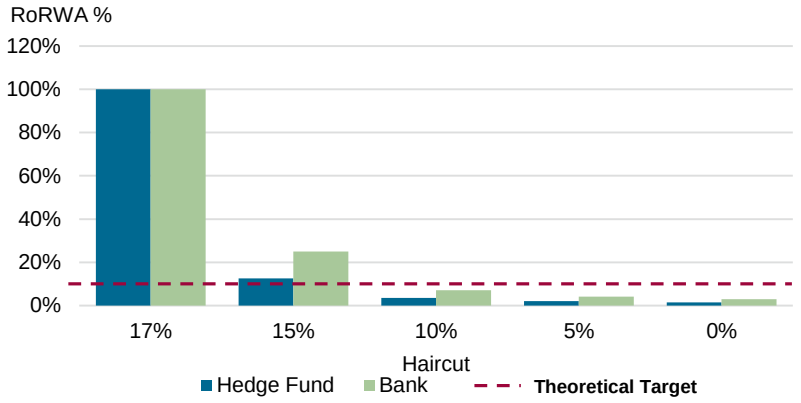
Repo transactions attract primarily two types of risk: counterparty and market risk. This risk is mitigated by taking haircuts which ensure minimal capital is required to support a repo transaction.

RWA = Exposure at Default x Counterparty Risk Weighting

RWA Generated



Return on RWA (RoRWA)



Asset Side RWA Calculation Assumption

Client Type	Hedge Fund	Bank (A Rated)
Counterparty Risk Weighting	100%	50%
Collateral Type	High Yield	High Yield
Notional	$100,000,000	$100,000,000
Term	1 year	1 year
Bases Point Spread	25bp	25bp
Trade Revenue	$250,000.00	$250,000.00
Risk Covering Haircut Assumption	≥17%	≥17%

The “Leverage Ratio” Explained

“A non-risk based leverage ratio that includes off-balance sheet exposures will serve as a backstop to the risk based capital requirement also. Also helps contain system wide build up of leverage” - BCBS

The Leverage Ratio is the simplest, most straight-forward risk measurement tool

Banks adopt internal models for calculating RWAs, but this creates an uneven playing field when analyzing between banks. Leverage ratio, once you’ve adjusted for the different accounting standards, gives you a better comparison, albeit only on the size of the leverage/assets and not the quality (risk adjusted) of the assets.

Calculation: $\frac{\text{CET1}}{\text{Total Expose measure}}$

Compliance for the new Basel III leverage ratio is targeted for 1st Jan 2018.
While running parallel the years leading up to the implementation

This will be reported in the form of an ***average leverage ratio.***

Maximum 33.3x leverage or minimum 3% of capital as a percentage of total exposure measure.

Under US proposed rules it will be 5% or 6% (US GAAP accounting).

1. *Common Equity Tier (CET1) / Basel III “Good Equity”.*
2. *“AGL” – Adjusted Gross Leverage.*

Basel III Leverage Ratio

$$\frac{\text{CET1}}{\text{Total } \textbf{Exposure} \text{ measure}}$$

E-C

Exposure – Collateral = **Exposure**

Exposure = Leverage

Repo Netting, E-C and Pricing

The new model uses both the accounting based measure and has an add-on for exposure. This add-on is net Exposure – Collateral per counterpart netting set (i.e. same counterparty only).

The Leverage Ratio: Feeling the Effects

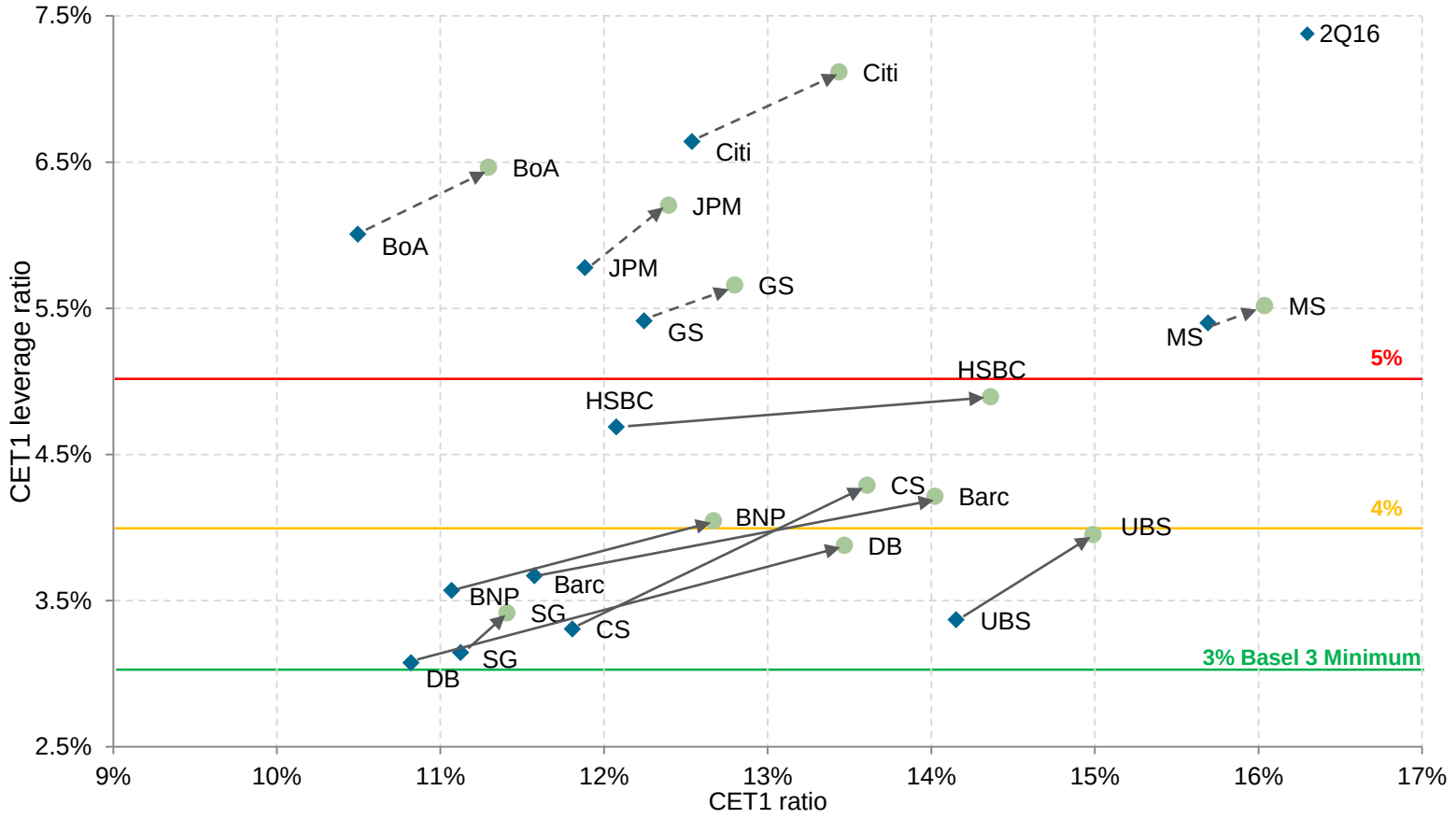
	Old World AGL[2]	New World CRD IV / PRA / BCSB270						
Calculation is:	Tier 1 capital / Total Adjusted Assets	CETI[1] / Total Exposure Measure						
	Old World	**New World**						
	Dec-12	**Dec-12**	**Dec-13**	**Jun-14**		**Dec-14**	**Dec-15**	**Dec-16**
				PRA	BCBS270			
Asset	£975bn	£1,498bn	£1,377bn	£1,266bn	£1,353bn	£1,233bn	£1,028bn	£1,125bn
Capital	£51.6bn	£37.3bn	£42.7bn	£43.2bn	£45.4bn	£46.0bn	£46.2bn	£52.0bn
Leverage Ratio (multiple)	18.9x	40x	32.2x	29.3x	29.8x	26.8x	22.2x	21.6x
Leverage Ratio (%)	*5.2%*	*2.5%*	*3.1%*	*3.41%*	*3.36%*	*3.70%*	*4.50%*	*4.3% /4.6%[4]*
BoE /PRA Adjustment [3]	–	–	–	–	–	–	–	*4.6%/5.0%*
Securities Financing Transactions (SFT)								
IFRS Accounting 'Classic'	*£177bn*	*£177bn*	*£187bn*	–	*£199bn*	*£132bn*	*£78bn*	*£76bn*
CRD IV (FCCM)	–	*£119bn*	*£92bn*	*£60bn*	–	–	–	
BCBS270 (IFRS + Exposure)	–	–	–	–	*£228bn*	*£157bn*	*£94bn*	*£105bn*
Secured Financing as a % of Assets	*18%*	*7.9%*	*6.7%*	*4.7%*	*16.9%*	*12.7%*	*9.1%*	*~~9.3%~~*
E-C Add-on Amount	–	–	–	–	*£29bn*	*£25bn*	*£16bn*	*~~£29bn~~*

Source: Barclays Financial /Reports 2012-2015.

1. *Common Equity Tier (CET1) / Basel III "Good Equity". Includes AT1.. 2, "AGL" – Adjusted Gross Leverage, 3. BoE, http://www.bankofengland.co.uk/publications/Pages/news/2016/008.aspx / http://www.bankofengland.co.uk/pra/Documents/publications/reports/prastatement0816.pdf, 4. Avg./31Dec LBS*

2017: The Leverage Landscape

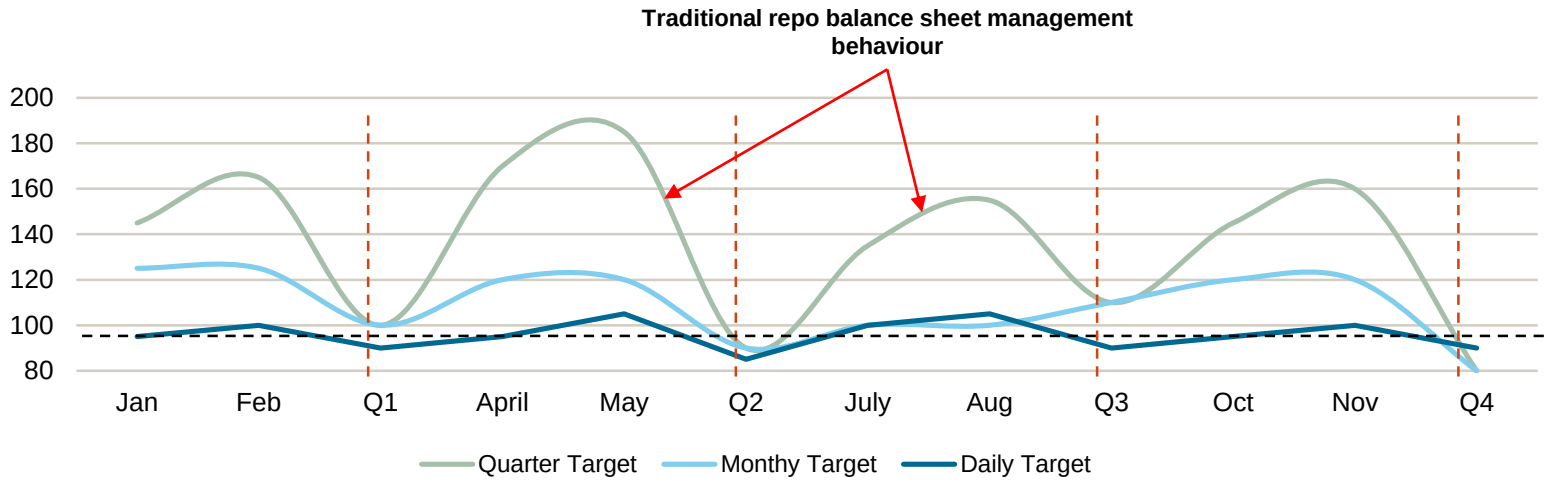
We are fast approaching 2019 and banks are busy executing their publically stated capital and leverage plans. The leverage solutions take the form of either deleverage and /or increase capital base. Also worth noting currently only 3 jurisdictions in this sample have binding leverage rules (US, UK & Switzerland).



Source: Barclays Research
Note: US Banks based on GAAP.

Balance Sheet Capacity: Reporting

In the past, intra-quarter end leverage increases were standard market practice. Now that leverage is a key focus, reporting is done on an average basis rather than at specific points in time, thus avoiding the opportunity for 'window dressing'. This reduces volatility but also reduces the repo balance sheet between the traditional reporting periods.



This type of behaviour is not only limited to Repo but any activity which is easy to 'dial up and down' and impacts leverage. Examples include cash trading and a bank's treasury desk taking advantage of arbitrage opportunities.

Liquidity Risk:
LCR & NSFR

Liquidity: LCR & NSFR

Financial leverage (repo or margin lending) requires certain elements to support it. Capital, in the form of balance sheet, which is binary (you either have it or you don't) and Liquidity, which is dependant on the cost associated to obtain it will determine the price at which you can facilitate leverage. Historically, banks would keep funding costs "competitive" by accepting liquidity mismatch risk through the classic lend long borrow short strategy.

The Basel III regulation gives special focus to liquidity risk, the rules are captured in the LCR and NSFR

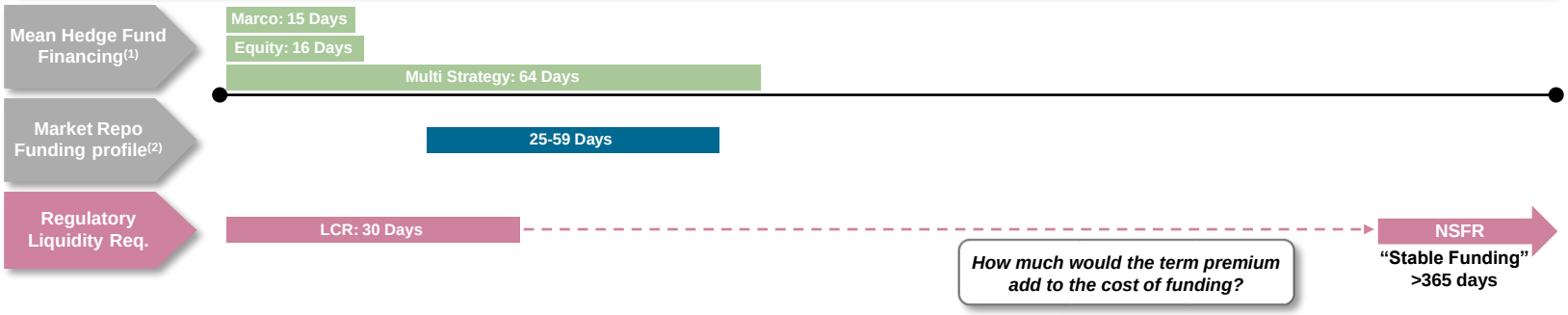
LCR

- LCR is designed to address a stressed funding scenario of 30 days. It requires banks to hold sufficient levels of liquid assets (HQLA) to cover a net outflow expected in the stress scenario (lasting 30 days). Some banks have taken additional steps to protect themselves further by also managing to a 90 day period (e.g., per the past UK PRA requirements).
- The negative effects seems to have been minimal given; duration is in line with available liquidity, the quantum of excess liquidity conditions and the hunt for yield has helped facilitate a smooth adoption.

NSFR

- NSFR is designed to look at the longer-term liquidity mismatches and to incentivise banks to seek stable sources of funding, i.e., raise funding > 1 year and applies "qualitative factors" to funding sources.
- The SFTs and unencumbered cash trading positions are shorted dated by nature, meaning the liabilities to support them are more in line with LCR rules then NSFR, i.e., 30 days vs 1year).

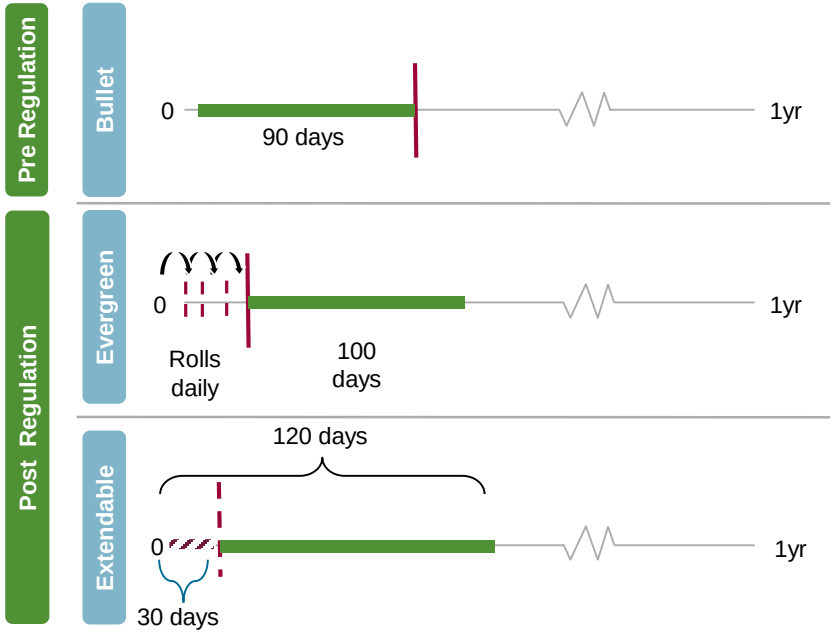
LCR & NSFR Applied to the Repo Market



Sources:
1. *Financial Conduct Authority, Hedge fund Survey June 2015.*
2. *ICMA, European Repo market Survey. Repo weighted average maturity profile.*

Liquidity: How Could it Impact Repo Pricing?

Assuming a repo matched book is self financed, how it generates liabilities will have an impact on the cost of funding. In the UK the regulator was first to implement a liquidity framework measuring contingent liquidity risk. Changing funding profiles to avoid the *"cliff effect"* . Part of the framework also addressed counterparty concentration which limits your ability to always source the cheapest cost of funding.



- In an environment where repo is NOT subject to a regulated liquidity framework, the pool of liquidity is broad and deep relative to asset class.
- Price was the primary driver of behaviour and influenced the matched book funding composition.
- When repo funding must comply to regulated liquidity rules, liquidity becomes fragmented and the "right" type of liquidity becomes limited.
- The limitations result from the fact that liquidity providers don't have an appetite to increase risk or the infrastructure to manage the exposure of new trade types.
- This limitation could impact the cost of funding for certain asset classes with the effect transferred to asset pricing depending how much leverage is being used.

Liquidity: Transfer Pricing Influences

In the past the real cost of a firm's liquidity wasn't appropriately transferred to business units. This created an environment where business models where built on a false cost of liquidity. This created the opportunity for moral hazard. Under the new framework, this has been eliminated and will have an impact on repo pricing.

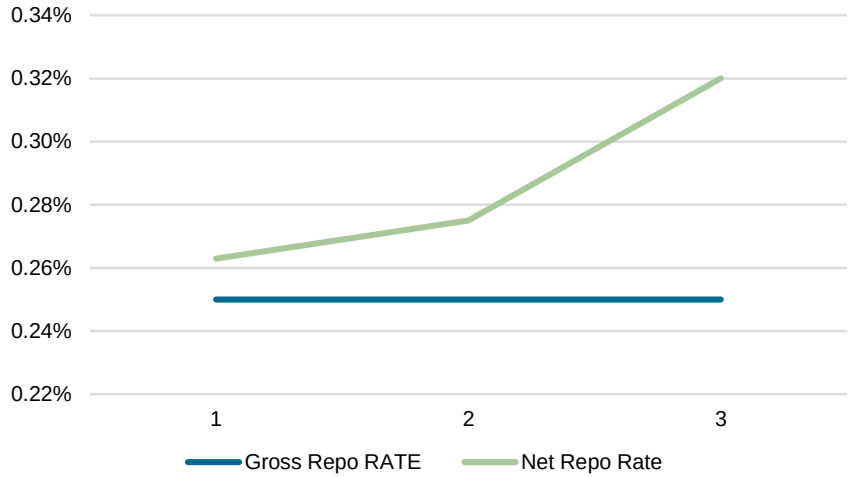
"A key weakness in firms' liquidity risk management has been designing and implementing an appropriate transfer pricing mechanism to align the commercial incentives in relation to individual products, business lines…"

FSA PS 09/16

..."These transfer pricing mechanisms are designed to ensure that liquidity risk is reflected in product pricing and performance measurement, thereby ensuring that the Liquidity Framework is integrated into business level decision making to drive the appropriate mix of sources and uses of funds"

Barclays 2013 Annual Report

Haircuts, Transfer Pricing, and the Impact on Repo



Gross Repo RATE	Haircut	Internal FTP	Net Repo Rate
0.25%	1%	1.5%	0.263%
0.25%	2%	1.5%	0.275%
0.25%	5%	1.5%	0.320%

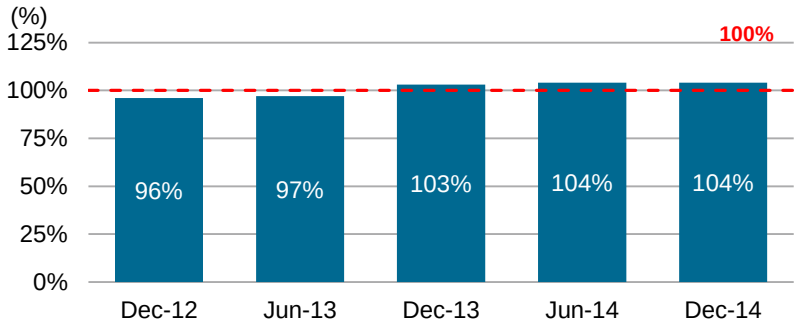
Liquidity: Top of the House vs Desk Level Compliance

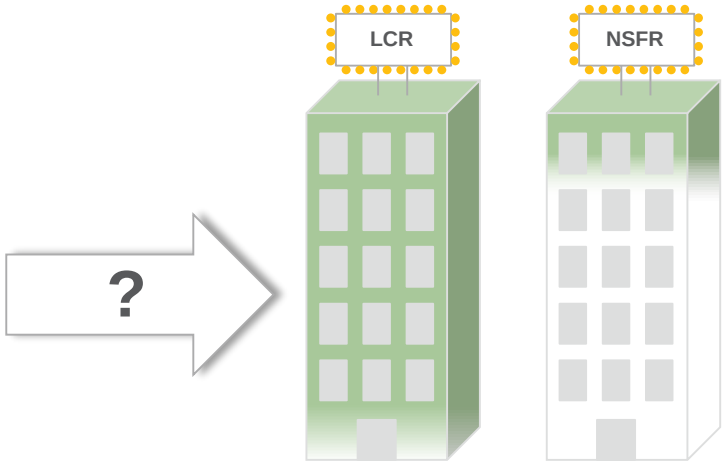
When reporting, banks will provide an aggregate, "Top of the House" view in the form of a numerical ratio or statement of compliance. One key difference between LCR and NSFR is that LCR has to be managed at an operating entity level. Whereas NSFR is the group level. How, when or if these rules are applied and if (pushed down) to individual business areas will determine the ultimate impact on individual business lines.

Recent Company LCR & NSFR Reporting[1]

Banks	LCR	Last Reported	NSFR	Last Reported
HSBC	136%	Q4-16	116%	Q4-16
JP Morgan	-	-	-	-
Barclays	131%	Q4-16	>100%	Q4-16
BNP Paribas	123%	Q4-16	-	
Citigroup	121%	Q4-16	>100%	Q4-16
Deutsche Bank	128%	Q4-16	-	-
Bank of America	>100%	Q4-16	-	-
Credit Suisse	202%	Q4-16	-	-
Goldman Sachs	-	-	-	-
Morgan Stanley	-	-	-	-
RBS	123%	Q4-16	121%	Q4-16

EBA NSFR Monitoring Results[2][3]





Source:
1. *Most recent Company Reports/Disclosure.*
2. *EBA - Draft report on the calibration of a stable funding requirement under Article 510 CRR, London 15 Oct 15.*
3. *Data Source: QIS and EBA Monitoring Exercise, Consistent sample of 123 credit institutions.*

NSFR Sample Portfolio

A simple sample portfolio and assuming NSFR is managed at a group level, the following table illustrates the spirit of NSFR, the impact of non-compliance and consequences regarding levered balance sheet.

	NSFR Counterparty Combo	NSFR Ratio (≥ 100%)	Compliance	Additional >1year Funding Required
SFT Transactions				
Example #1	Sovereign vs. Financial	0%	No	€50.75m
Example #2	Sovereign vs. Non-Financial	100%	Yes	€0.00m
Example #3	Financial (L1) vs. Financial	0%	No	€10.15m
Example #4	Financial (L1) vs. Financial (CCP)	0%	No	€10.15m
Example #5	Financial (L2b: Credit) vs. Financial	0%	No	€15.34m
Example #6	Financial (L2b:Equity) vs. Financial	0%	No	€75.00m
Example #7	Financial (L1) vs. Financial – LT	50%	No	€50.75m
Total SFT Portfolio Requirement				**€212.14m (Deficit of Stable funding)**
Unencumbered Assets (Cash Desk Positions)				
Example #8	Unencumbered Level1 vs. Financial	0%	No	€5.8m
Example #9	Unencumbered Level1 vs. non-Financial	>100%	Yes	-€45.68m (Excess Stable Funding)
Example #10	Unencumbered Level2b vs. Financial	0%	No	€15.5m
Example #11	Unencumbered Level2b vs. non-Financial	100%	Yes	€0.00m
Total Unencumbered Assets (Cash Trading Position) Portfolio Requirement				**-€24.38m (Excess Stable Funding)**
Total Portfolio Requirement				**€ 187.76 (Deficit of Stable funding)**

NSFR Sample Portfolio: Consequences - Cost & Balance Sheet

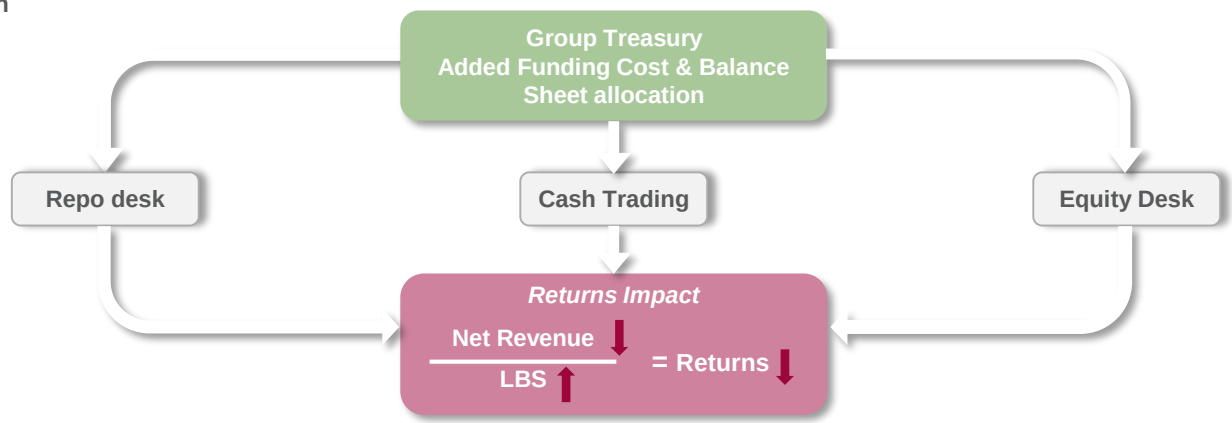
- Non-Compliance of NSFR requires firms to increase their long term funding, > 1 Year Funding
- In this example portfolio

£1.375Bln of Balance Sheet Transactions *"Which are Already Funded"* → **Requires** → £187.76 of > 1 Year of Funding

- Assuming NSFR is managed at a global level, the additional funding would lead to an increase of HQLA holdings which would have obvious implications on leverage balance sheet

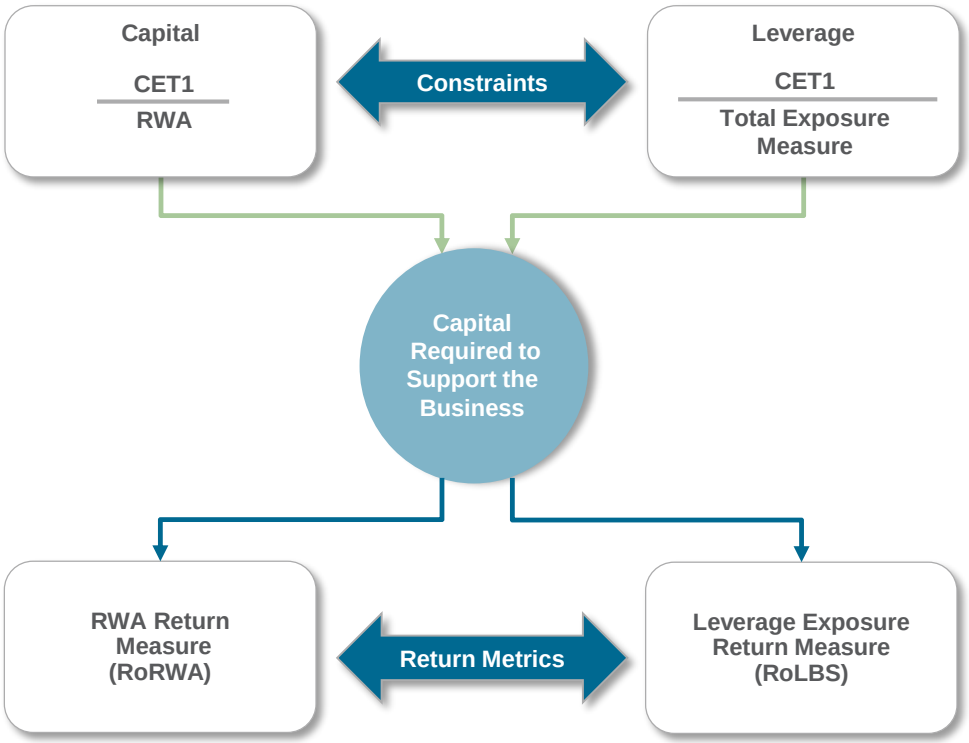
+ £187.76 of New 1 Year Liabilities → Bank's Balance Sheet *Impact* £187.76m or 13.7% Increase ← + £187.76 of New HQLA

- As banks become more sophisticated in passing through regulatory costs to the end user, the 'cost' associated with the extra liquidity requirements could impact return metrics both in the form of additional funding costs and associated balance sheet allocation



Recap: Regulation and Price

Basel III is actually very simple.
Everything is about CAPITAL, the good stuff, loss absorbing and expensive to raise. The amount of capital a bank holds will influence both the size and shape of businesses that can be supported. Businesses will be measured against their use of capital by both: how much they need to support required leverage and/or the amount of risk it takes.



Influence on Capacity and Pricing?

Repo matched books will need to balance two resources

Assuming demand for leverage remains constant across asset classes and repo matched book revenue targets remain unchanged. In order to achieve revenue objectives, spreads and/or matched book composition could change.

	Past	Present
	Matched Book Size €100bln	Matched Book Size €60bln
	Composition 50% Gov't 30% Credit 20% EM	Composition 40% Credit 30% EM 30% Gov't
	WAM 45 Days	WAM 95 Days

Equity Financing which funds at a wider spread than certain Fixed Income assets could determine how resources are allocated.

1. *Minimum value excluding G-SIB add on.*

Repo Returns Under Capital (RoRWA)?

Assumptions	
BCBS 270 Balance Sheet	£1bln
PnL Flat 1YR Run Rate	100bp
Counterparty Risk Weight (CP-RW)	100%
FCCM Volatility Adjustment Haircut*	7%[2]
Hair Cut Applied to Client Trades	0%
Target RoE	12%
Operating Assumptions[2]	
Cost / Income Ratio	55%
Tax Rate	35%

How many RWA's are produced with the given trade assumption?

RWA = EAD x CPRW
EAD: £1bln x 7% = 70m
CPRW: 100%
RWA = 70m

How much capital do I need to support 70m of RWA?

$11\% = \frac{£70m}{X}$ → X = £7.7m

How much gross revenue do I generate?

£1bln X 100bp = £10m

What is my NET revenue?

PBT: £10m – C/I Ratio = £4.5m

Net Income: £4.5m – Tax = £2.925m

What do my returns based on RWA exposure look like?

Return on RWA

Gross	PBT	NET
$\frac{£10m}{£7.7m}$ = 130%	$\frac{£4.5m}{£7.7m}$ = 58%	$\frac{£2.9m}{£7.7m}$ = 38%

1. *Note: Figures are illustrative ONLY.*
2. *Source: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:176:0001:0337:EN:PDF Figure is a blended Rate to simply illustrate and example.*

Repo Returns Under Leverage Returns (RoLBS)?

Assumptions	
BCBS 270 Balance Sheet	£1bln
PnL Flat 1YR Run Rate	100bp
Target RoE	12%
Operating Assumptions[1]	
Cost / Income (C/I) Ratio	55%
Tax Rate	35%

How much capital does a bank need to support £1bln of Repo?

$4\% = \frac{X}{£1bln} \rightarrow X = £40m$

How much gross revenue do I generate?

£1bln x 100bp = £10m

What is my NET revenue?

PBT: £10m – C/I Ratio = £4.5m

Net Income: £4.5m – 35% Tax Rate = £2.925m

What do my Repo returns on leverage balance sheet look like?

Return on Leverage Balance Sheet (LBS)

Gross	PBT[2]	NET
£10m / £40m = 25%	£4.5m / £40m = 11.25%	£2.9m / £40m = 7.3%

To achieve a 12% targeted return

Increase revenue by £6.4m (+64%)

Reduce Balance sheet to £610m (-39%)

1. *Note: Figures illustrative ONLY.*
2. *PBT = Pre Tax Profit.*

Thank you

General Conflict Disclosure & Disclaimer

BARCLAYS
This communication has been prepared by Barclays.

"Barclays" means any entity within the Barclays Group of companies, where "Barclays Group" means Barclays Bank PLC, Barclays PLC and any of their subsidiaries, affiliates, ultimate holding company and any subsidiaries or affiliates of such holding company.

CONFLICTS OF INTEREST
BARCLAYS IS A FULL SERVICE INVESTMENT BANK. In the normal course of offering investment banking products and services to clients, Barclays may act in several capacities (including issuer, market maker and/or liquidity provider, underwriter, distributor, index sponsor, swap counterparty and calculation agent) simultaneously with respect to a product, giving rise to potential conflicts of interest which may impact the performance of a product.

NOT RESEARCH
This document is from a Barclays Trading and/or Distribution desk and is not a product of the Barclays Research department. Any views expressed may differ from those of Barclays Research.

BARCLAYS POSITIONS
Barclays may at any time acquire, hold or dispose of long or short positions (including hedging and trading positions) and trade or otherwise effect transactions for their own account or the account of their customers in the products referred to herein which may impact the performance of a product.

FOR INFORMATION ONLY
THIS COMMUNICATION IS PROVIDED FOR INFORMATION PURPOSES ONLY AND IT IS SUBJECT TO CHANGE. IT IS INDICATIVE ONLY AND IS NOT BINDING.

NO OFFER
Barclays is not offering to sell or seeking offers to buy any product or enter into any transaction. Any offer or entry into any transaction requires Barclays' subsequent formal agreement which will be subject to internal approvals and execution of binding transaction documents.

NO LIABILITY
Neither Barclays nor any of its directors, officers, employees, representatives or agents, accepts any liability whatsoever for any direct, indirect or consequential losses (in contract, tort or otherwise) arising from the use of this communication or its contents or reliance on the information contained herein, except to the extent this would be prohibited by law or regulation.

NO ADVICE
Barclays is acting solely as principal and not as fiduciary. Barclays does not provide, and has not provided, any investment advice or personal recommendation to you in relation to the transaction and/or any related securities described herein and is not responsible for providing or arranging for the provision of any general financial, strategic or specialist advice, including legal, regulatory, accounting, model auditing or taxation advice or services or any other services in relation to the transaction and/or any related securities described herein. Accordingly Barclays is under no obligation to, and shall not, determine the suitability for you of the transaction described herein. You must determine, on your own behalf or through independent professional advice, the merits, terms, conditions and risks of the transaction described herein.

THIRD PARTY INFORMATION
Barclays is not responsible for information stated to be obtained or derived from third party sources or statistical services.

PAST & SIMULATED PAST PERFORMANCE
Any past or simulated past performance including back-testing, modelling or scenario analysis contained herein is no indication as to future performance.

No representation is made as to the accuracy of the assumptions made within, or completeness of, any modelling, scenario analysis or back-testing.

General Conflict Disclosure & Disclaimer (Continued)

OPINIONS SUBJECT TO CHANGE
All opinions and estimates are given as of the date hereof and are subject to change. The value of any investment may also fluctuate as a result of market changes. Barclays is not obliged to inform the recipients of this communication of any change to such opinions or estimates.

NOT FOR RETAIL
This document is being directed at persons who are professionals and is not intended for retail customer use.

IMPORTANT DISCLOSURES
For important regional disclosures you must read, visit the link relevant to your region. Please contact your Barclays representative if you are unable to access.
EMEA
https://www.home.barclays/disclosures/important-emea-disclosures.html.
APAC
https://www.home.barclays/disclosures/important-apac-disclosures.html.
U.S.
https://www.home.barclays/disclosures/important-us-disclosures.html.

CONFIDENTIAL
This communication is confidential and is for the benefit and internal use of the recipient for the purpose of considering the securities/transaction described herein, and no part of it may be reproduced, distributed or transmitted without the prior written permission of Barclays.

ABOUT BARCLAYS
Barclays offers premier investment banking products and services to its clients through Barclays Bank PLC. Barclays Bank PLC is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority and is a member of the London Stock Exchange. Barclays Bank PLC is registered in England No. 1026167 with its registered office at 1 Churchill Place, London E14 5HP.

COPYRIGHT

Coffee break

The life cycle of a triparty repo trade

Richard Glen, Senior Vice-President, Global Funding & Financing (GFF) Sales, Deutsche Boerse Group

DEUTSCHE BÖRSE GROUP

ICMA Professional Repo & Collateral Management Course

The lifecycle of a triparty repo trade

1 June 2017

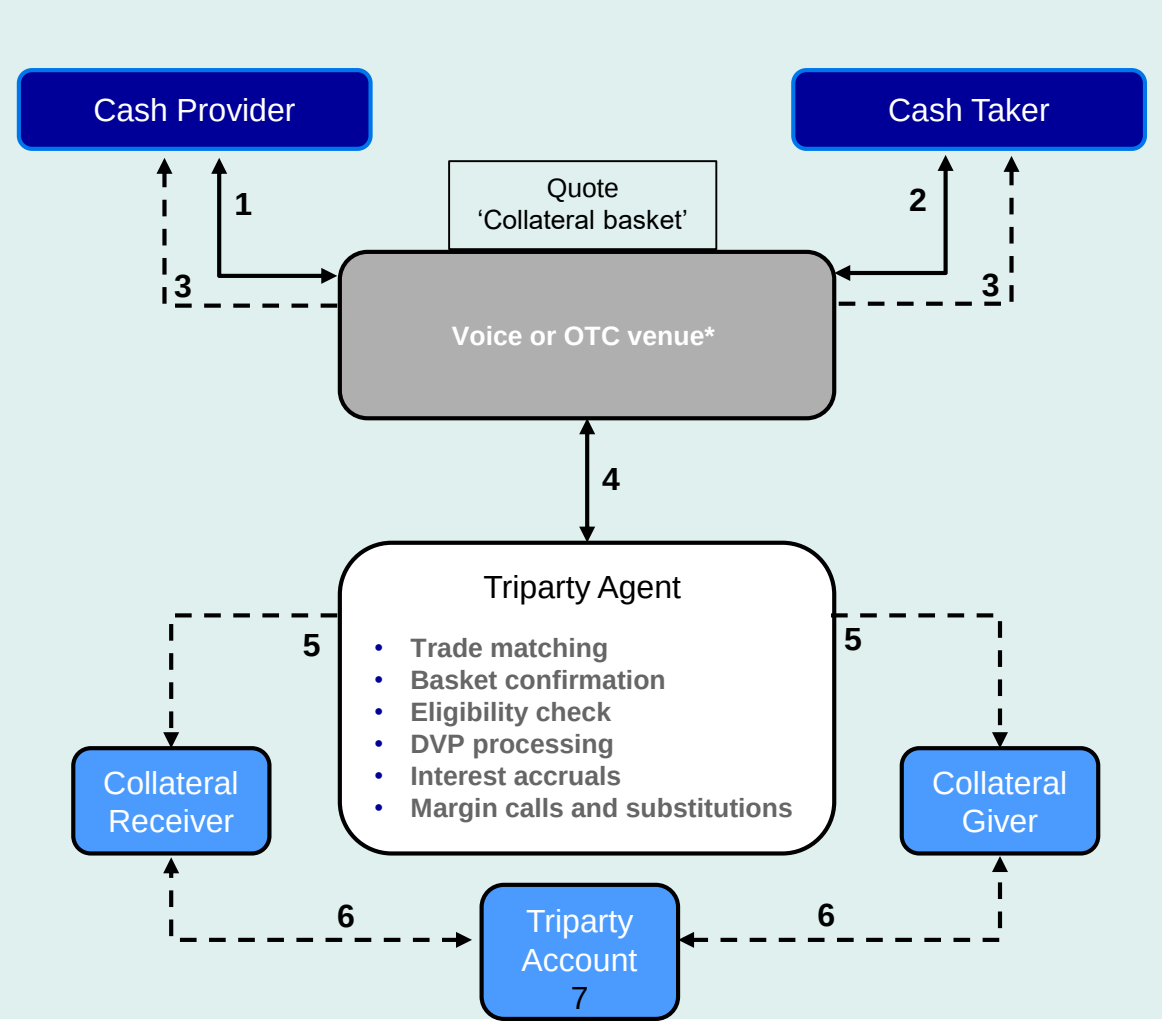
Global Funding & Financing

What is triparty repo?

Definition	A repurchase agreement, **or repo**, that is managed and monitored **a triparty collateral management agent**			
Triparty repo is used for	Financing of inventory	To support market-making and liquidity management	A safer alternative to unsecured deposits	Open market operations
Triparty repo is used by	Dealers	Banks	Sovereigns, Supras and Agencies	Corporates, Asset Managers, Insurance
Triparty agents include	Clearstream & Euroclear	BNY Mellon & JP Morgan	SIS	Domestic custodians
Benefits of Triparty	**Outsource administration** to a neutral third-party Access a standardized, **scalable collateral management solution** for end users			

Global Funding & Financing

The mechanics of traditional triparty repo



1. Cash Provider sends an offer request to its preferred counterparties
2. Cash Taker provides a bid to the Cash Provider
3. If quote is accepted, both parties confirm full trade details
4. Trade details are routed to triparty agent as an RQV or triparty notification
5. CMAX confirms transaction matching and initiates opening and eligibility checks
6. DVP settlement
7. The triparty agent continues to value and manage the collateral throughout the lifecycle of the trade (opening, margin calls, substitutions, closing)

*automated trading systems are starting to be introduced into triparty repo markets, in particular for B2C activities

Global Funding & Financing

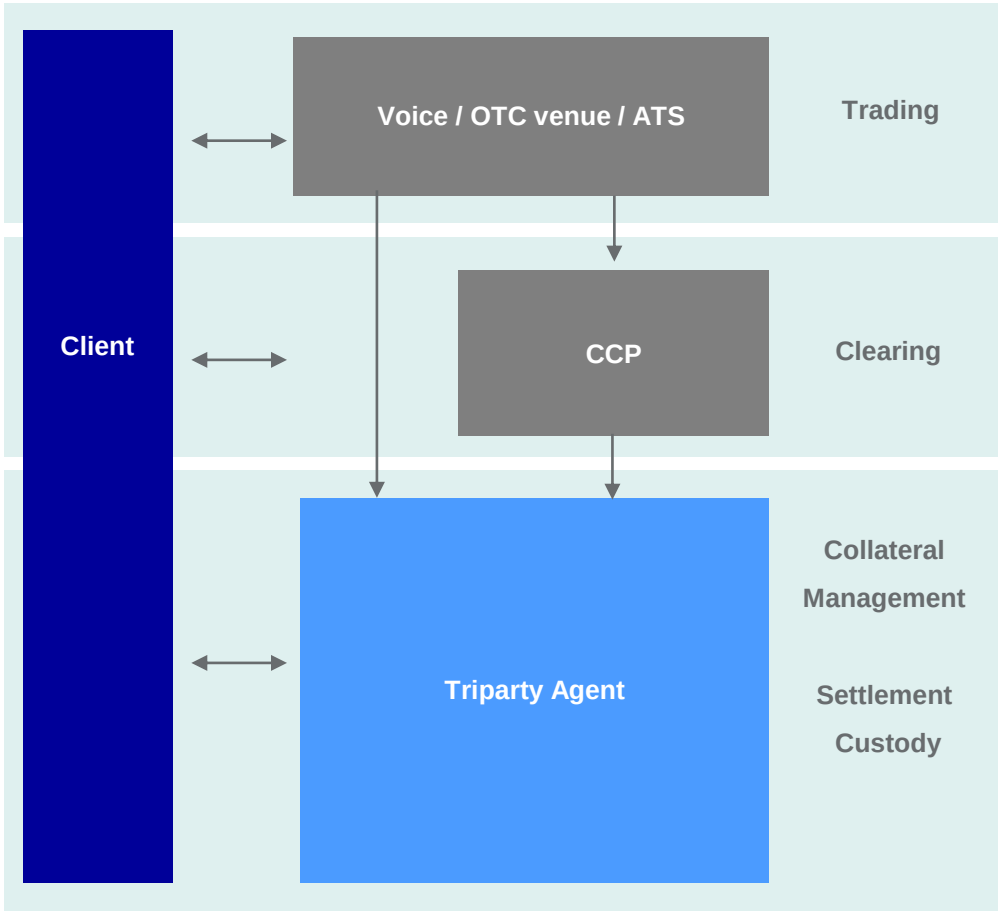
Understanding the key elements of the operational lifecycle

Definition	After the initial opening of the triparty repo, the operational lifecycle includes a number of specific events that are managed by the triparty agent. This includes margin calls, substitutions, corporate action processing and optimisation			
Margin calls are triggered by	Price changes	Change in exposure value	Corporate action	Interest payment
A substitution is triggered by	Bilateral recall	Corporate action	Ineligibility event	Exclusion
Collateral is optimized because of	Three-way substitution	Portfolio rebalancing	Cheapest to deliver rules	Other firm funding requirement
US vs European Triparty	After the financial crisis of 2007 – 2009, US triparty repo market reform was necessary to reduce systemic risk and the potential vulnerability of the two triparty clearing banks. US triparty now works in a broadly similar fashion to European triparty.			

Global Funding & Financing

Comparing traditional triparty repo and GC basket financing

In addition to traditional triparty repo arrangements, the ability to financing **general collateral (GC) baskets** via central counterparties has become more commonplace. This is largely down to an increasing demand for standardized baskets, an increasing use of technology across the securities finance value chain and regulatory pressures that encourage central clearing and promote the advantages of netting.



Triparty Repo

- Disclosed trading
- Counterparties face each other from a risk perspective
- 1:1 legal set-up
- Customised or standardized collateral baskets
- Wide range of currencies and asset classes
- All transactions are cleared on a gross basis
- Requires the services of a triparty agent

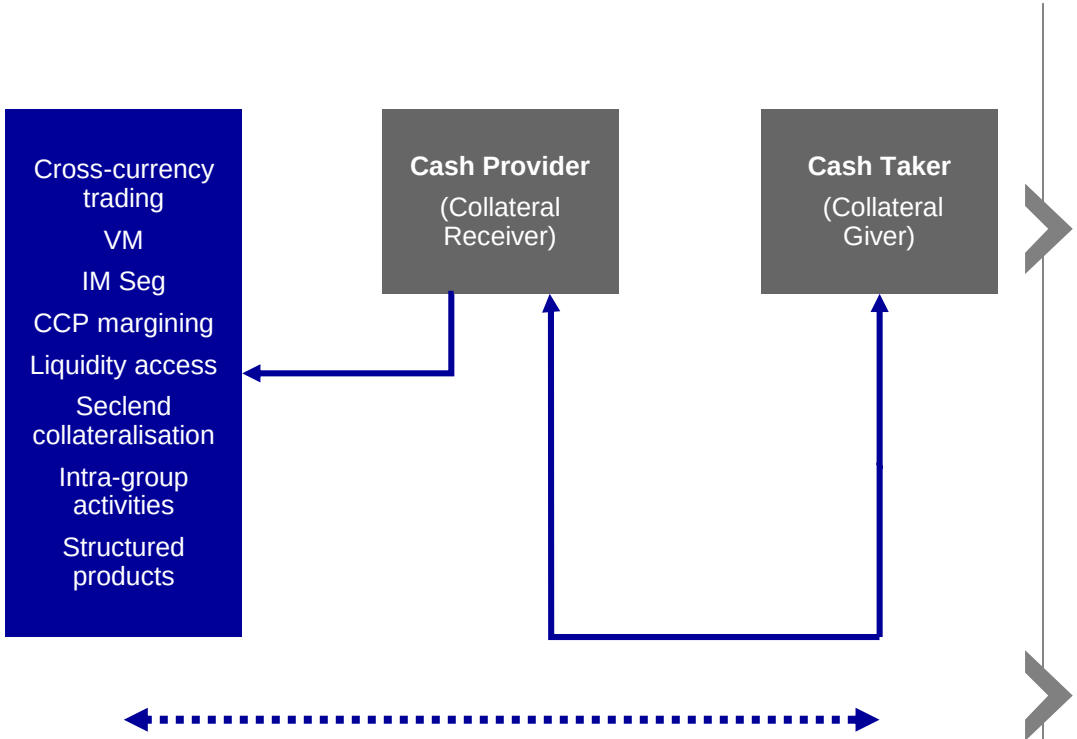
GC basket financing

- Disclosed ‘give-up’ or anonymous screen trading
- All counterparties face the CCP from a risk perspective
- n:n legal set-up
- Standardized baskets
- Narrower range for currencies and asset classes
- All transactions are cleared on a net basis
- Requires membership of an eligible CCP and a triparty agent

Global Funding & Financing

Collateral re-use opportunities and triparty repo

- Mobility and **velocity of collateral** has become more important in light of recent regulatory changes. Banks are focusing efforts more and more on **efficient inventory management** and looking to optimize their ability to re-use collateral as far as possible. In fact, the capital savings that can be achieved through the maximisation of **collateral efficiency** are yet to be realized by many financial institutions.



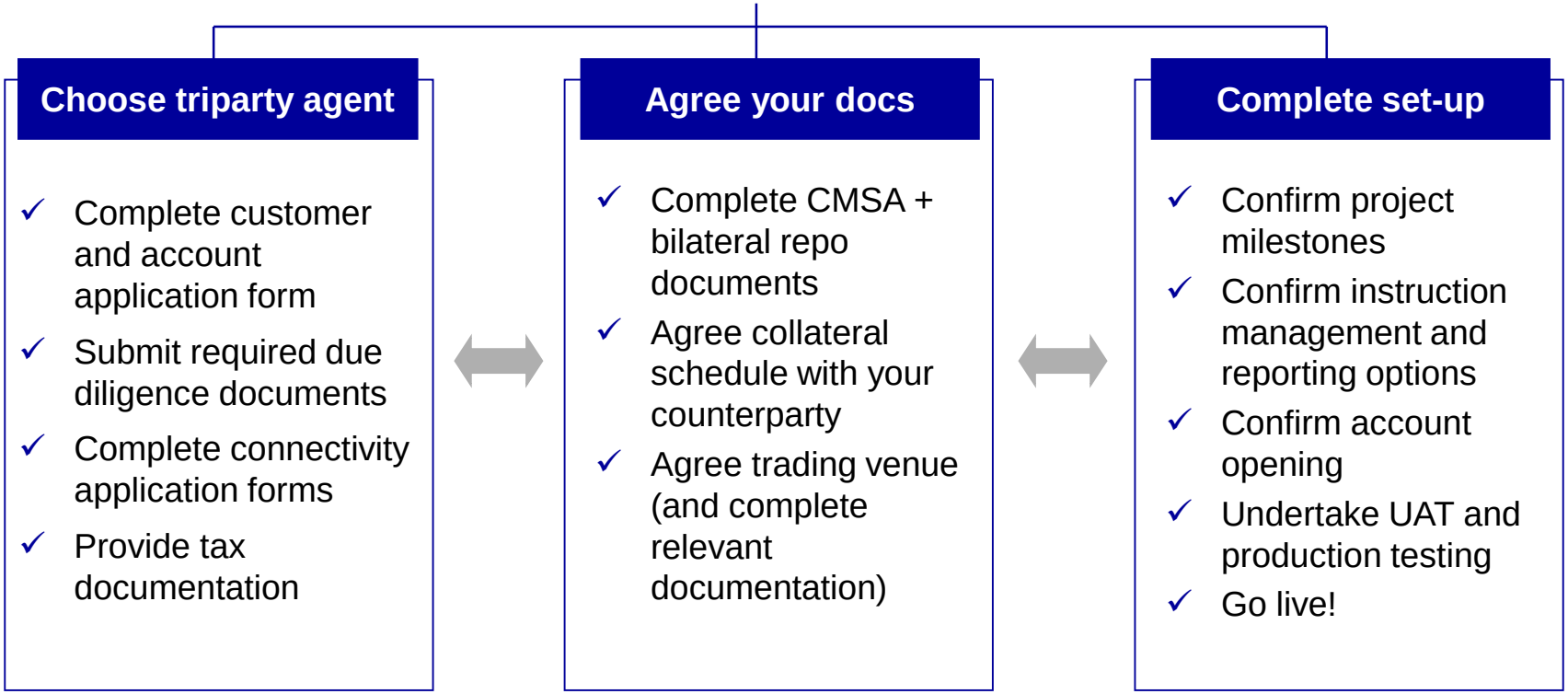
Re-use options

- **Mobilize collateral** to cover:
  - Liquidity management and x-ccy repo activities
  - Raise cash for variation margin
  - Uncleared initial margin requirements
  - CCP margining
  - Central bank obligations
  - Liquidity buffer
  - Collateralization of cleared or uncleared securities lending activities
  - Intra-group activities including credit lines
  - Structured products including collateralized issuance
- **Re-use of pledged assets** also possible under some jurisdictions
- Triparty **interoperability**

Global Funding & Financing

Getting started

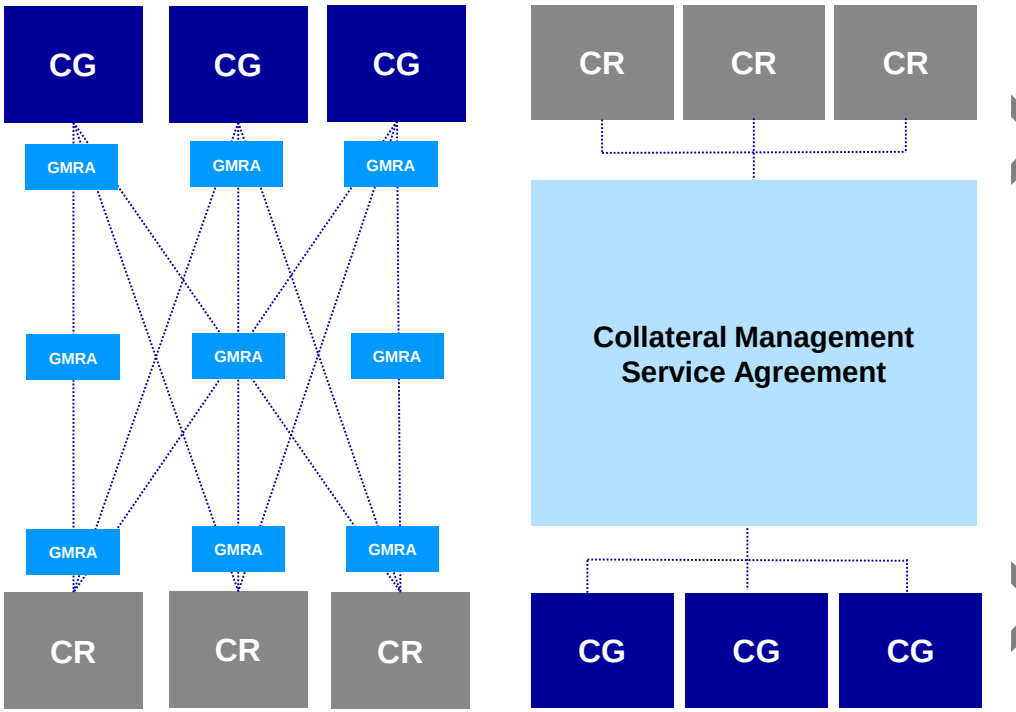
To get started in triparty repo, you need to do the following



Global Funding & Financing

Legal set-up of triparty repo

To start trading in triparty repo, counterparties need both a **bilateral repo agreement** - industry standard (GMRA, MRA), local equivalent (DRV, FBF) or multilateral terms (CRC's) – plus a **triparty collateral management service agreement**. Both of these documents provide the legal framework for the relationship, the terms and conditions for the collateral management process as well as detail what happens in the event of a default or insolvency of a counterparty.



Bilateral terms

- Standardized repurchase agreement terms
- May be appended by supplemental terms and conditions and other annexes
- May be updated to reflect changes to legal structure or regulatory change
- Legal opinions available to evidence enforceability and netting capacity.

Triparty terms

- Standardized collateral management terms
- May be limited to repo or used for wider multi-product set-up
- Confirms account set-up
- Defines the role of the cash provider / collateral receiver and cash taker / collateral giver
- Defines the obligations of triparty agent

Global Funding & Financing

Agreeing triparty collateral eligibility criteria

In addition to the collateral management service agreement, it is the **collateral eligibility criteria** that forms the backbone of the secured funding relationship. This document allows clients to choose a **standardized basket** or to set specific eligibility rules as part of a **customized basket**. This is then offered to either one or multiple counterparties at the same time. The counterparty then accepts the basket either in paper or electronic form.

Appendix A. Counterparty acceptance list and baskets

clearstream | DEUTSCHE BÖRSE GROUP

Triparty Collateral Management Services

Please indicate, per underlying triparty contract and basket, the name and contact details of your counterparty and the triparty collateral management (TCM) service type that will govern the contract: Triparty Repo Service Clearstream Repurchase Conditions (TRS CRC) or Other Master Repurchase Agreement (TRS OTH); Triparty Securities Lending Service Level 1 (TSLS1) or Level 2 (TSLS2); Triparty Collateral Management Service Pledge (TCMS PL) or Transfer of Title (TCMS TT)

Collateral Giver		Holder of Collateral Giver's Account		TCM Service type[a b]	Basket Reference	Clearstream Standardised Basket Reference[c]
Name	Address	Name	Address			

Eligibility criteria

Order	Field	Oper	Value	Outcome
1	Counterparty Own Issue	=	Yes	Not eligible
2	Evaluated Price	=	Yes	Not eligible
3	Cash As Collateral	=	EUR, GBP, USD	Eligible
4	Denomination Currency	=	ATS, BEF, CYP, DEM, EEK, ESP, FIM, FRF, GRD, IEP, ITL, LUF, LVL, NLG, PTE, SIT, SKK	Not eligible
5	Security Types	=	Bond	Accepted
6	Bond Types	=	Medium Term Notes, Short Term Notes, Bills, Straight Bonds	Accepted
7	Bond Risk Profiles	=	Sovereign	Accepted
8	Price Age	>	31 Business days	Not eligible
9	Issuer Country	Not in	AT - Austria, AU - Australia, CA - Canada, DE - Germany, DK - Denmark, FI - Finland, FR - France, GB - United Kingdom, JP - Japan, NL - Netherlands, NO - Norway, US - United States	Not eligible
10	Issuer Country Security Currency Security Rating Issuer Rating	= = = =	AU - Australia AUD AAA LT, AA+ LT, AA LT, A-1+ ST AAA LT, AA+ LT, AA LT, NR LT, A-1+ ST, NR ST	Eligible
11	Issuer Country Security Currency Security Rating Issuer Rating	= = = =	AU - Australia AUD NR LT, NR ST AAA LT, AA+ LT, AA LT, A-1+ ST	Eligible
12	Issuer Country Security Currency Security Rating Issuer Rating	= = = =	CA - Canada CAD AAA LT, AA+ LT, AA LT, A-1+ ST AAA LT, AA+ LT, AA LT, NR LT, A-1+ ST, NR ST	Eligible
13	Issuer Country Security Currency Security Rating Issuer Rating	= = = =	CA - Canada CAD NR LT, NR ST AAA LT, AA+ LT, AA LT, A-1+ ST	Eligible

*Bloomberg asset classification (uncleared margin rules)

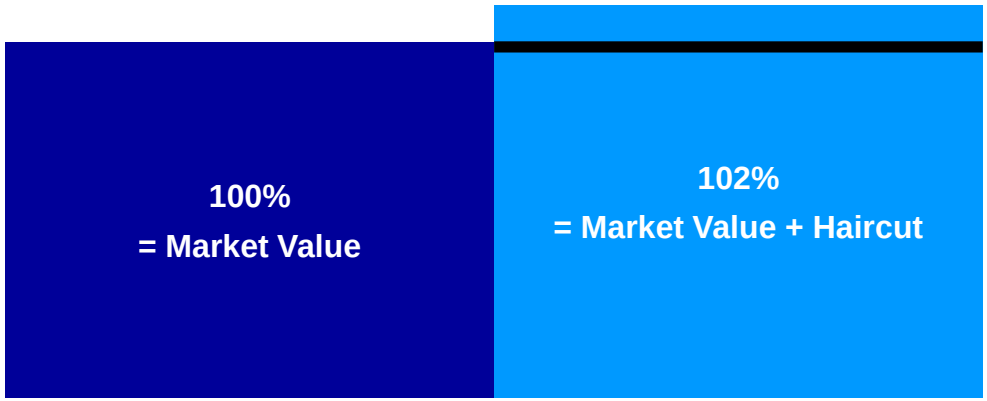
Eligibility criteria

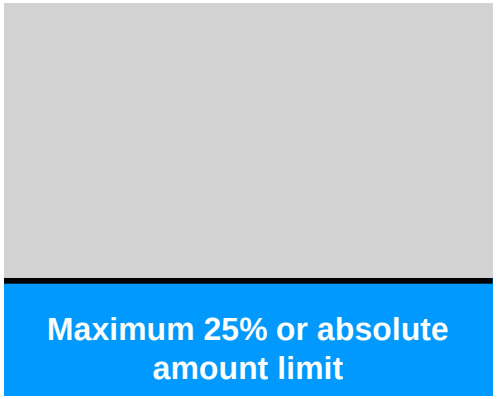
- Create eligibility rules based upon **single or multiple conditions**
- Rules can be used to define **eligibility, haircuts and concentration limits**
- Field values include:
  - Asset Class or Type
  - Credit Rating
  - Currency
  - Issuer or Risk Country
  - Underlying asset location
  - Indices or baskets
  - Industry sector
  - Issuer or UPID
  - Security identifier
  - Regulatory classification*
- Eligibility rules can also be used by the collateral giver to trigger ad-hoc **portfolio optimisation**
- Eligibility rules are visible in via online portal or file download

Global Funding & Financing

Haircuts and concentration limits

Cash providers understand that they need to protect themselves from **market volatility** and **wrong-way risk**. For this reason, a triparty agent will provide all of its counterparties with different **haircut** and **concentration limit** options as part of its triparty collateral management process.





Haircuts

- Fixed percentage amounts per asset or security
- Based upon eligibility criteria options
- Additional cross-currency haircuts can be stipulated
- Dynamic haircut options are also available based upon price age
- Mark-to-market processes take place at least once per day

Concentration Limits

- Issuer or UPI limit
- Security limit per ISIN
- Issued amount limit
- Absolute limits in currency amount
- Combination limit options
- Regulatory concentration limits e.g. uncleared margin rules, UCITS V
- Limits applied post-haircut but pre-allocation
- Automated breach monitor

Global Funding & Financing

End-to-end connectivity

- As electronic trading and real-time processing grow in importance, **integrated end to end processing** is becoming standard features of triparty repo. In addition to supporting traditional **SWIFT** reporting options, triparty agents not only provide online portal access to clients but also have the ability to integrate **middleware** or **vendor solutions** as part of the overall lifecycle management workflow.

	Portal access	SWIFT	Trading venue
	Clearstream's online portal	**Secure financial messaging**	**Multi-user triparty repo execution**
Simulation • Forecast reports	Yes	-	-
Execution* • Price discovery	-	-	Yes
Triparty notification • Online entry • Upload	Yes Yes	- Yes	Yes Yes
Reconciliation • Matching • Statements • Real-time confirmation	Yes Yes Yes	Yes Yes Yes	Yes - -
Cash processing • Cash instructions • Cash reporting	Yes Yes	Yes Yes	- -

Transaction Lifecycle

- **Forecast reports** show predicted pre-trade collateral availability positions
- Execution venues support **price discovery** as well as automated downstream processing
- Online entry or upload of triparty transactions by each counterparty is possible
- **Full downstream processing** is automated and each stage in the lifecycle is tracked and reported
- Dedicated **collateral management reporting** can be provided
- Standard settlement and **position reconciliation** reporting is also available
- **Cash management** and funding reporting is also offered as standard
- **Bespoke reporting** options can also be supported.

Global Funding & Financing

Triparty repo – a summary

- As triparty repo markets have evolved over time, triparty agents have been asked to make their services more **flexible** and **comprehensive** for their clients. The following lists the key points that anyone needs to consider when looking to select the most appropriate triparty repo solution.

Products

- **Funding**
- **Financing**
- **Collateral Management**

Asset Classes

- **Non-Cash**
  - Fixed Income
  - Equities
  - Funds
- **Cash**

Counterparties

- **Sovereigns, Supras & Agencies**
- **Banks & FI's**
- **Real Money**
  - Corporates
  - Insurance
  - Asset Managers

Central Clearing

- **CCP choice**
- **'Pooled' Baskets**
- **Single ISIN markets**

Collateral Locations

- **ICSD**
- **CSD**
- **Custodian**
- **Interoperability**

Operational

- **Eligibility criteria**
- **Optimisation**
- **Instructions & Reporting**

Technical

- **Message Media**
- **Vendor or platform integration**

Legal

- **Collateral Agreement**
- **Bilateral Agreement**
- **Account set-up**
- **Appendices & other documents**

If you have any questions, please contact

Richard Glen
Senior Vice-President**,** Clearstream Banking S.A., London Branch
Deutsche Boerse Group
Global Funding & Financing – Sales
tel +44 207 862 7142
e-mail richard.glen@deutsche-boerse.com

eurex | eurex clearing | eurex repo | clearstream | DEUTSCHE BÖRSE GROUP

An overview of the repo market: 15 years of the ICMA survey

Richard Comotto, ICMA Centre at Reading University

European Repo Council

32nd European repo market survey, conducted in December 2016

- **Mr. Richard Comotto,** Senior Visiting Fellow, ICMA Centre - Reading University

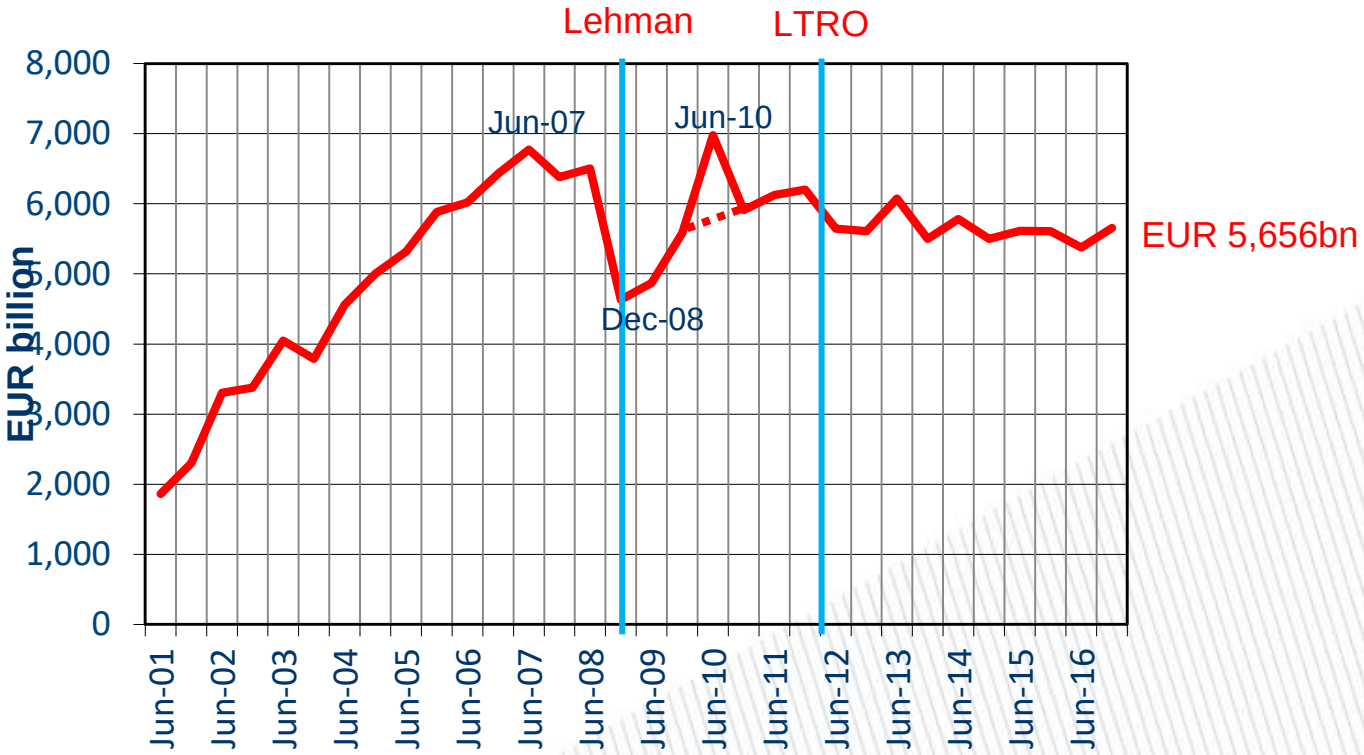
Survey overview

- outstanding value of contracts at close of business on Wednesday, 8th June 2016
- 65 responses (-2)

Headline numbers

December 2016	**EUR 5,656 billion**
June 2016	EUR 5,379 billion
December 2015	EUR 5,608 billion
June 2015	EUR 5,612 billion
December 2014	EUR 5,500 billion
June 2014	EUR 5,782 billion
December 2014	EUR 5,499 billion
June 2013	EUR 6,076 billion
December 2012	EUR 5,611 billion
June 2012	EUR 5,647 billion
December 2011	EUR 6,204 billion
June 2011	EUR 6,124 billion
December 2010	EUR 5,908 billion

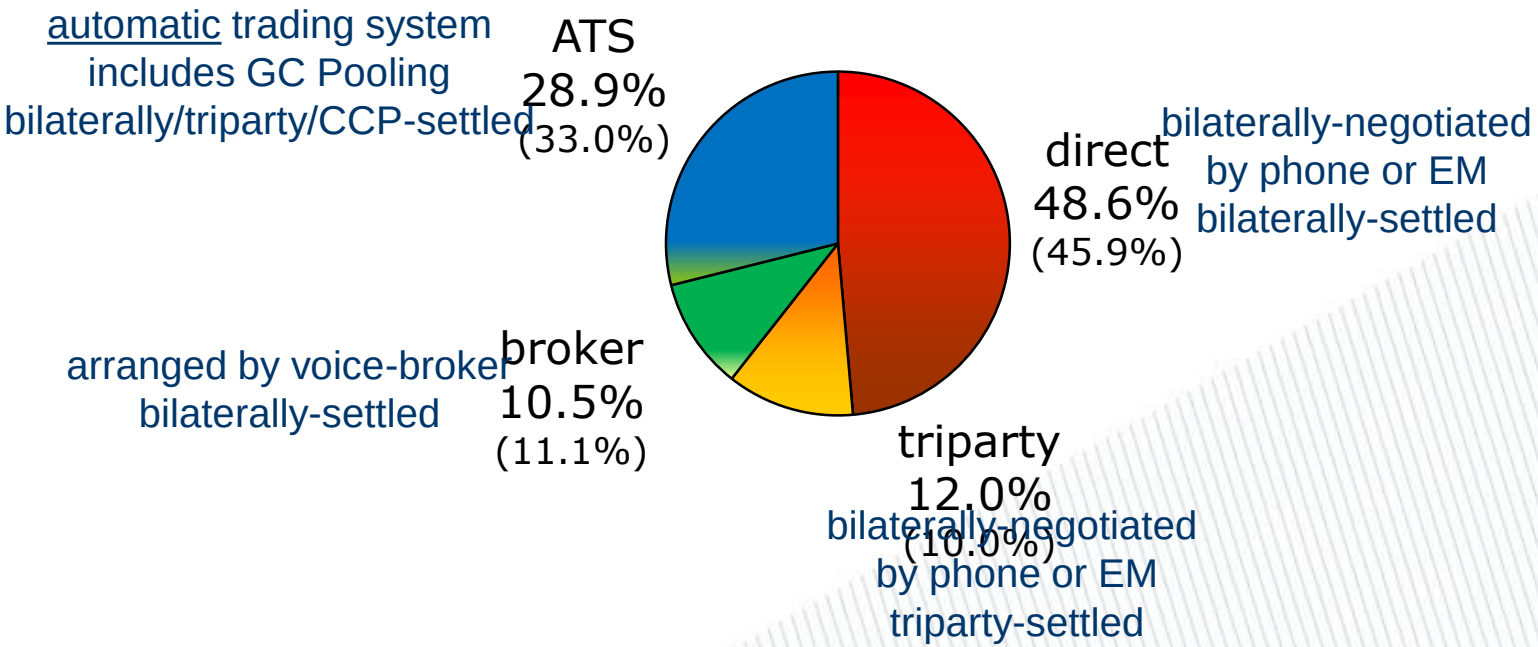
Headline numbers



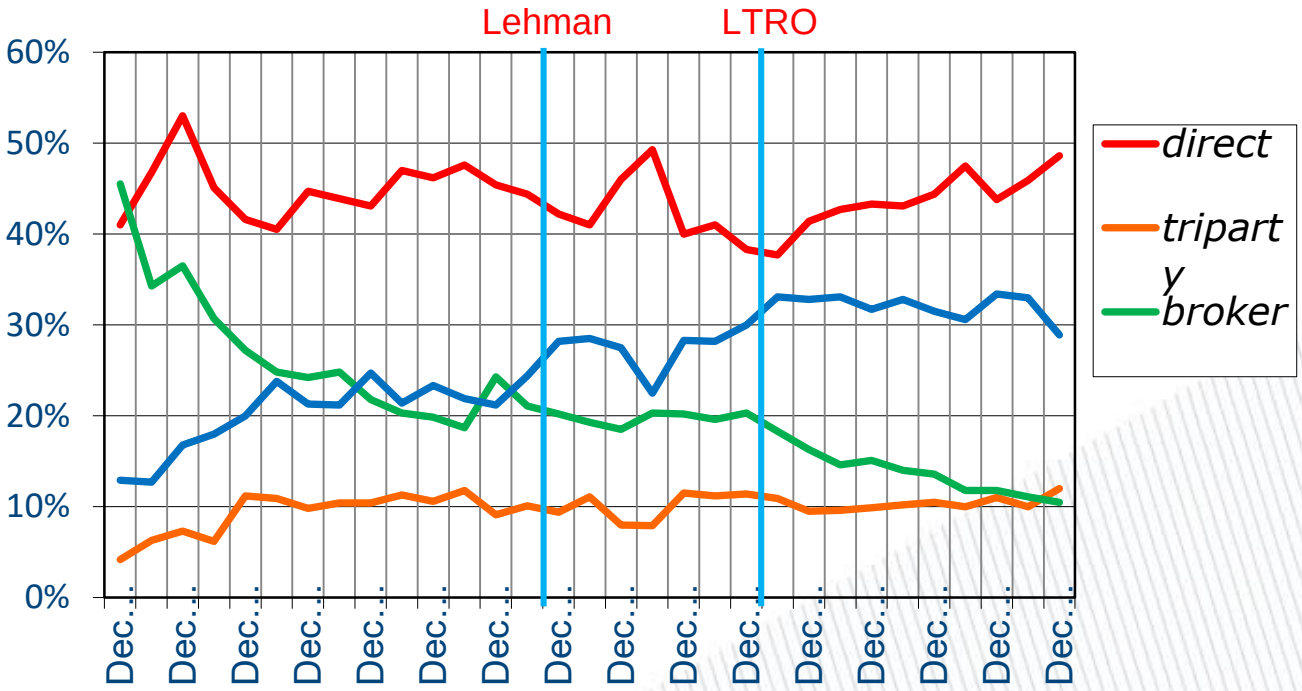
Comparable market growth

- headline number: +0.9% year-on-year; +5.2% since June 2016
- for 61 respondents participating in last 3 surveys: +0.8% year-on-year; +2.4% since June 2016

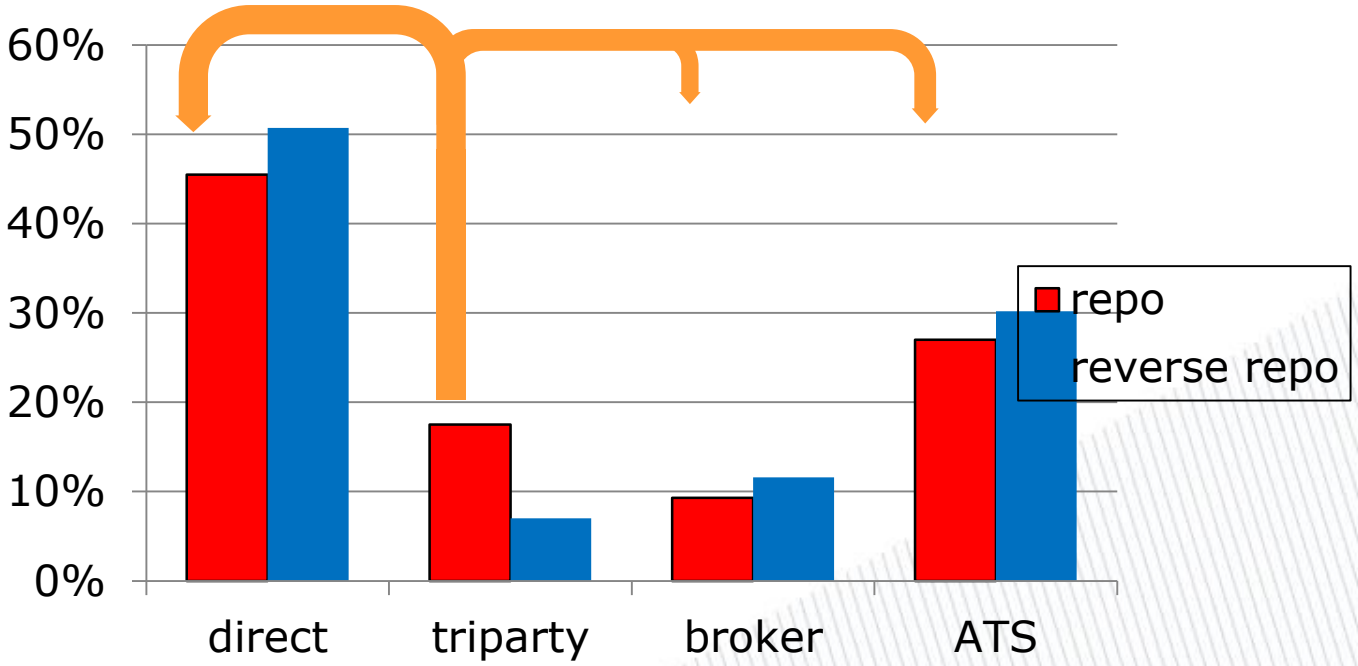
Trading analysis



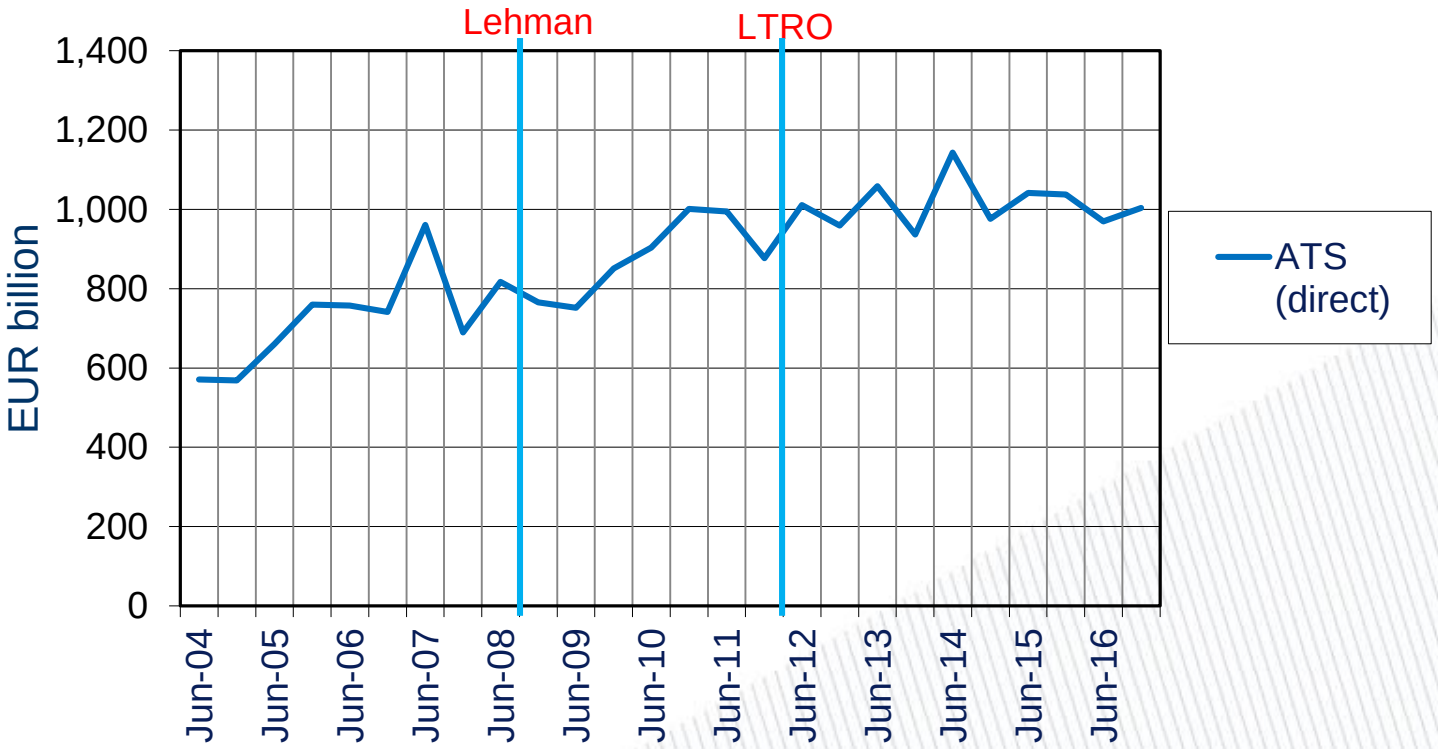
Trading Analysis



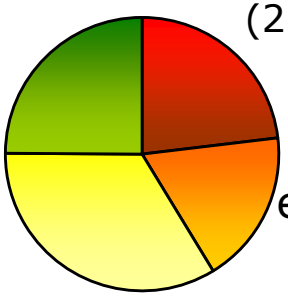
Trading analysis



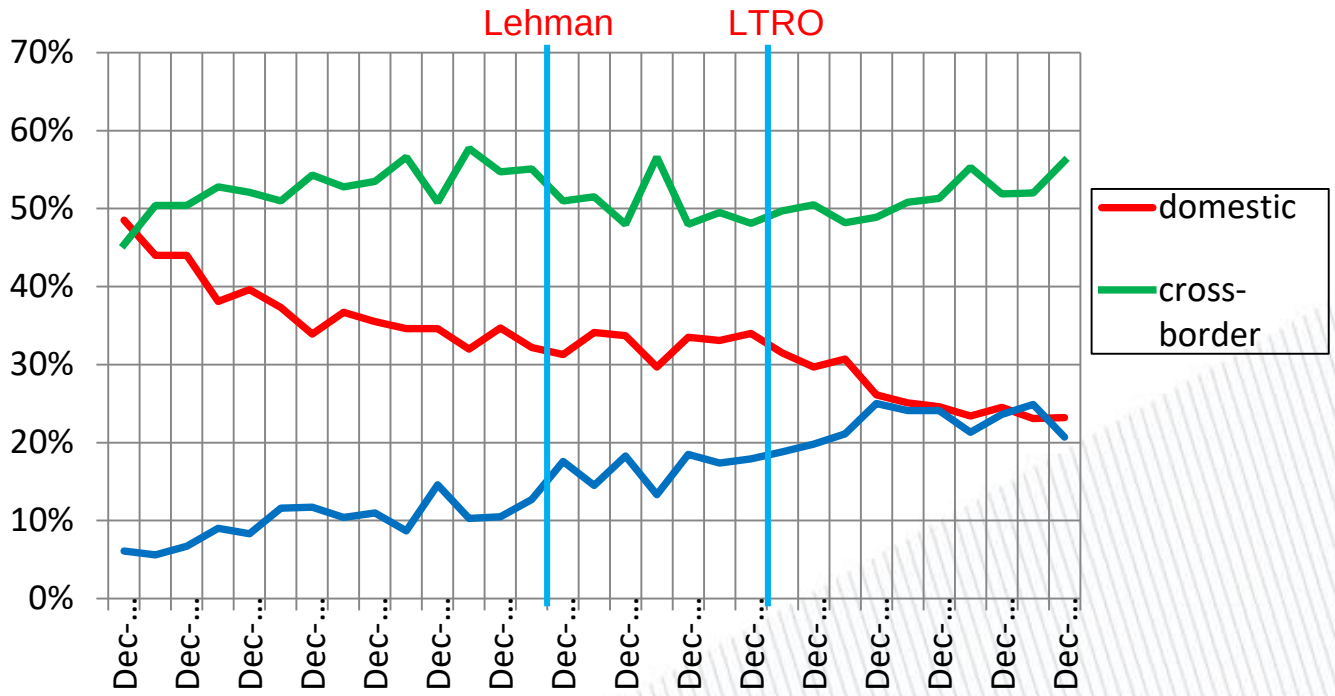
Trading Analysis (directly reported by providers)



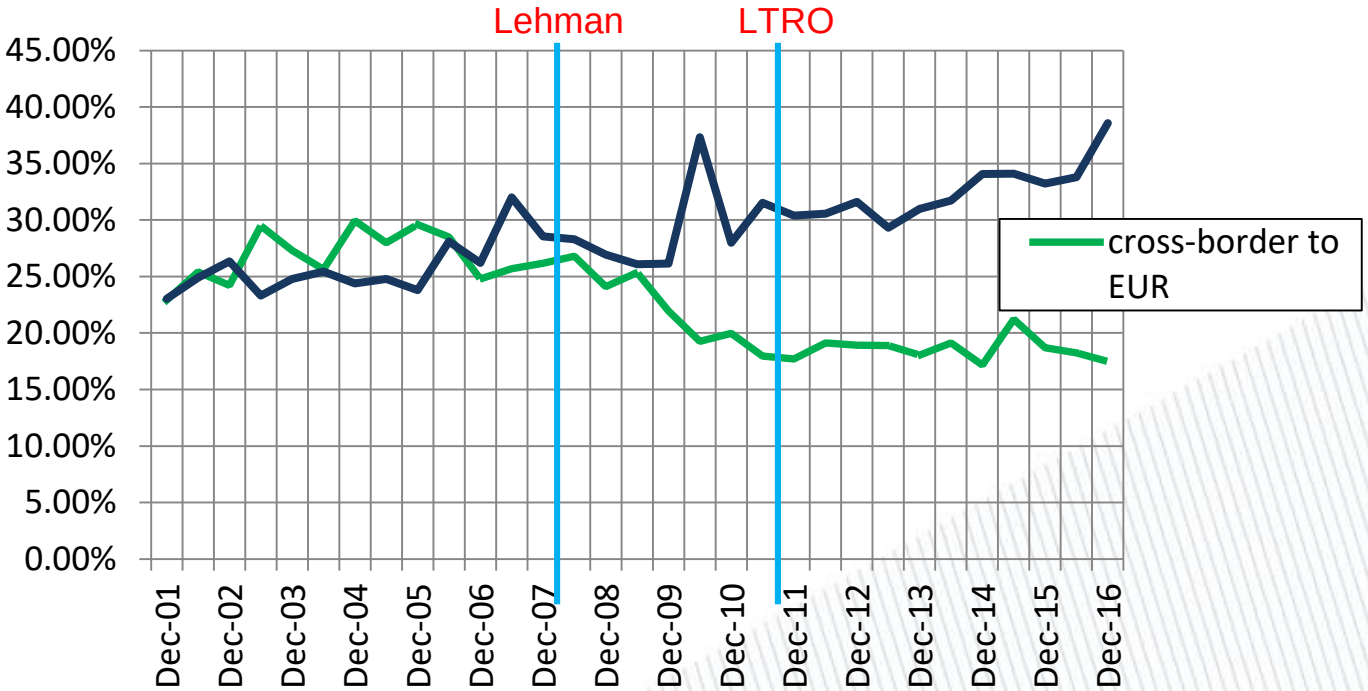
Geographical Analysis



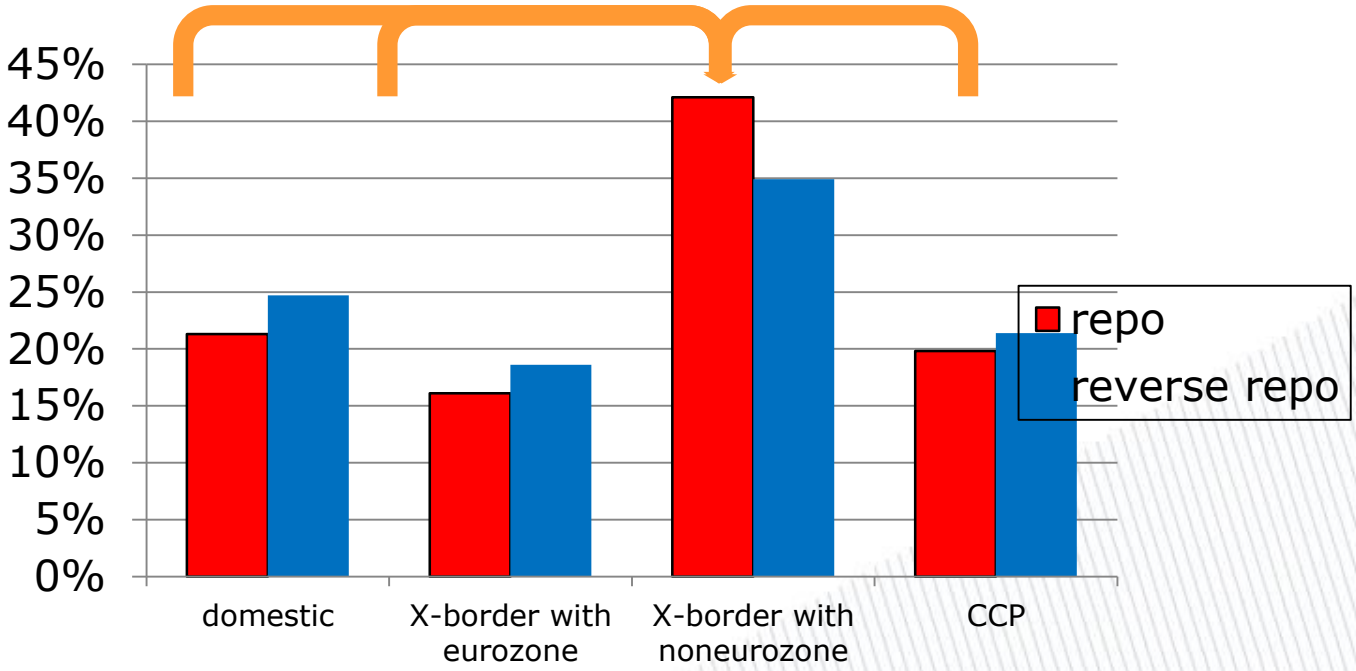
Geographical Analysis



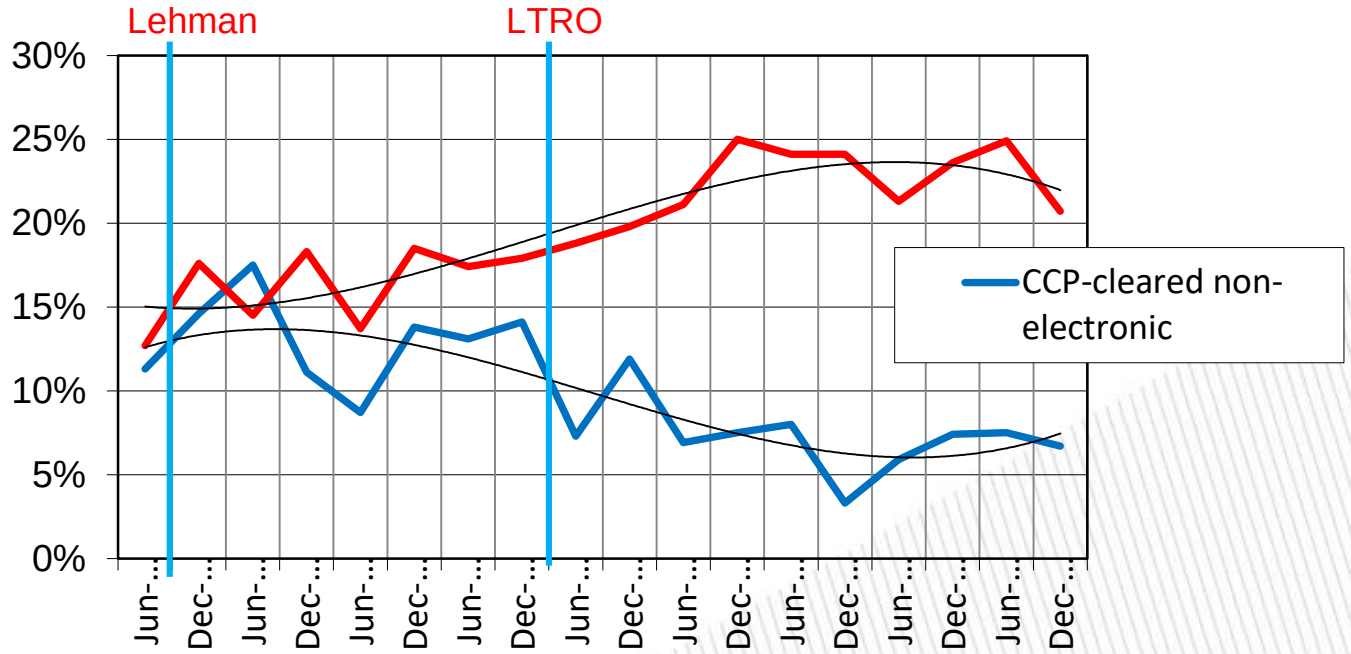
Geographical Analysis



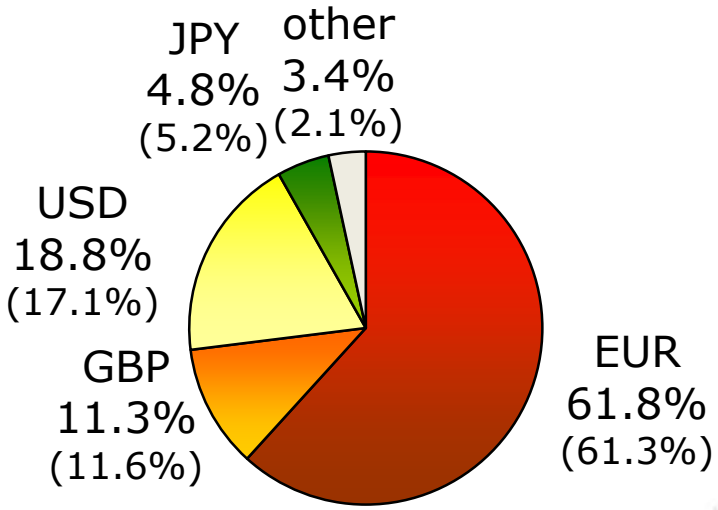
Geographic Analysis



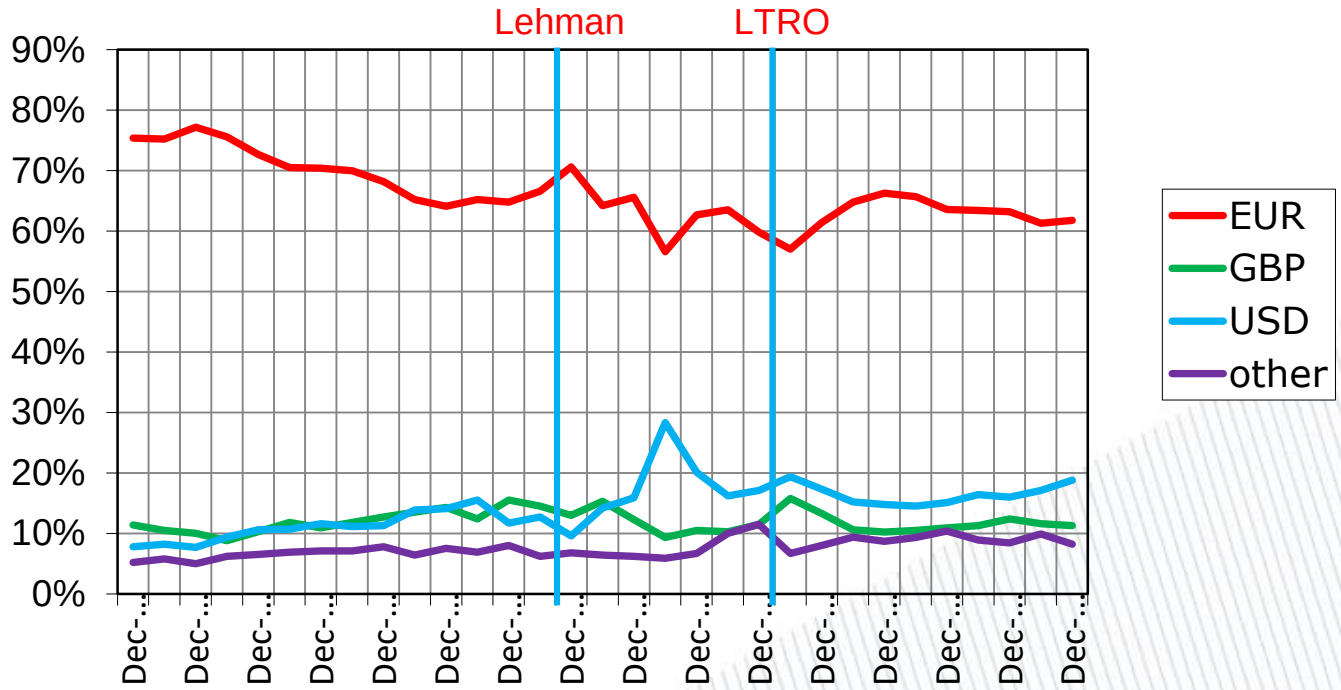
Business cleared across CCP



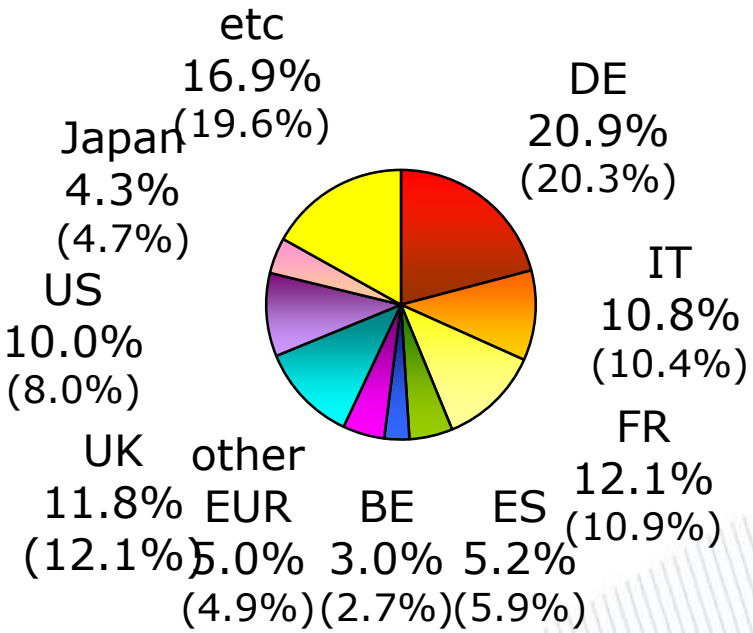
Currency Analysis



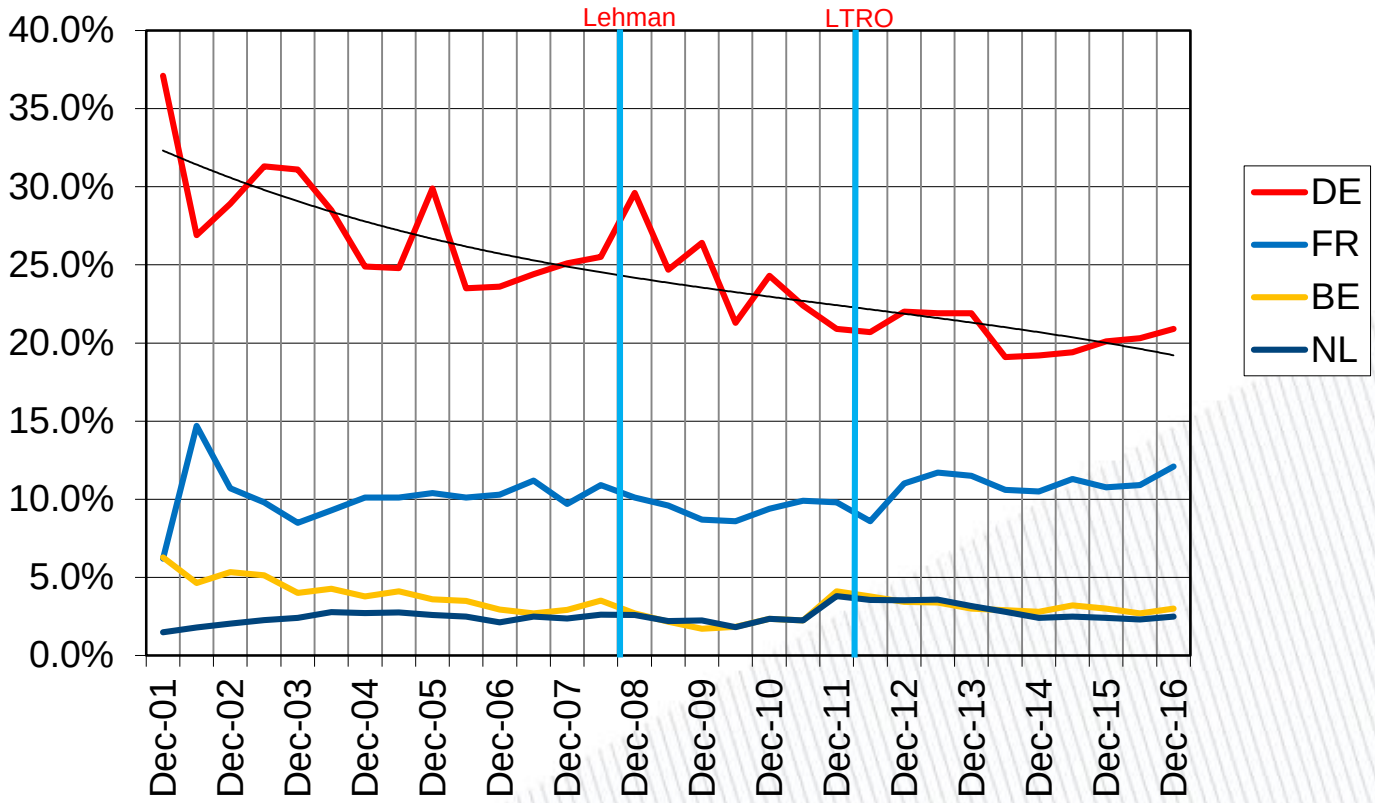
Currency Analysis



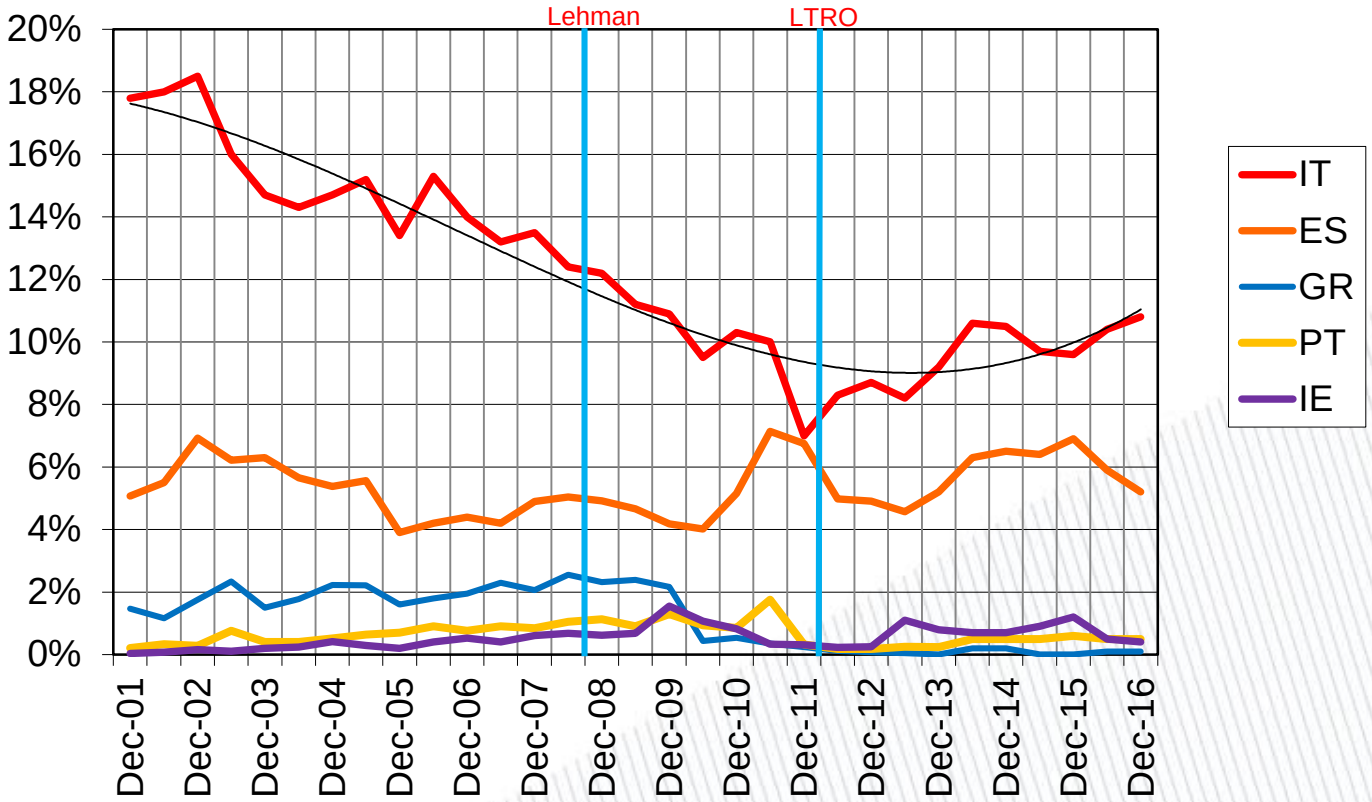
Collateral Analysis



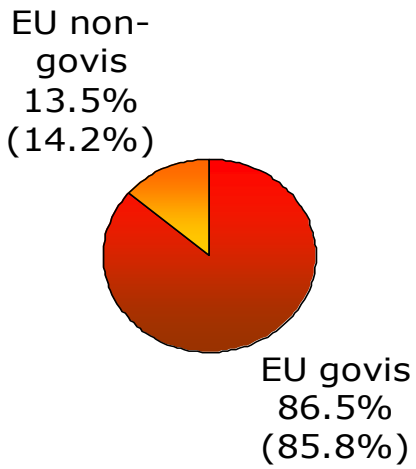
Collateral Analysis --- Core Eurozone



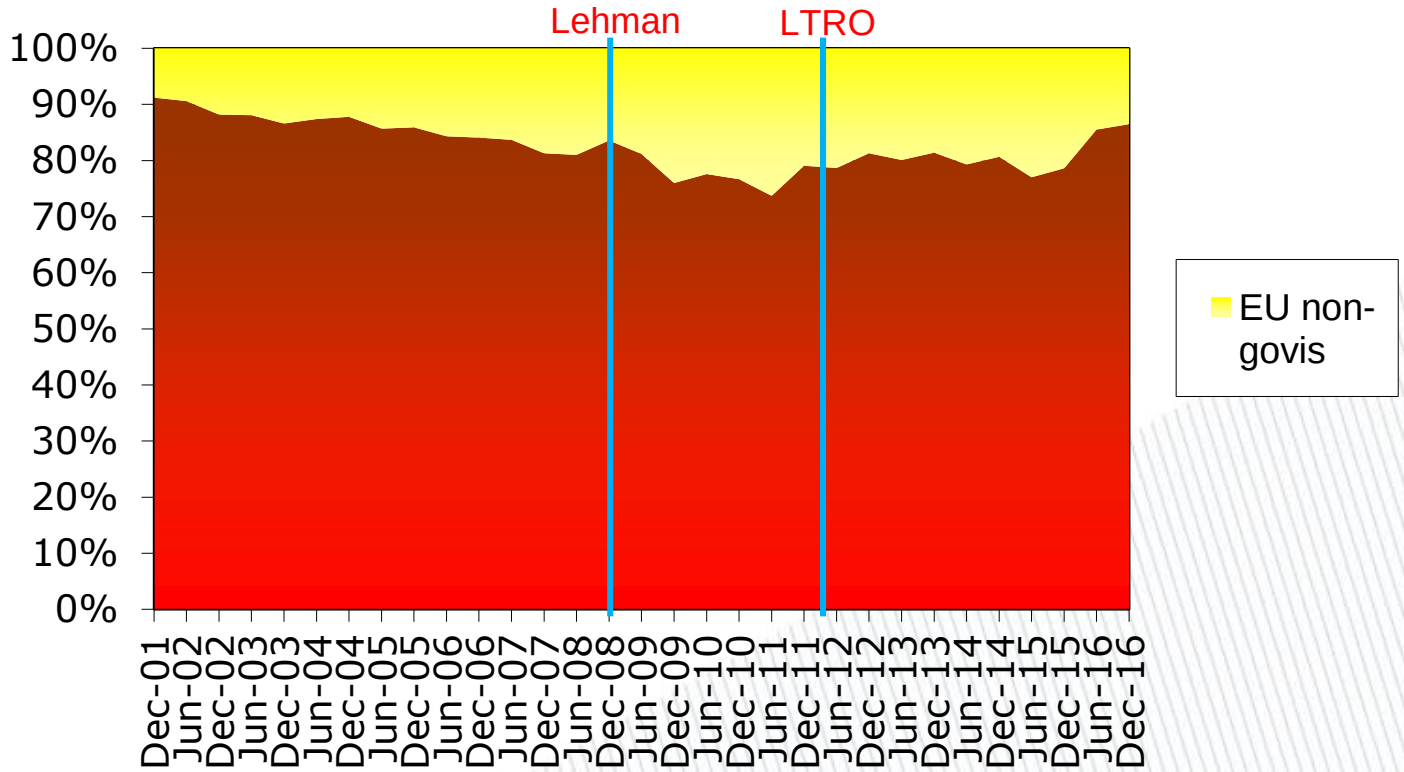
Collateral Analysis --- Peripheral Eurozone



Collateral Analysis

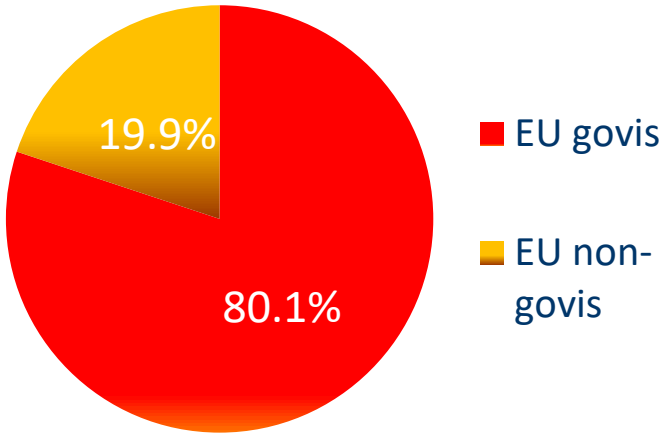


Collateral Analysis



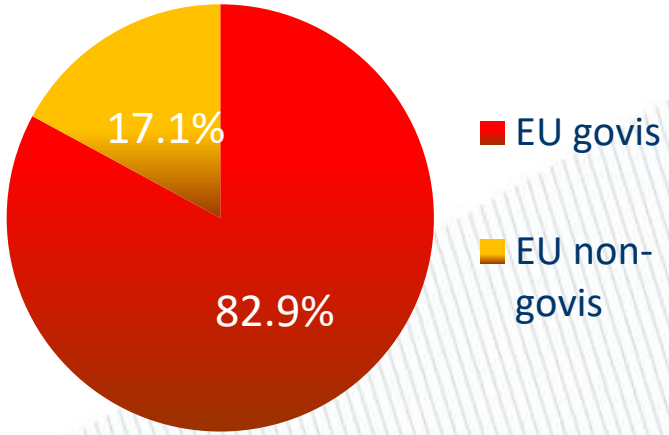
Collateral Analysis

repo



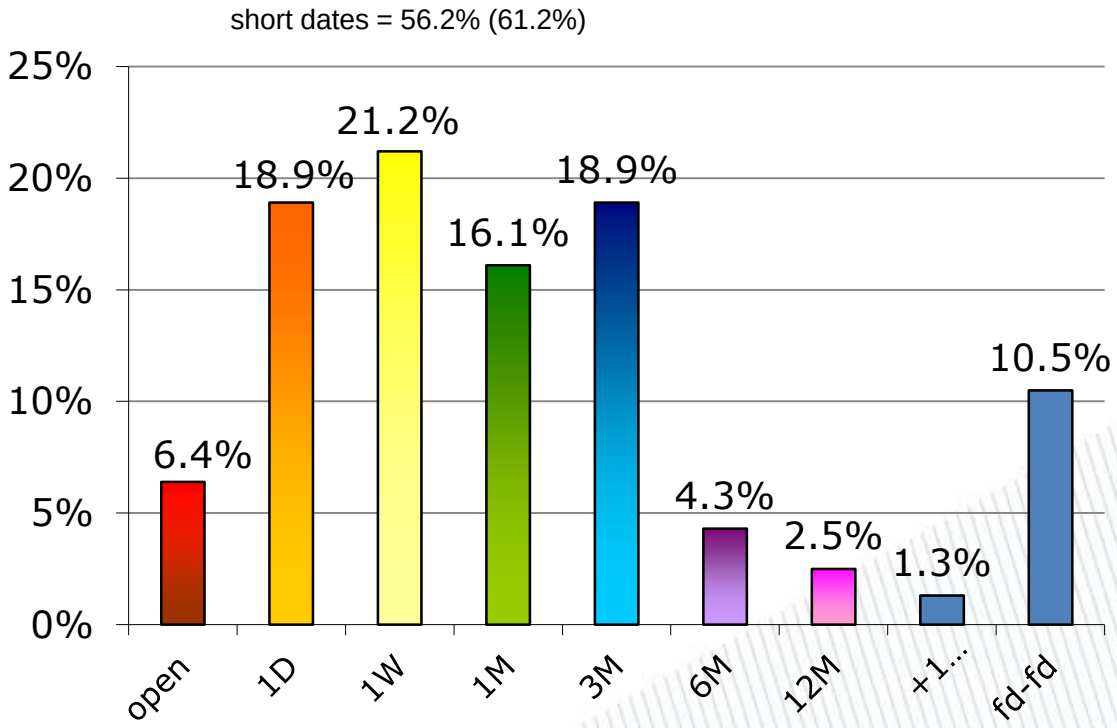
net borrowing v credit

reverse repo

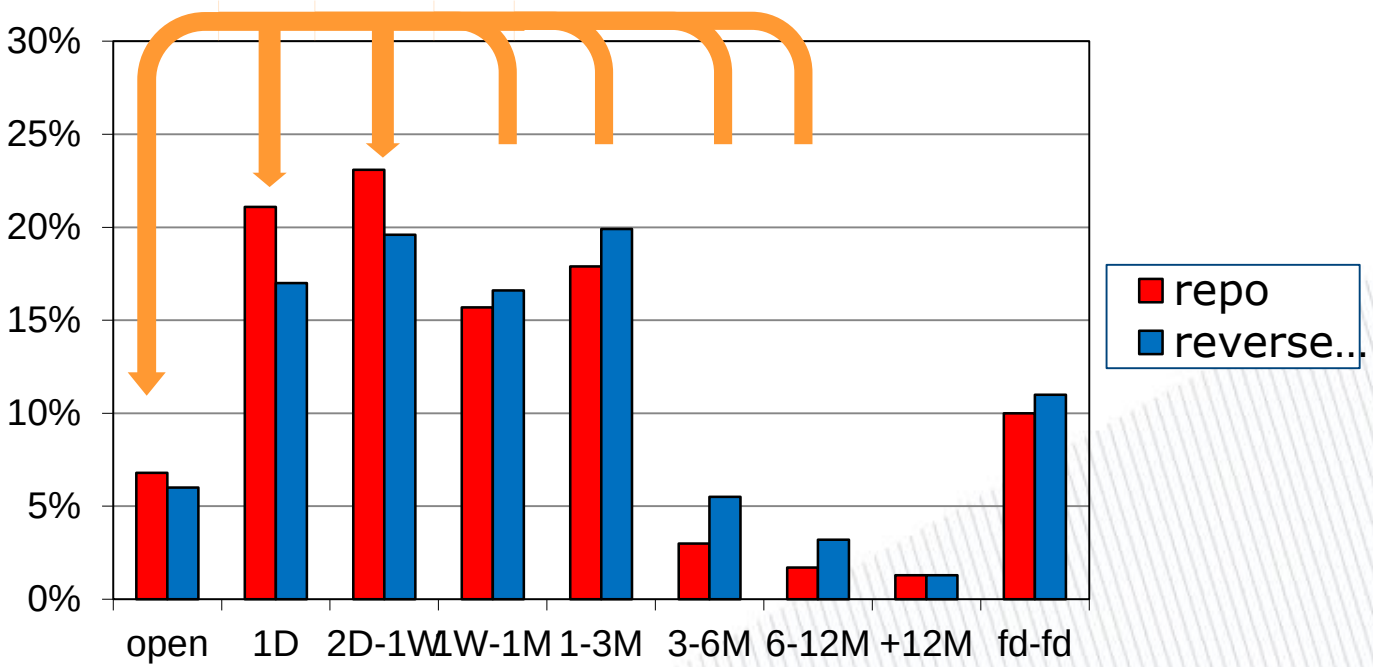


net lending v govis

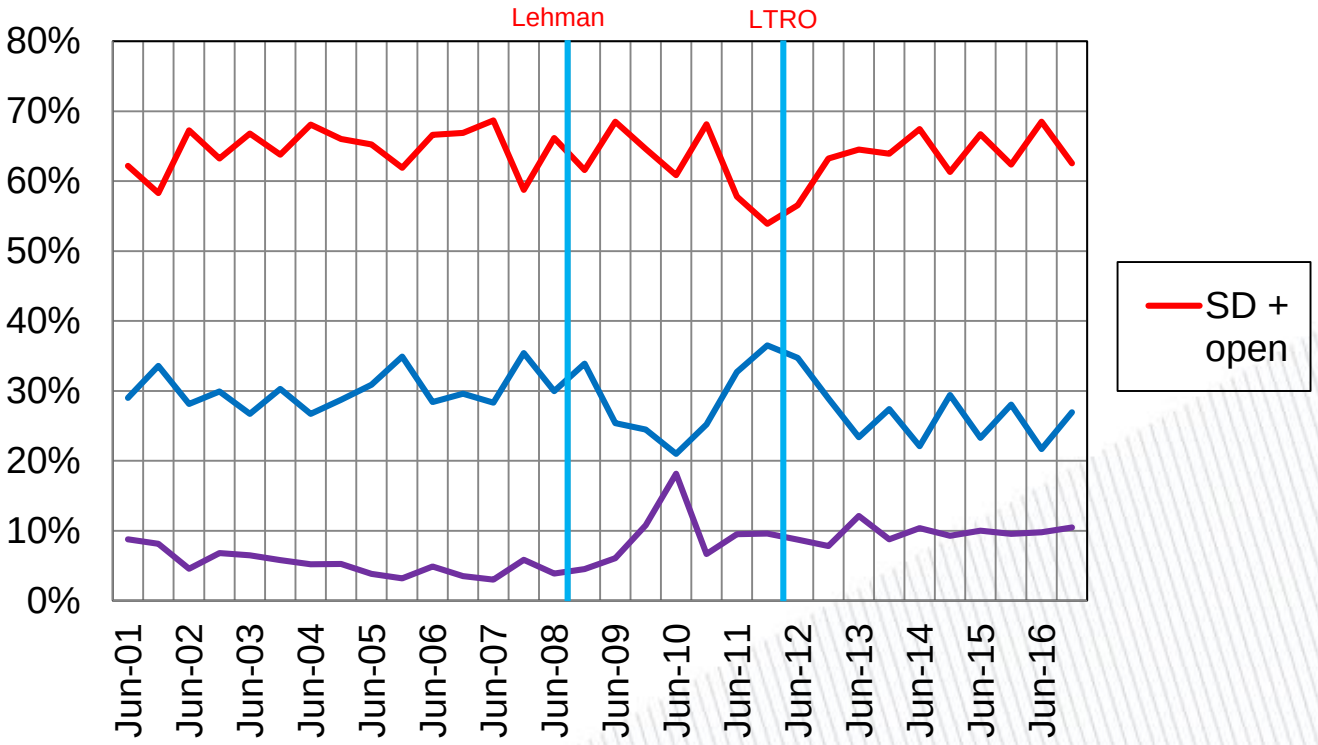
Maturity Analysis



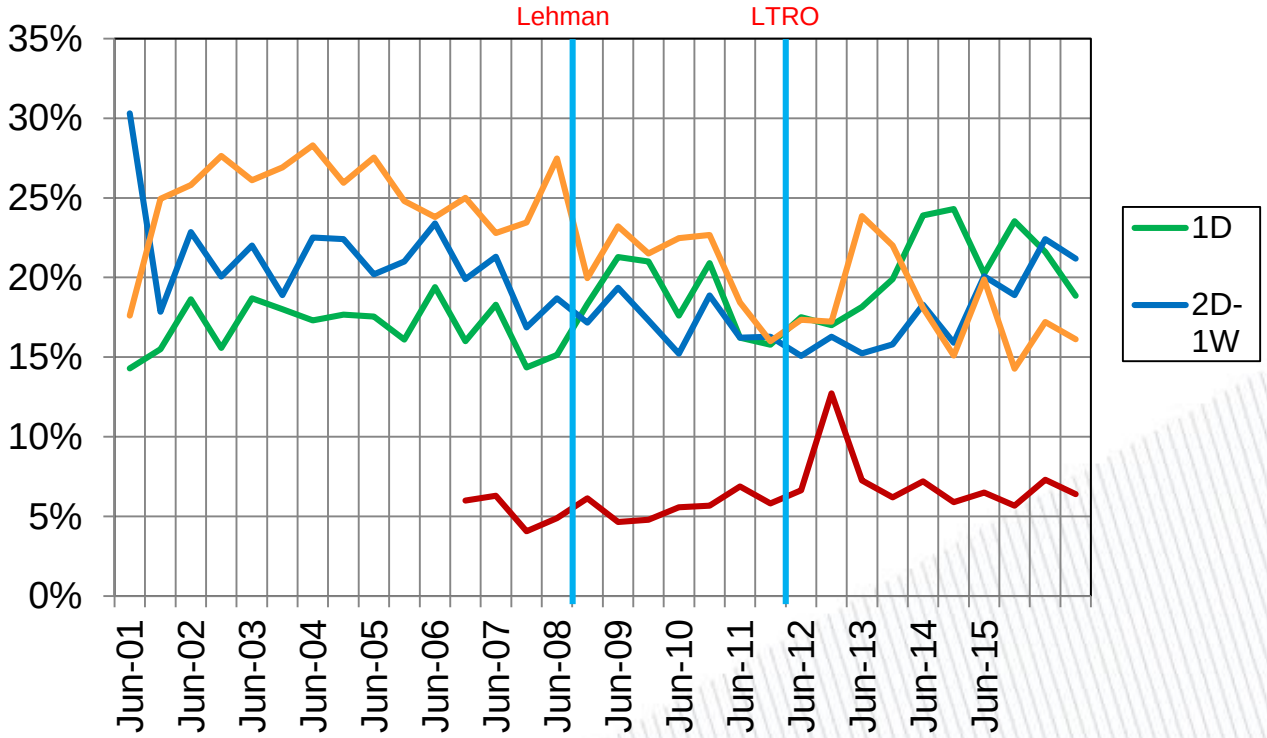
Maturity Analysis



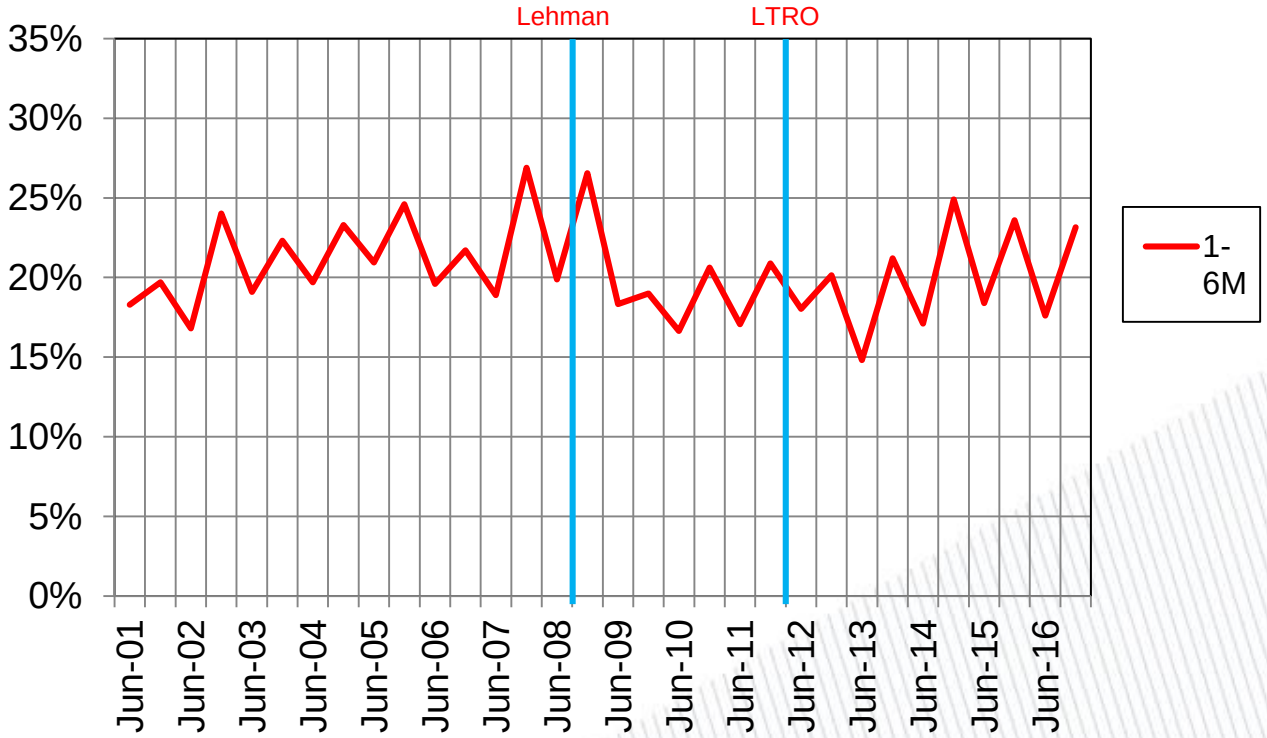
Maturity Analysis



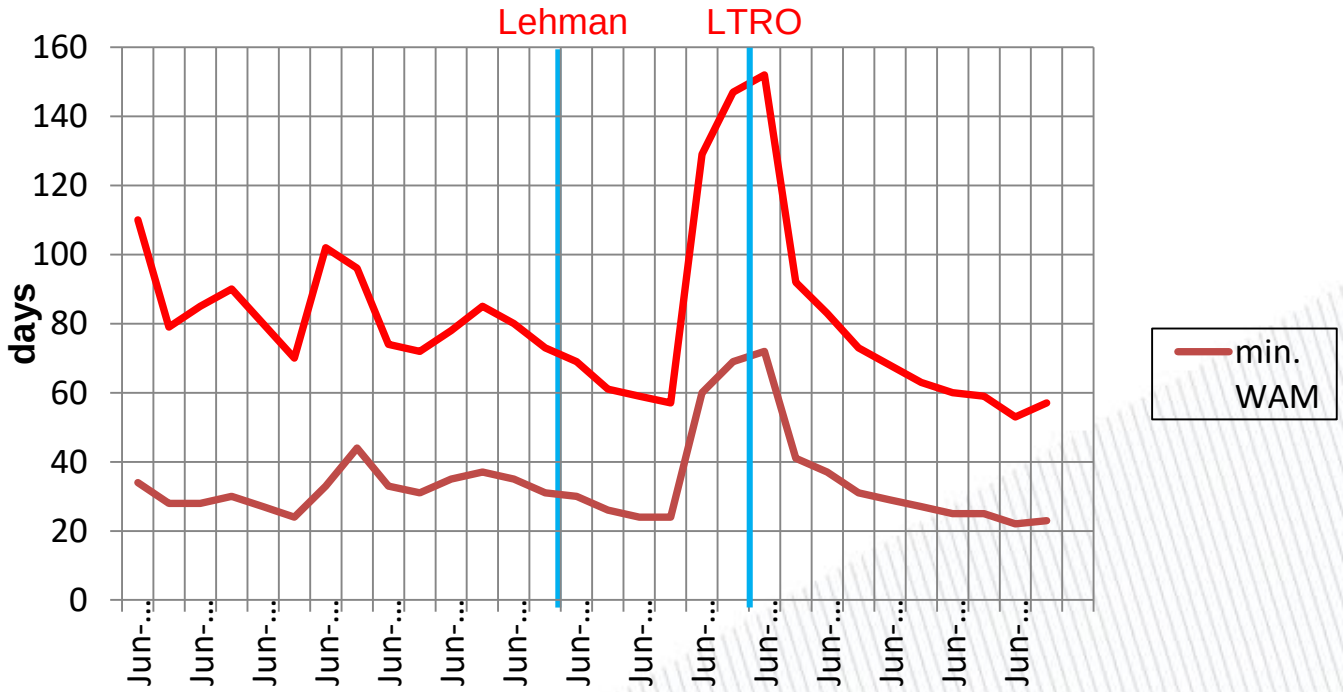
Maturity Analysis



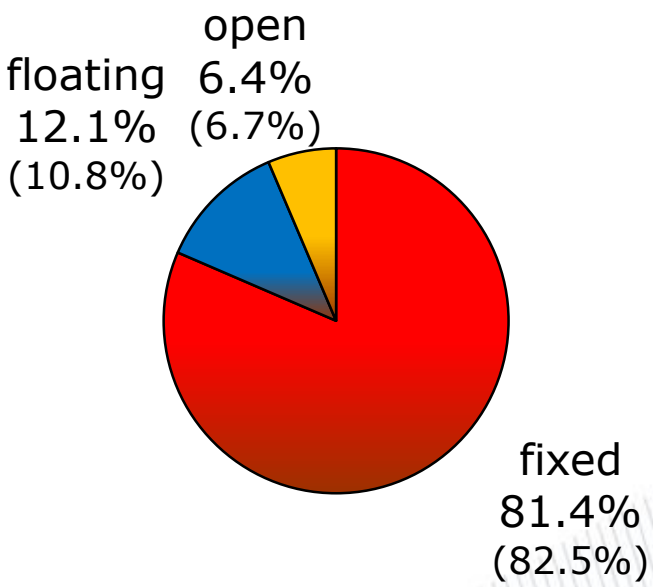
Maturity Analysis



Maturity Analysis



Rate Analysis



Next Survey

Wednesday, 7th June 2017

ICMA

International Capital Market Association

ICMA Workshop: Professional Repo and Collateral Management
1-2 June 2017