

TEC 10[®]

PRINCIPLE & MECHANISM

Jacques FOURNIER & Philippe LAROCHE

6th June 2013



The French Bond Association
Comité de Normalisation Obligataire

Frankfurt, Germany

TEC10® – principle and mechanism

Executive summary : On June 2013 this presentation has been done in Frankfurt by Jacques Fournier and Philippe Laroche. With capital markets expansion, yield fixing is crucial. As far as the TEC® is concerned, its fixing is under the responsibility of the FBA (CNO) which has set up a full process based on a Chinese wall between data provider and calculation agent. The European Prospectus Directive requires TEC® structures disclosures in EMTN programs and FBA reminds market participants that it owns the TEC® trade mark. Also in this presentation, readers could find a comparable analysis between the French TEC®, the UST CMT and the German REX® as well as a TEC10® FRN pricing introduction.

Many thanks to Pierre Lebel, Société Générale Paris, Klaus von Massenbach and Max Gerling, Société Générale Frankfurt, for the event organization.

Résumé: Cette note a été présentée par Jacques Fournier et Philippe Laroche à Francfort en juin 2013. Avec le développement des marchés de capitaux, les modalités de fixing des taux sont devenues cruciales. Pour ce qui est du TEC®, le fixing est de la responsabilité du CNO (FBA) qui a mis en place un processus de fixing basé sur la distinction entre les contributeurs et l'agent de calcul. La directive Prospectus Européen requière une description détaillée du mode de calcul des coupons des FRN. Le CNO rappelle aux acteurs du marché que le TEC® est une marque déposée. Dans cette note, le lecteur pourra trouver d'une part une analyse comparative entre le TEC®, le CMT et le REX®, qui sont respectivement l'équivalent aux USA et en Allemagne et d'autre part, une introduction au pricing des émissions TEC10®.

Un grand merci à Pierre Lebel (Société Générale Paris), Klaus von Massenbach et Max Gerling (Société Générale Francfort) pour l'organisation de cette rencontre.

Key words: CNO, FBA, Frankfurt, TEC, the French CMT, Fixing process, US CMT, German REX, FRN market, TEC pricing, Normalization, normalisation, Inflation linked bond market, data provider, calculation agent, agent de calcul, contributeurs, directive, prospectus, pricing, coupon, marque déposée, trade mark

Table of content

- Section 1 : TEC[®], the French CMT
 - What is TEC[®] ?
 - Fixing process
 - Its peers US CMT and German REX[®]
- Section 2: Market approach
 - Development of the FRN market
 - TEC[®] FRN pricing introduction
 - Indicative Terms & Conditions
- Appendix
 - Normalization trend in the Inflation linked bond market

Section 1: TEC[®], the French CMT

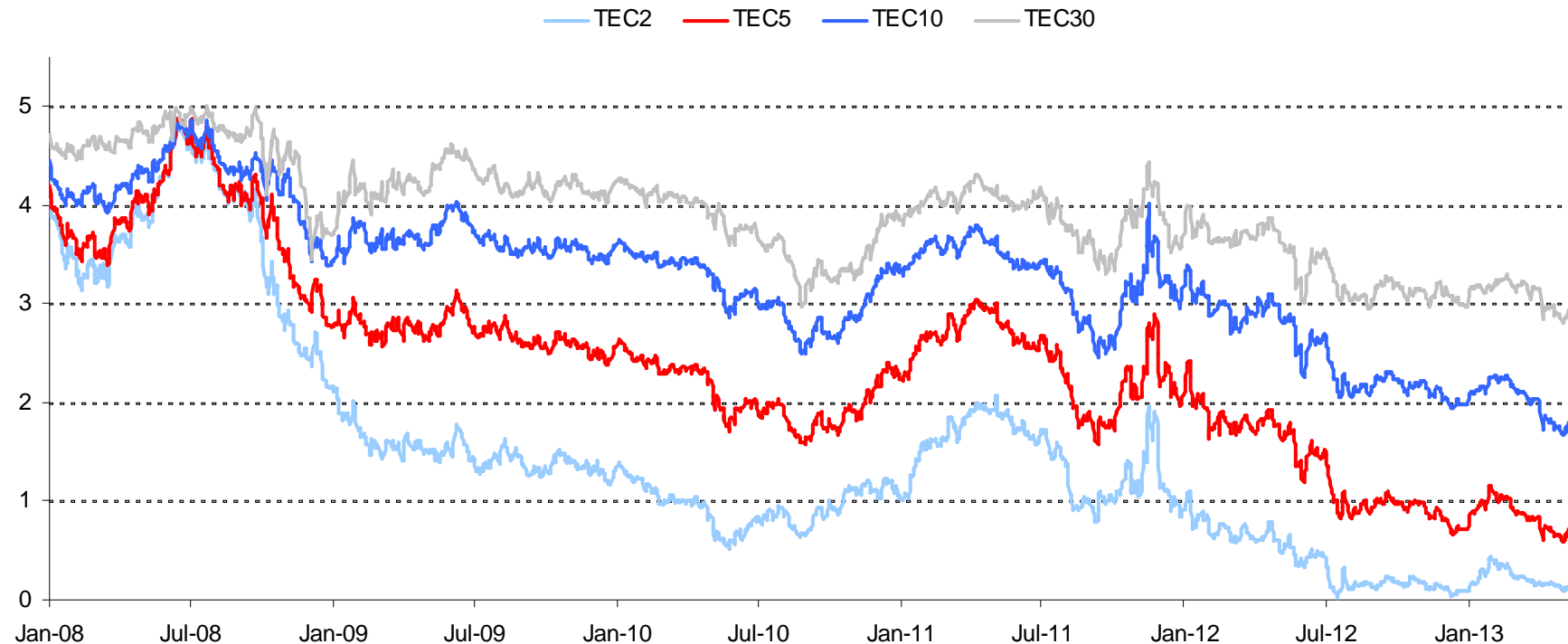


The French Bond Association
Comité de Normalisation Obligataire

What is TEC[®] ? (*Taux Echéance Constante*)

- The CNO TEC[®] is a **generic** yield linked to the French Government bond curve; its value is defined according to a specific tenor : e.g. 2 years, 5 years, 10 years or 30 years.
- It has been created in 1996 when French State issued its inaugural OAT TEC10[®]. Since then it is a community trade mark owned by the CNO.
- **transparent and reliable** :
 - Calculated by independent third parties
 - Straightforward calculation method
 - Data are freely available

Who is using TEC[®] series ?



On a daily basis, all market participants can access to a large range of values: TEC1[®], TEC2[®], TEC3[®], TEC5[®], TEC7[®], TEC10[®], TEC15[®], TEC20[®], TEC25[®] and TEC30[®]. This yield is largely used by French insurance companies, is explicitly mentioned within the French Insurance Code, is a proxy for various yield series such as TME, TMO, TMB, is the index (TEC5[®]) for OSEO innovative financing, for FRN Bond issuers (TEC10[®]) and also for assessing very long term liabilities (TEC30[®]).

Source: Banque de France/CNO-FBA, 17 May 2013

<http://www.banque-france.fr/economie-et-statistiques/changes-et-taux/les-indices-obligataires.html>

Fixing process

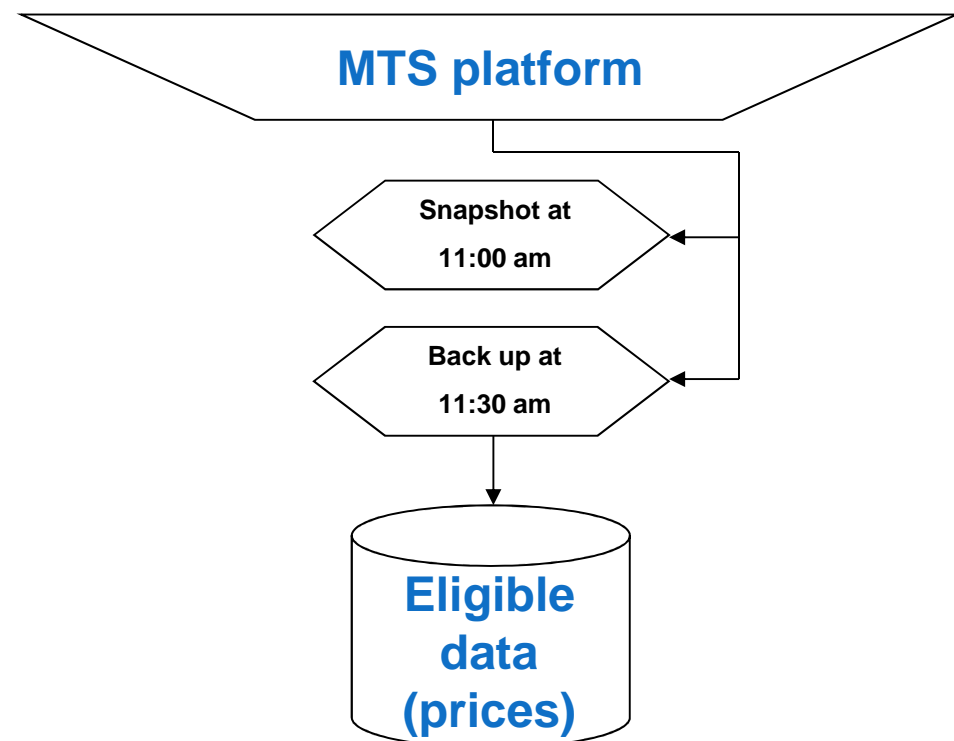
3 key features

1. Source of data are **B-to-B electronic platform**
2. **“Chinese wall”** between Data Provider (MTS) and Calculation Agent (BDF)
3. **Tests on data and linear interpolation**

Data sourcing

- The Data Provider's role is to provide from its interdealer trading platform the best prices from market participants and to supply a daily snapshot at 11:00am and 11:30am to the Calculation Agent
 - Security / best ask / best bid
 - Target calendar
- 1. Normal market conditions : fixing at 11:00am
- 2. Back up : fixing at 11:30am potentially needed in case of market liquidity or technical issue

Interdealer bond market (European primary dealers)



Calculation Agent

- **Each month, the Calculation Agent sets up the eligible assets pool (Ref's).** “Off-the-run” bonds can be considered as non eligible as when two bonds have the same maturity date, the most recent “on-the-run” bond is preferred.
- **Each TARGET day, for each TEC(n)[®], two reference bonds (Ref1 and Ref2) are selected among the eligible assets pool in order to interpolate yields and set up the index value**
the Calculation Agent can select the first Shorter (Ref1') and/or the first Longer (Ref 2') within the eligible bond pool if tests 1 & 2 fail

Test 1: “Test of Data Availability on a Ref's bond”

- If the Data provider is not able to provide a price for a “Ref's bond” (either Ref 1 or Ref 2),

Test 2: “Liquidity Test on the Ref's bond”

- For each reference bond, the **bid and ask yield spreads** are calculated based on:
 - Best bid price → best bid yield
 - Best ask price → best ask yield
- If **bid/ask yield spread $D_0 \leq 10 \text{ bps}$** → the mid price is eligible for the TEC[®] calculation
- If **bid/ask yield spread $D_0 > 30 \text{ bps}$** → the mid price is not eligible
- If **$10 \text{ bps} < \text{bid/ask yield spread } D_0 \leq 30 \text{ bps}$ and $\text{bid/ask yield spread } D_0 \leq 2x \text{ bid/ask yield spread } D_{-1}$** → the mid price is eligible

Fixing under bond market liquidity constraint

Case 1: “Market liquidity issue” on specific ref’s bonds

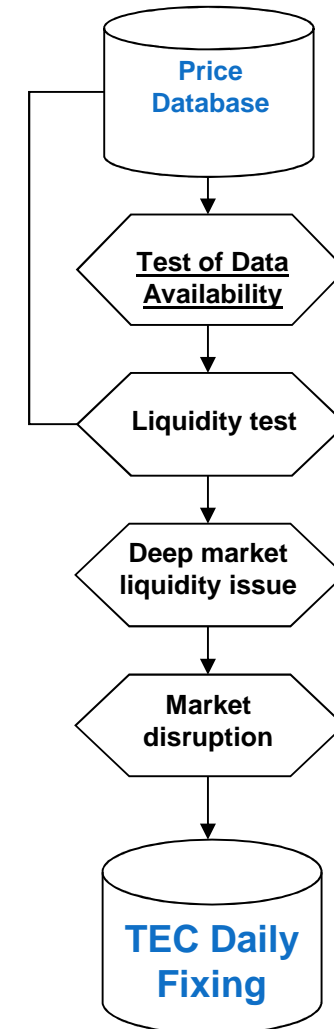
- If a Ref’s bond doesn’t meet liquidity requirement at 11:00am fixing, the Calculation Agent refers to 11:30am back up fixing

Case 2: “Deep market liquidity issue”

- If a Ref’s bond doesn’t meet liquidity requirement at 11:30am fixing, the Calculation Agent calls the 5 top SVT’s and calculates ask/bid yield on the best prices provided by the 5 top SVT’s

Case 3: “Total market disruption”: substitution clause will apply

- If prices are not available, fixing D_{-1} applies on D_0



Example: calculation of the TEC10[®] (D₀=21 May 2013)

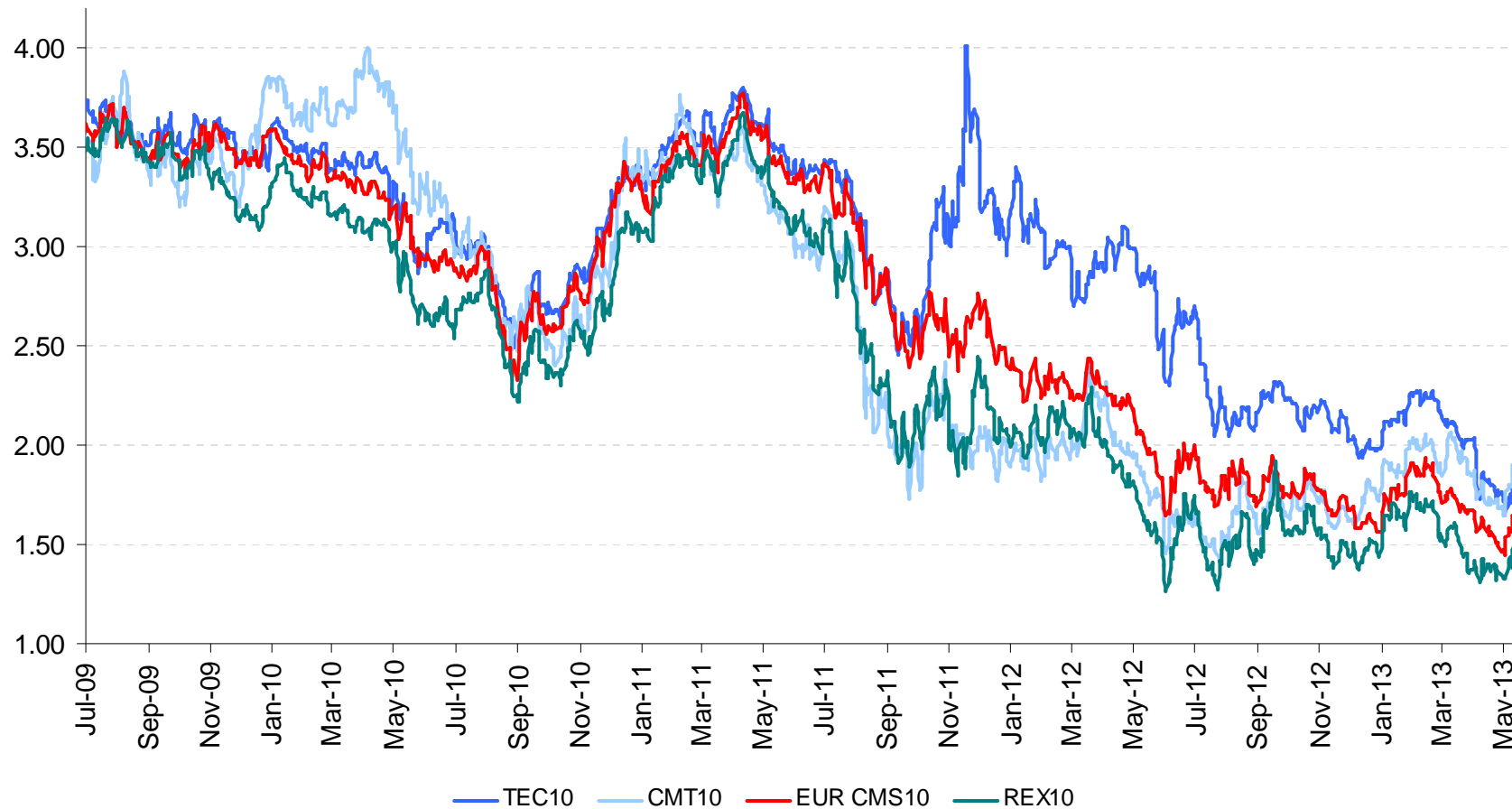
- Eligible assets pool and framing OATs set up → as of 01/05/2013 : OAT 04/23 and OAT 10/23
- **Test 1:** Data availability on 21/5/13 → prices provided by MTS (Data Provider) at 11:00am:
 - OAT 04/23: 160.63 (bid) and 160.84 (ask) / 1.791 (bid) and 1.778 (ask)
 - OAT 10/23: 121.67 (bid) and 121.84 (ask) / 1.935 (bid) and 1.919 (ask)
- **Test 2:** Liquidity test on 21/5/13
 - OAT 04/23: bid/ask yield spread at D₀ = 1.791-1.778 = 1.3bp < 10bp → eligible bond
 - OAT 10/23: bid/ask yield spread at D₀ = 1.935-1.919 = 1.6bp < 10bp → eligible bond
- Calculation of interpolated yield
 - Calculation of each mid price
 - Conversion into mid yield
 - Interpolation of yield as of 21st May 2023
- TEC10[®] on 21/05/2013 = 1.80

	BID Price	ASK Price	MID Price	MID Yield
25/04/2023	160.63	160.84	160.61	1.78
25/10/2023	121.67	121.84	121.76	1.92
21/05/2023			(interpolation)	1.80

Comparable analysis

	TEC® (French OAT)	CMT (US Treasury bonds)	REX® (German BUND)
Origin	1996	1962	1967 (end of month) 1988 (daily)
Owner	CNO/FBA	No trade mark	Deutsche Börse AG
Data Provider	MTS	FED	Deutsche Börse AG
Calculation Agent	Banque de France	FED	Deutsche Börse AG - Frankfurt Stock Exchange
Available Maturity	From 1 to 30 years	From 13 weeks to 30 years	From 1 to 10 years
Frequency	TARGET	UST trading day	FFT exchange trading day
Free Availability	BDF website	FED website	Upon request
Formula	Linear interpolation	Quasi Cubic hermit spine function - undisclosed	Regression based on a 30 synthetic bond matrix (3 different coupons x 10 different maturities) - detailed results available Upon request
On the run vs. Off the run	Yes	Yes	No, min EUR500mln outstanding
Type of data	B to B Electronic platform Snapshot - bid/ask market price – 11:00am	Contributors : primary dealers Snapshot COB 3:00pm NYT	Stock Exchange End of day - snapshot - ask prices
Technical memorandum	Yes, updated 2012	Yes, updated 2010	Yes, updated 2004

TEC10[®] and its peers



Source: CNO, FED, Bloomberg (REX[®]), 17 May 2013

Section 2: Market Approach



The French Bond Association
Comité de Normalisation Obligataire

FRN Market developments

- **New market conditions** has generated new investor needs to tackle low yield environment, rates volatility and potential “Exit Strategy”.
- Constant maturity products offer opportunities to hedge/play on yield curve movements.
- US Constant Maturity Treasuries (CMT), German REX[®], Constant Maturity Swaps (CMS) and TEC[®] are all part of the same group of index.
- Recently, the US Treasury has announced a 2 year FRN project linked to a 13 weeks CMT.
- In May 2013 *Communauté Française de Belgique* issued a 20-year FRN linked to the Belgium 8-year OLO CMT.
- Since January 2012, CMS transactions have exceeded EUR3.5bn (source MTN-i) and have confirmed this trend across Europe. Among them, two deals linked to TEC10[®] could pave the way for other TEC[®] initiatives in France

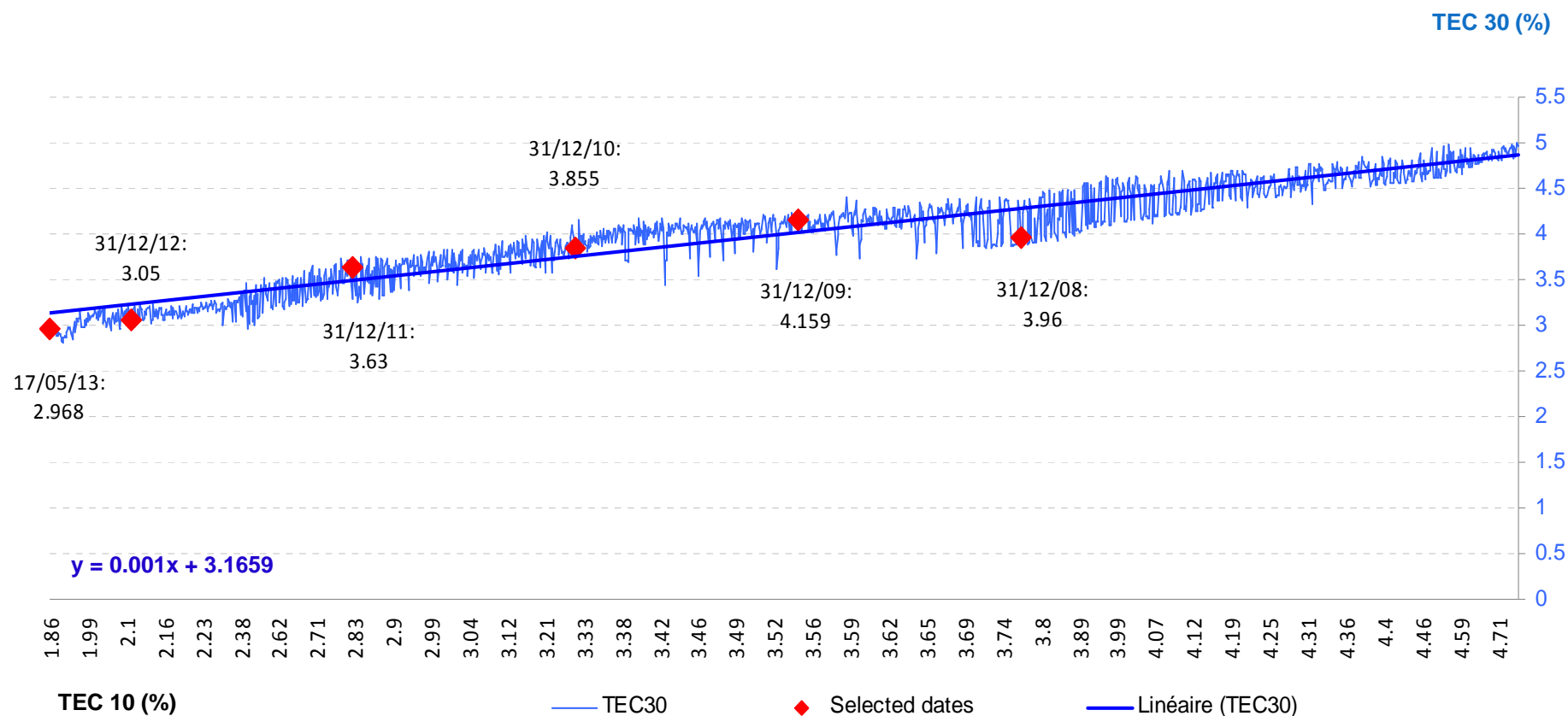
- France TELECOM – December 2021 – EUR272mln

http://www.info-financiere.fr/upload/MAN/2011/12/FCMAN135736_20111221.pdf

- AREVA – March 2022 - EUR200mln

http://www.mtn-i-3.co.uk/mtn-i_marketing/awards/2012_awards_global_europe.htm

TEC10[®] and TEC30[®] relationship... apparently “under control”

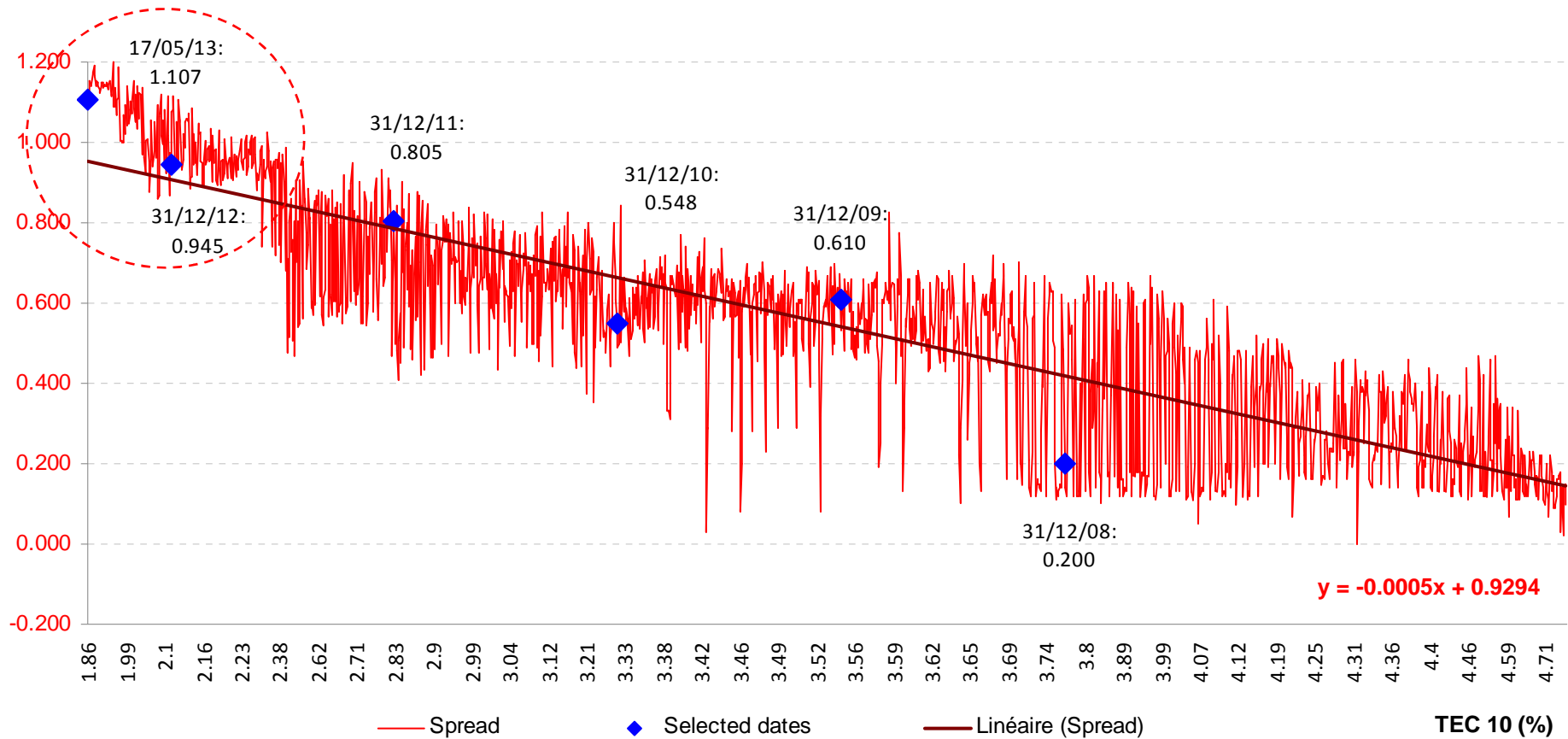


Source: Banque de France / CNO-FBA, 17 May 2013

Daily data from 02-10-2006 to 17-05-2013

Is the TEC10[®] -TEC30[®] relationship changing ?

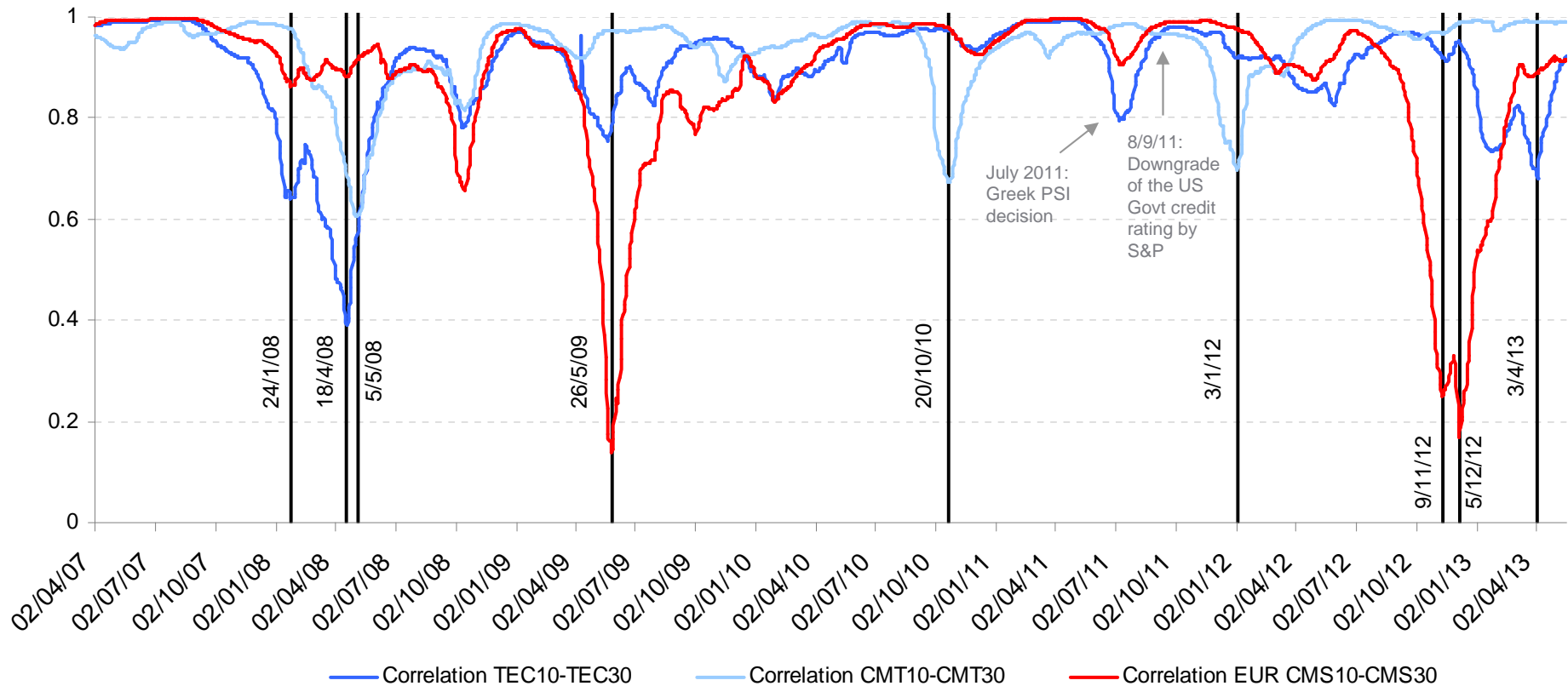
TEC 30-TEC 10 SPREAD (%)



Source: Banque de France / CNO-FBA, 17 May 2013

Daily data from 02-10-2006 to 17-05-2013

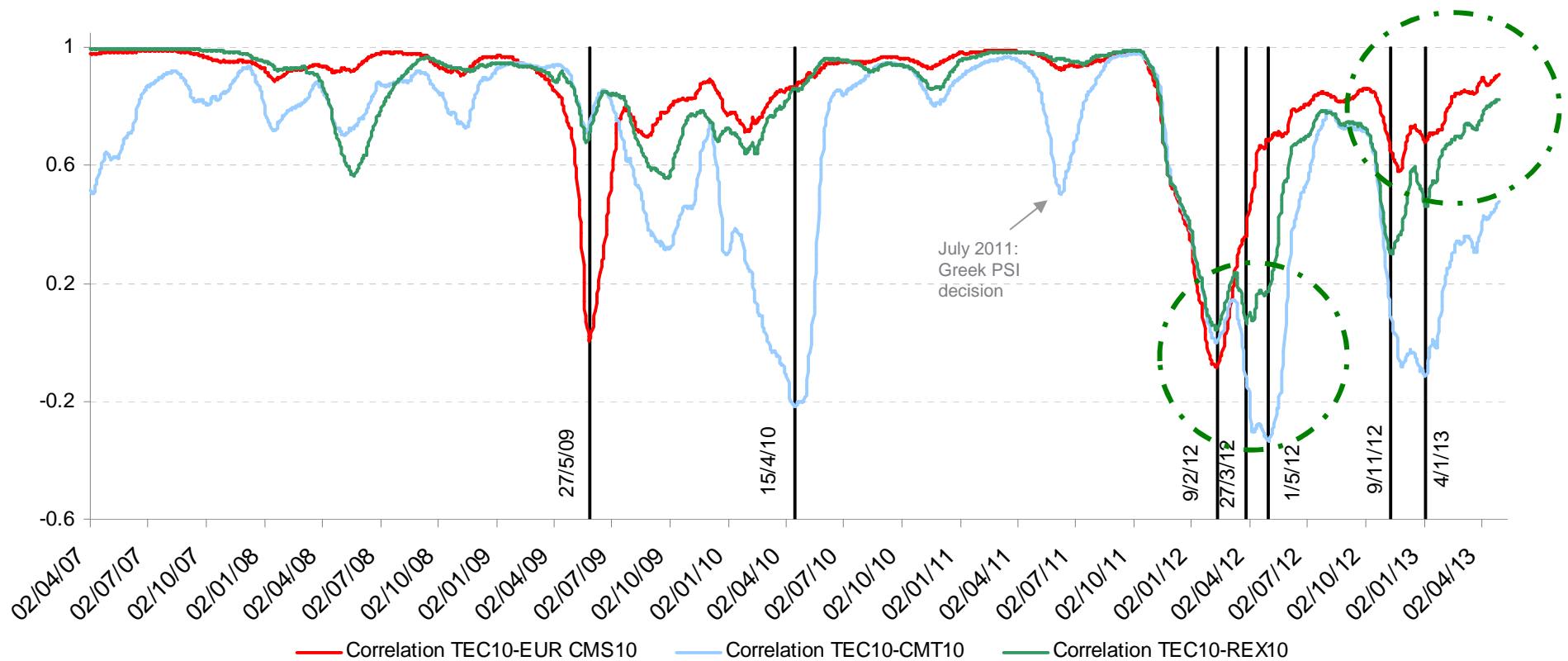
Crisis and QE may affect yield curve shapes



6 Months Rolling Correlation TEC30/10[®], CMT30/10 and EUR CMS30/10

Source: CNO, Bloomberg, 17 May 2013

Is TEC10[®] Correlation coming back to normality ?

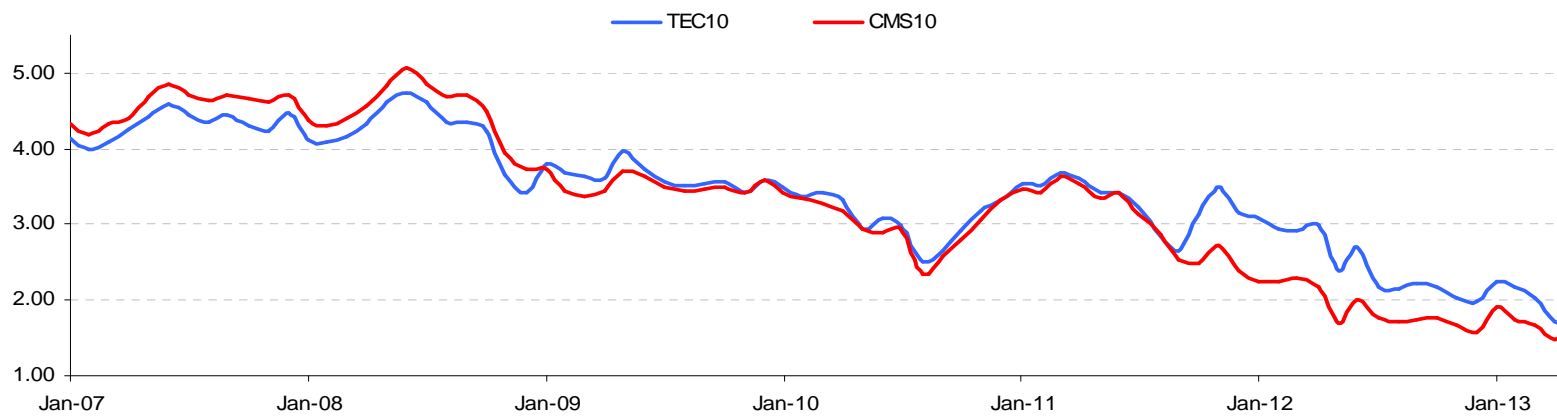


6 Months Rolling Correlation TEC10[®]/EUR CMS10, TEC10[®]/CMT10 and TEC10[®]/REX10[®]

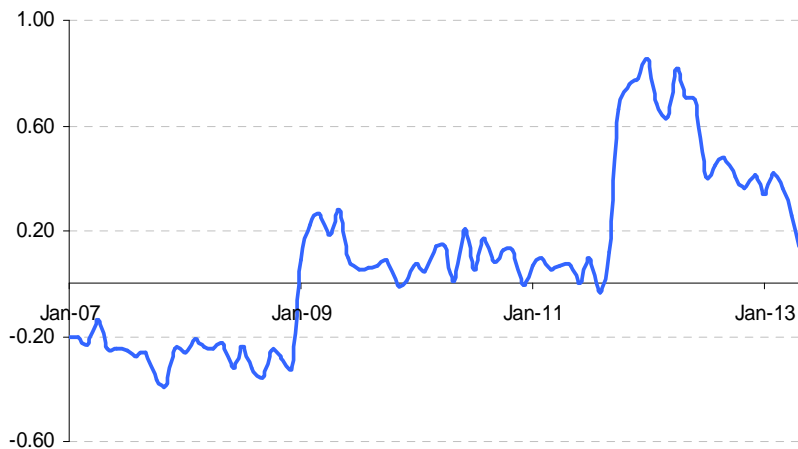
Source: CNO, Bloomberg, 17 May 2013

CMS10 vs. TEC10[®]

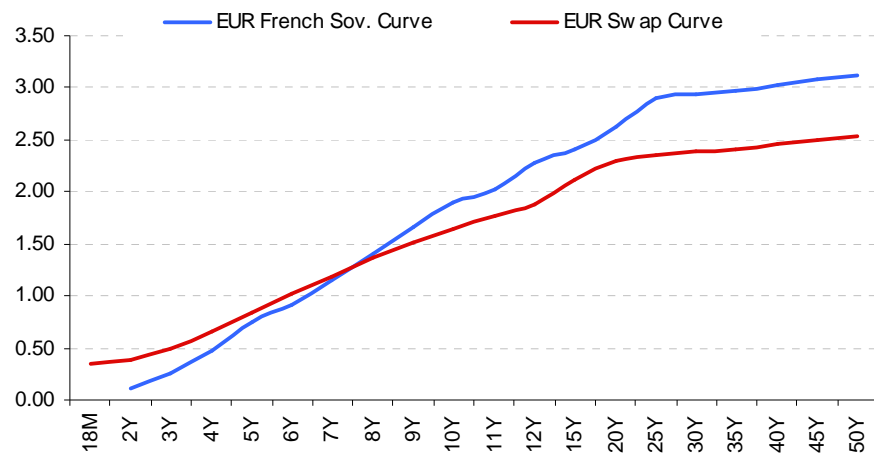
TEC10[®] vs. EUR CMS10



(TEC10[®] – CMS10) Spread

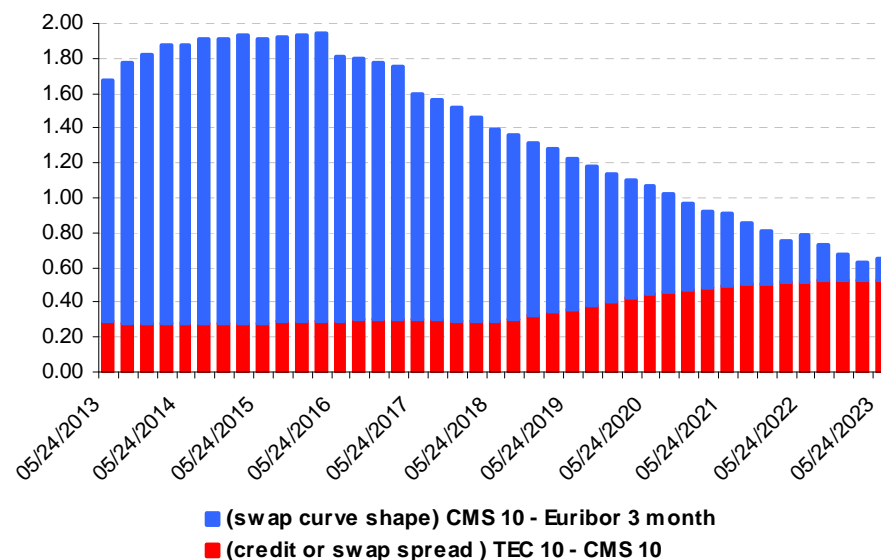
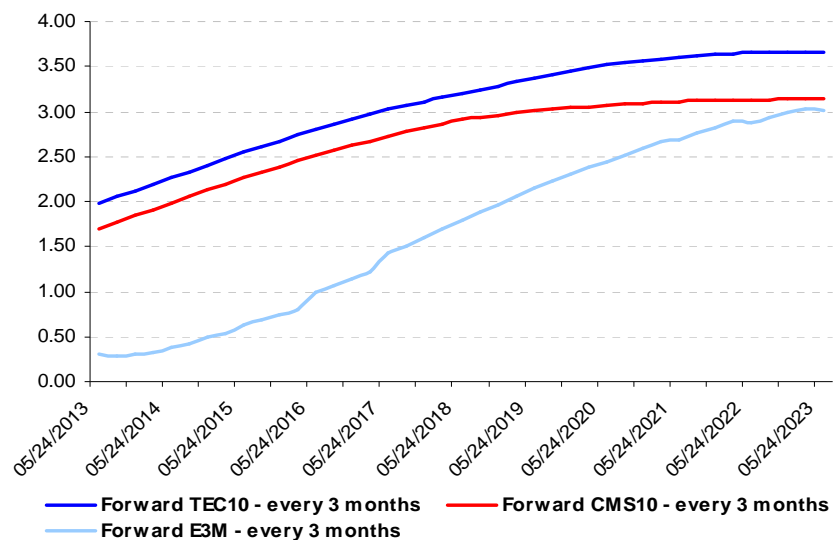


French Government Yield Curve vs. EUR Swaps Curve



Source: Bloomberg / FBA / HSBC

TEC10[®] : 4 pricing components



- 1) basis swap TEC10[®]-CMS10
- 2) basis swap CMS10/Euribor 3month
- 3) Yield volatility
- 4) Funding cost of the issuer



TEC10[®] FRN vs. Fixed and Euribor 3m FRN

	TEC10 [®] FRN OAT	Fixed rate OAT	E3M FRN OAT
Coupon	<ul style="list-style-type: none"> • Variable coupon quarterly resettable • Linked to TEC10[®] fixings • Increases if French yields raise and vice-versa 	<ul style="list-style-type: none"> • Fixed coupon Annual Act/Act • Independent of future moves in French yields 	<ul style="list-style-type: none"> • Variable coupon resettable quarterly • Linked to 3month Euribor fixings • Increases if Euribor raises and vice-versa
Indicative Pricing (21/05)	• TEC10 – 130bp	• 1.80%	• Euribor 3 months +35bp
MtM Sensitivities	<ul style="list-style-type: none"> • Almost insensitive to parallel shifts of the French yield curve • Sensitive to the shape of the curve <ul style="list-style-type: none"> ▫ MtM increases if curve steepens ▫ MtM decreases if curve flattens • Sensitive to rates volatility, due to TEC[®] convexity 	<ul style="list-style-type: none"> • Sensitive to parallel shifts of the French yield curve <ul style="list-style-type: none"> ▫ MtM increases if French yields fall ▫ MtM decreases if French yields rise • Insensitive to the shape of the curve, as long as the residual maturity-matched yield is unchanged • Insensitive to volatility 	<ul style="list-style-type: none"> • Almost insensitive to parallel shifts of the French yield curve and shape of the curve
French Credit Impact	<ul style="list-style-type: none"> • Higher coupon and almost no impact on MtM if French credit spread widens and swap rates are unchanged 	<ul style="list-style-type: none"> • Coupon insensitive to French credit spread but MtM loss if French credit spread widens and swap rates are unchanged 	<ul style="list-style-type: none"> • Coupon insensitive to French credit spread but MtM loss if French credit spread widens and swap rates are unchanged
Rates Scenarios	<ul style="list-style-type: none"> • Scenario 1: Realized TEC10[®] fixings equal to currently expected fixings → TEC10[®], Fixed rate and FRN OATs equally perform • Scenario 2: Realized TEC10[®] fixings higher than currently expected fixings → TEC10[®] outperforms • Scenario 3: Realized TEC10[®] fixings lower than currently expected fixings → TEC10[®] underperforms 		

TEC10 FRN indicative terms

Typical T&C of a 10 yr TEC10 FRN OATS		10y TEC10 FRN CADES issued in 2004 and maturing in 2020	
Issuer	[...]	Issuer Information	
Currency	EUR	Issuer CAISSE D'AMORT DETTE SOC	Identifiers
Maturity	10y	Industry Government Agencies	BB Number ED6336678
Coupon	$(1 + \text{TEC10} + \text{Fixed Margin})^{1/4} - 1$, floored at 0%	Security Information	ISIN FR0010120436
Frequency / Basis	Quarterly, Act/Act	Mkt of Issue Euro MTN	BBGID BBG00007CB87
TEC10	TEC 10 fixing 5 business days prior to start of the relevant period, as published by CNO/FBA	Country FR	Bond Ratings
Redemption	100%	Currency EUR	Moody's Aa1
		Rank Sr Unsecured	S&P NR
		Series EMTN	Fitch AAA
		Coupon 1.16	Composite AA+
		Formula TEC10 -100.0000	Issuance & Trading
		Day Cnt ACT/ACT	Amt Issued/Outstanding
		Iss Price 98.55000	EUR 1,000,000.00 (M) /
		Maturity 07/25/2020	EUR 1,000,000.00 (M)
		BULLET	Min Piece/Increment
		Issue Spread	1,000.00 / 1,000.00
		Calc Type (624)TEC10:FFR VAR NOTE	Par Amount 1,000.00
		Announcement Date 09/29/2004	Book Runner JOINT LEADS
		Interest Accrual Date 10/25/2004	Exchange Multiple
		1st Settle Date 10/25/2004	
		1st Coupon Date 01/25/2005	
		MIN CPN=0%. SERIES 99, TRANCHE 1.	

Source: Bloomberg

Key facts	<ul style="list-style-type: none"> The first coupon is based on the TEC10 rate prevailing at the bond issuance date Subsequent coupons will depend on future TEC10 fixings, ranging from the fixing 3 months after the issue date to the fixing 9 years and 9 months after the issue date
Possible coupon variations	<ul style="list-style-type: none"> Multiplicative format: coupon = $(1 + \text{Fixed Leverage} \times \text{TEC10})^{1/4} - 1$, floored at 0% Monetary basis: coupon = TEC10 + Fixed Margin, floored at 0%, quarterly, Act360

Appendix

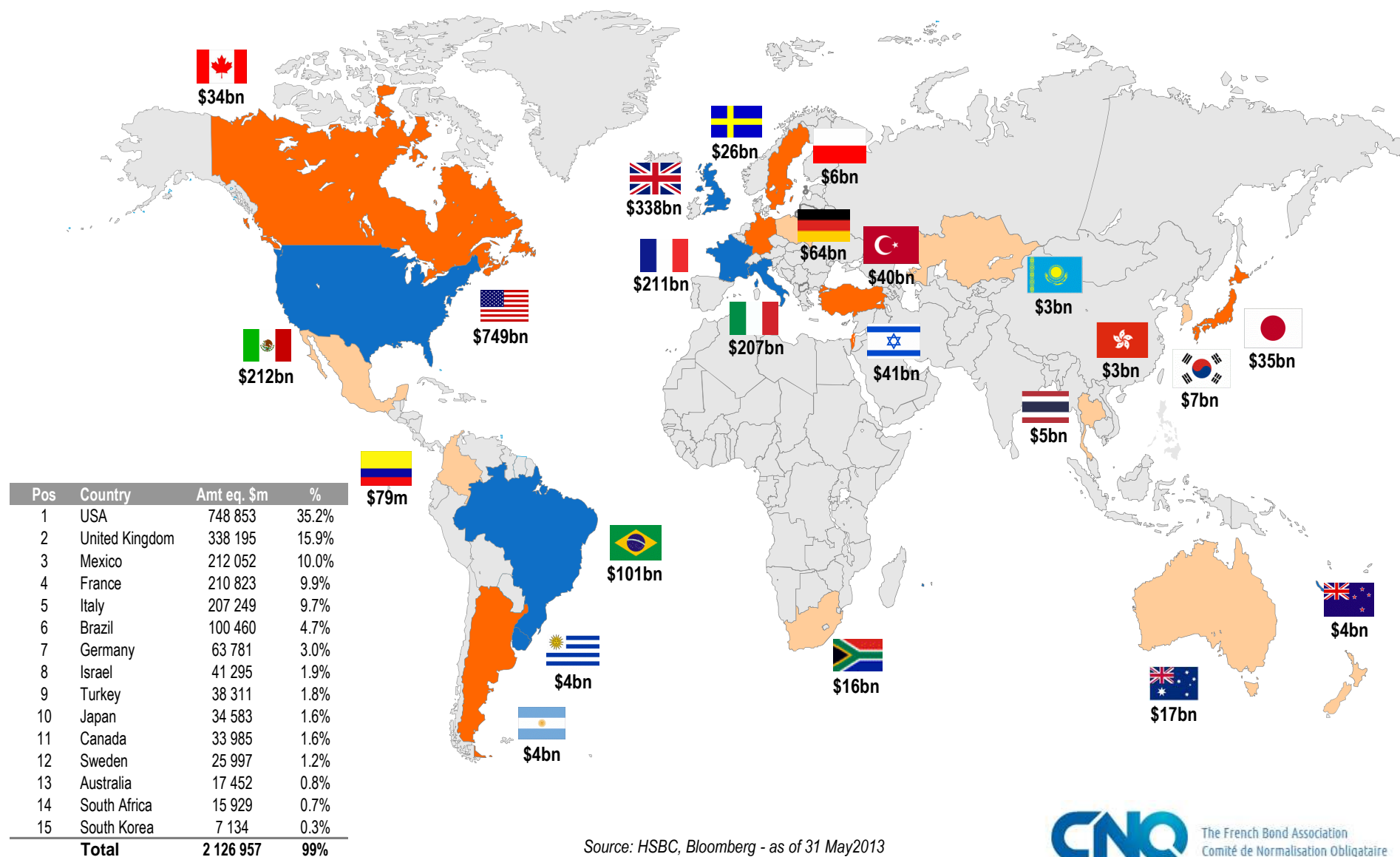


The French Bond Association
Comité de Normalisation Obligataire

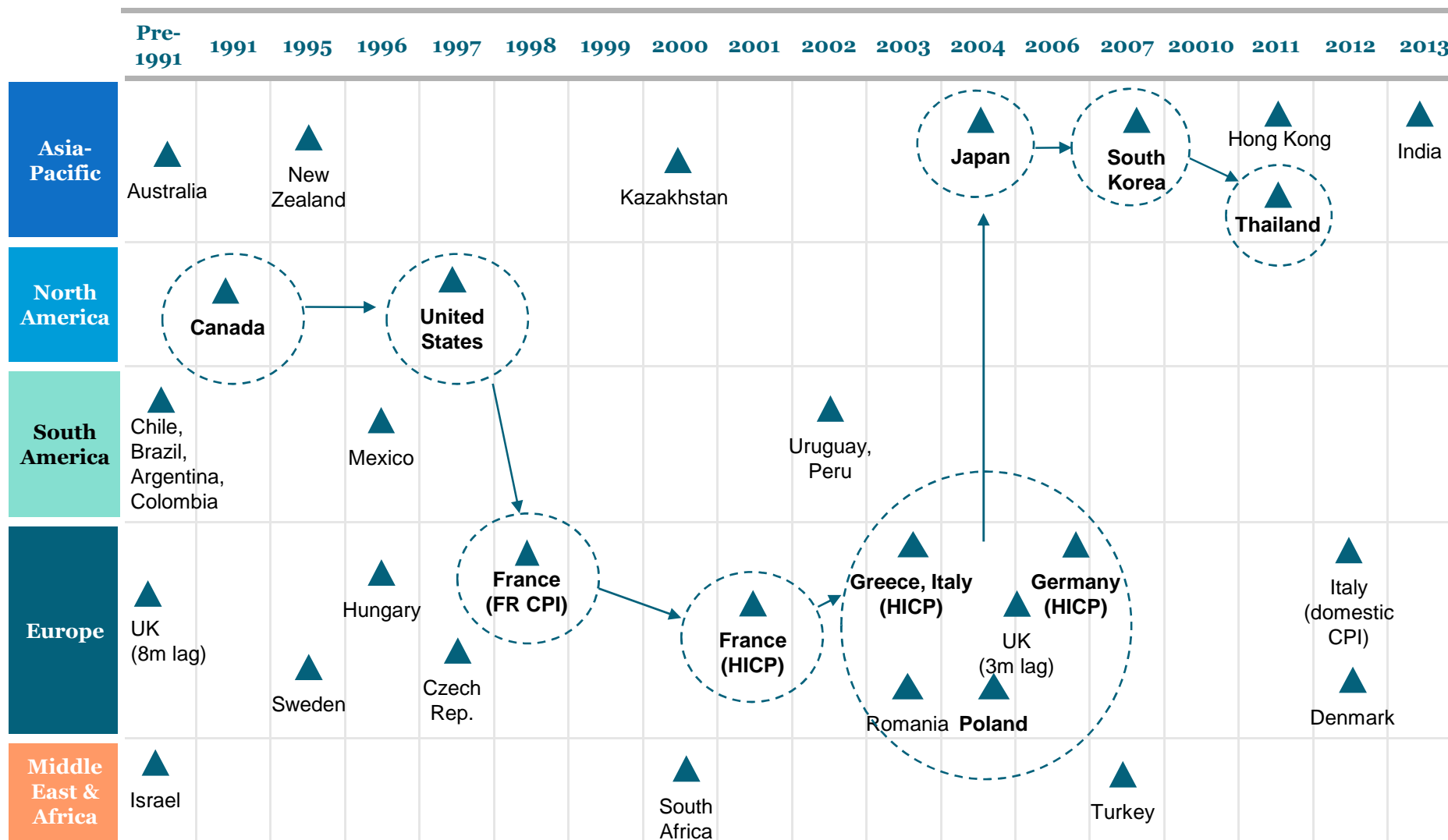
Sources

- CNO website
 - <http://www.cnofrance.org/index-gb.cfm>
 - Banque de France:
 - 1192-CNOTECBDF-UT@banque-france.fr
 - <http://www.banque-france.fr/economie-et-statistiques/changes-et-taux/les-indices-obligataires.html>
 - MTS <http://www.mtsmarkets.com/>
 - AFT http://aft.gouv.fr/rubriques/l-oat-tec-10_173.html
 - Reuters FRTEC=
 - Bloomberg:
 - TEC 10[®] : TEC10 Index <Go>
 - 10-year US CMT : H15T10Y Index <Go>
 - 10-year REX[®] : REXY10Y Index <Go>
 - FED & US Treasury
 - <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/yieldmethod.aspx>
 - <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield>
 - [http://www.treasury.gov/resource-center/data-chart-center/quarterly-refunding/Documents/TBAC Discussion Charts May 2013 r.pdf%20-%20Adobe%20Acrobat%20Pro.pdf](http://www.treasury.gov/resource-center/data-chart-center/quarterly-refunding/Documents/TBAC_Discussion_Charts_May_2013_r.pdf%20-%20Adobe%20Acrobat%20Pro.pdf)
 - REX[®]
 - http://dax-indices.com/EN/MediaLibrary/Document/REX_L_3_9_e.pdf
 - Other data vendors

Inflation-linked bonds: market overview



The inflation-linked bond market: normalization trend



Disclaimer

The information contained in this document, although established on the basis of information obtained from sources which are considered reliable by the French Bond Association (Comité de Normalisation Obligataire - CNO), are derived from publicly compiled sources and this document shall in no circumstances be used or deemed to incur any liability on the part of the CNO. Any information relating to market data are provided free of charge by the CNO on an indicative basis only, in particular for the purposes accounting valuations. Such information is capable of evolving at any time, as a result of market conditions. The CNO does not give any assurances as to the accuracy or completeness of such information and reserves the right to modify such information without having to notify any of its counterparties. This information remains the property of the CNO or of any third party from whom the CNO has obtained such information. Accordingly, the counterparty undertakes to use such information solely for internal purposes and not to reproduce, distribute or publish any such information without the prior consent of the proprietors of such information. The CNO shall not be responsible for any differences in valuations between its own data and that of any third party. The CNO shall not be required to update or to continue to publish any information so provided.

All rights reserved – Reproduction for educational and non-commercial purposes is permitted provided the source is acknowledged