QIS 5 Technical Specification
Risk-free interest rates

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1. Executive summary

We would like to thank you for the opportunity to specify certain aspects of the risk-free interest rate term structure for QIS 5 as set out in your letter of 11 February 2010. A summary of our proposal is contained at the end of this section. The remainder of the technical paper is set out in four sections to cover the aspects of the risk-free interest rate term structure which you sought from the European Insurance CFO Forum and CRO Forum. For the 18 currencies highlighted by you, the four sections cover:

- Selection of the basic risk-free interest rate term structure.
- Method for adjusting inter-bank swaps for credit risk.
- Assessing the last liquid point to enter the yield curve extrapolation.
- Derivation of the liquidity premium.

In addition, there are supporting appendices which contain further technical details and a spreadsheet containing the basic risk-free interest rate curves adjusted for credit risk ("CFOF_CROF_QIS 5 RFR Curves.xls").

Given the timescales for QIS 5 and the breadth of currencies in scope, we have had to make a number of simplifying assumptions which are highlighted in this paper. These matters will need to be reconsidered for full Solvency II implementation. We remain firmly committed to work further on the identified matters in this paper.

In preparing this technical paper, we have been in regular correspondence with the CEIOPS working party that is preparing the risk-free interest rate extrapolation tool for QIS 5. The aim of the correspondence is to ensure that the distinct parts of the risk-free interest rate term structure can be combined in an effective manner. We understand that for QIS 5 purposes, the CEIOPS working party is proposing to consider two extrapolation methods – a linear method and a Smith-Wilson functional form. We recommend that other extrapolation methods are evaluated for full Solvency II implementation including, for example, the Nelson-Siegel method developed and extensively tested by Barrie & Hibbert and the method articulated in a recent CEA publication[1]. **In particular, the period of grading and method for setting the ultimate long term forward rate will need to be examined in detail for full Solvency II implementation.**

We additional draw the following matters to your attention:

- We have considered a range of methods, primarily qualitative, to assess the last liquid market data point for entry into the yield curve extrapolation. These methods have allowed conclusions to be reached for QIS 5 purposes. **For full Solvency II implementation, further analysis is required to develop quantitative measures of assessing swap curve liquidity. Consequently, the entry points in this analysis may need to be revised for full Solvency II implementation.**
- The term that the liquidity premium can be earned, especially in EUR, GBP and USD, requires further investigation for full Solvency II implementation. Specifically, to consider the full range of investments available to earn the liquidity premium in financial markets not just the subset of potentially more liquid assets used in the reference portfolio of assets to derive the liquidity premium estimate.
- We have agreed with the CEIOPS working party on extrapolation a list of secondary currencies for which we will provide market data to set the QIS 5 risk-free interest rate term structure on a best endeavours basis following 31 March 2010.

[1] http://www.cea.eu/uploads/DocumentsLibrary/documents/1265043387_cea-paper-on-macroeconomic-extrapolation-examples.pdf

- We propose that the risk-free interest rate term structure is based on the swap curve adjusted for credit risk and a liquidity premium (dependent on features of the liability). The implications of the adjustment to the swap curve will need to be considered in the calibration of stochastic asset models for the valuation of options and guarantees, specifically the pricing of equity options and swaptions.

- As outlined in our letter of 24 February 2010, we propose a reduction of 10bps to the inter-bank swap curve to reflect the impact of credit risk. **However, given the magnitude of the reduction, we question whether it is required.**

- **Though not directly within the scope of this paper, we reiterate (as also noted in our letter of 24 February) that the illiquidity premium applies to all liabilities and not just immediate annuities in payment at the point of Solvency II implementation.**

We are happy to discuss any of the matters set out in this paper with you. In the meantime we will continue to support the European Commission in its development of the Level 2 implementing measures and QIS 5.

We would like to take this opportunity to thank our members and Barrie & Hibbert who contributed to the preparation of this paper.

Summary of QIS5 proposals

		(1)	(2)	(3)	(4)	(4)	(5)
Currency	**Abbreviation**	**Inter-bank swap curve (Bloomberg ticker)**	**Adjustment for credit risk (bps)**	**Entry point to extrapolation**	**Liquidity premium 31/12/2008**	**Liquidity premium 31/12/2009**	**Liquidity premium cut-off point**
European Euro	EUR	EUSATT	10	30	179	53	15
UK Pound Sterling	GBP	BPSWTT	10	50	221	82	30
US Dollar	USD	USSWTT	10	30	231	71	30
Japanese Yen	JPY	JYSWTT	10	20	42	15	10
Swiss Franc	CHF	SFSWTT	10	15	32	9	10
Swedish Krona	SEK	SKSWTT	10	10	84	54	10
Danish Krone	DKK	EUSATT, GDBR10, GDGB10yr	10	30	62	40	15
Norwegian Krone	NOK	NKSWTT	10	10	70	20	10
Czech Koruna	CZK	CKSWTT	10	15	63	19	15
Polish Zloty	PLN	PZSWTT	10	15	63	19	15
Hungarian Forint	HUF	HFSWTT	10	15	63	19	10
Romanian Lei	RON	RNSWTT	10	10	0	0	Not applicable
Bulgarian Lev	BGN	BLSATT	10	10	0	0	Not applicable
Turkish Lira	TRY	TYSWTTV3	10	10	0	0	Not applicable
Iceland Krona	ISK	IKSWTT	10	5	0	0	Not applicable
Estonian Kroon	EKK	EUSATT	10	30	63	19	15
Latvian Lats	LVL						
Lithuanian Litas	LTL						

Notes:
(1) Inter-bank swap curves are proposed as the basic risk-free interest rate term structure for each currency. For several currencies which are pegged to the EUR (notably, DKK, EKK, LVL) the EUR inter-bank swap curve is proposed with adjustments, where required, as detailed in Section 2.
(2) The 10bps deduction to remove credit risk in the inter-bank swap curve is applied as a parallel shift to the simply compounded forward rates.
(3) The same entry point into the yield curve extrapolation is proposed for 31 December 2008 and 2009.
(4) & (5) The liquidity premium is applied additively to the basic forward swap curve up to the cut-off point where the addition applied to the forward rate is reduced linearly to zero over the next 5 years.

2. Basic risk-free interest rate

Principles for the selection of the basic risk-free interest rate

In selecting the basic risk-free interest rate for QIS 5 purposes we have used, as our guiding framework, the principles provided in our letter to you dated 24 February. In summary:

1. ***For each currency where swaps exist and are sufficiently liquid and reliable, the basic risk-free interest rate applicable to the valuation of a liability should be based on the swap curve appropriately adjusted to remove credit risk.***

2. ***When using swaps where the deposit period on the floating rate leg is not overnight an adjustment for long-term through-the-cycle credit risk appropriate to the deposit period should be made.***

3. ***Where swaps do not exist or are not sufficiently liquid and reliable from a certain point, the basic risk-free interest rate applicable to the valuation of a liability should have reference to the government curve in that currency.***

4. ***For government curves where the government is of credit quality lower than AAA an adjustment for long-term through-the-cycle credit risk should be made.***[2]

5. ***In all cases, the basic risk-free interest rates should follow a smooth progression.***

Proposed basic risk-free interest rate for QIS 5

We have examined the 18 currencies as requested in your letter dated 11 February. For QIS 5 purposes, we propose to use the local currency inter-bank swap curves as the basic risk-free interest rate for 14 of the required currencies. The exceptions are the Danish Krone, Estonian Kroon, Latvian Lats and Lithuanian Litas which are considered separately below.

Local currency inter-bank swap curves

The inter-bank swap curves are based on rates collected from Bloomberg. We have used what we believe to be the most commonly used convention in terms of compounding and term of the underlying deposit. Where available we use Bloomberg tickers with the convention XXSWTT (where XX represents the economy and TT represents the term of the swap). For example, BPSW10 is the British Pound 10 year swap rate. This ticker returns a rate with semi-annual settlement and compounding versus 6 month Sterling LIBOR as is the market convention.

It is possible to obtain alternative definitions of rates using different tickers. For example, BPSA gives an annually settled rate and alternative floating rates can be specified by the addition of an extension to the ticker, so BPSW10V3 gives the sterling swap rate versus 3 month LIBOR. However, these alternate specifications are generally not the most common method for expressing forward rates in a given market of the most liquid instruments.

[2] It is noted, though Principle 4 does not apply for the EUR, if it were the case then the government yield curve based on AAA rated government bonds would be used.

A major exception is EUR swap rates where the convention is to use annually settled rates. We therefore use the EUSA convention. There is no information available for rates using the EUSW convention as market practice is to use the annual rate. The same is also true of Bulgarian swap rates. Further, Turkish swap rates are only quoted versus 3 month LIBOR using the ticker TYSWTTV3.

All of the rates used in the analysis are based on the Bloomberg London Composite (CMPL).

Bloomberg swap rate tickers allow rates less than 1 year to be specified by the convention of expression the term with the letters A, B, C etc corresponding to terms 1 month, 2 month, 3 month etc. While these rates are described using the swap rate ticker, they will usually be derived from deposit rates as a swap with a term less than its settlement frequency may not be meaningful. However, in some cases no rate is actively supplied for these shorter terms, most notably for EUR. A potential concern with using deposit rates is the difference in behaviour that can be exhibited from the short end of the swap curve. This can create issues such as negative or excessive oscillations in forward rates. **For QIS 5 purposes, we have not specified any rates of maturity shorter than one year and propose that the short end is completed as part of the extrapolation process. This is to reflect the practical concerns detailed previously and the relatively small impact that short term rates have on long term insurance valuations. For full Solvency II implementation, this matter will need to be examined further.**

Danish Krone (DKK), Estonian Kroon (EEK), Latvian Lats (LVL) and Lithuanian Litas (LTL)

These 4 currencies are pegged to the EUR and so require specific consideration.

For DKK, we propose to use the EUR swap curve adjusted for the spread between the 10 year German and Danish government bonds (both AAA rated countries). Explicitly, the spread is determined as the 10 year Danish government bond yield minus the 10 year German government bond yield (using Bloomberg tickers: GDBR10 and GDGB10yr). The EUR swap curve is used as this is significantly more liquid than the local DKK swap curve. The spread adjustment is to convert the EUR rate into DKK (and so providing currency alignment) through the interest differential between German and Danish government bonds. The adjustment could be positive as well as negative. This represents a simplification of the current approach used by the Danish regulator for solvency purposes. Full details on the calculation of this modified curve are contained in Appendix 1.

For EEK, LVL and LTL, we were not able to source local currency swap rates or government bond prices. Consequently, we propose a pragmatic solution to use the EUR risk-free interest rate.

It is also noted that the Bulgarian Lev (BGN) is the only other currency in the scope of this paper which is pegged to the EUR. We propose to use local BGN swap curve for QIS 5 as though the EUR swap curve is more liquid there is no current standard method to translate to the BGN currency as for DKK, not least given the BBB rating of Bulgaria.

Proposals for QIS 5

For QIS 5, we propose the following inter-bank swap curves for each currency as sourced from Bloomberg. The only exception is DKK where the EUR inter-bank swap curve is adjusted as detailed previously.

Currency	Bloomberg ticker
EUR	EUSATT
GBP	BPSWTT
USD	USSWTT
JPY	JYSWTT
CHF	SFSWTT
SEK	SKSWTT
DKK	EUSATT, GDBR10, GDGB10yr
NOK	NKSWTT
CZK	CKSWTT
PLN	PZSWTT
HUF	HFSWTT
RON	RNSWTT
BGN	BLSATT
TRY	TYSWTTV3
ISK	IKSWTT

The only other country not considered in the European Economic Area is Liechtenstein. However, as the Swiss Franc is the local currency this risk-free interest rate including the associated liquidity premium would be applied.

Associated to this paper is a spreadsheet ("CFOF_CROF_QIS 5 RFR Curves.xls") which contains fitted curves (adjusted for credit risk) for each currency based on the Bloomberg data using the Barrie & Hibbert standard yield curve fitting methodology. The method uses a regression spline with smoothing constraints. This method produces rates that are very close to but not exactly equal to market rates. The average absolute error is generally less than 1 basis point[3]. It is also noted that the fits presented use all available data and do not apply the proposed cut-off points for entry into extrapolation for QIS 5 considered in Section 4.

[3] See: http://www.barrhibb.com/knowledge_base/article/a_framework_for_estimating_and_extrapolating_the_term_structure_of_interest/

3. Method for adjusting inter-bank swaps for credit risk

Background

Features such as collateralisation arrangements and the fact that the notional amount is never at risk means the credit risk in a swap contract is negligible. However, for swap contracts based on 3 or 6 month inter-bank rates there can be credit risk associated with earning the reference floating rate, as there is some risk associated with depositing the notional amount with an institution for the 3 to 6 month period. An overnight index swap is where the period of depositing the notional amount with an institution is overnight so limiting the credit risk in the floating rate. However, at this time the inter-bank swap curve represents the most liquid and therefore reliable source of data. We therefore focus on the deposit risk in inter-bank swaps.

Data analysis

The difference between unsecured inter-bank lending and secured repurchase agreement (repos) rates is commonly used by academic researchers[4] as a measure of the impact of credit risk in swap rates. Although credit risk is the main contributor to the observed difference, other elements such as differing levels of liquidity in both markets would also impact.

We sourced daily data for 3 month repos, inter-bank rates and overnight index swap rates going back 10 years for EUR, GBP, USD and JPY, where available. The data for EUR, GBP and USD was sourced from DataStream and the JPY is from Bloomberg. Detail of the data used is shown below:

Repo Rate	Inter-bank Rate
EURO REPO BENCHMARK 3MTH (EUR:FBE) – MIDDLE RATE	EURO INTERBANK 3 MTH (LDN:BBA) – OFFERED RATE
UK REPO BENCHMARK 3 MTH (LDN:BBA) – MIDDLE RATE	US INTERBANK 3 MTH (LDN:BBA) – OFFERED RATE
US BID SIDE REPO 12:00 TERM 3 MTH – MIDDLE RATE	US INTERBANK 3 MTH (LDN:BBA) – OFFERED RATE
JPY 3m Repo (JYRPC Curncy)	JPY 3m TIBOR (TI0003M Index)

We have analysed the data in a number of ways looking at the mean and median of the difference between inter-bank and repo rates. The results are shown below:

Basis Points	EUR		GBP		USD		JPY	
	Inc Crisis	Pre Crisis	Inc Crisis	Pre Crisis	Inc Crisis	Pre Crisis	Inc Crisis	Pre Crisis
Mean	21	7	31	18	31	15	14	8
Median	7	6	16	15	16	15	9	8

We also show an analysis for 6 month rates although the required data is available for fewer currencies:

Median spread (bps)	EUR		GBP	
	6 month	3 month	6 month	3 month
Inc Crisis	8	7	17	16
Pre Crisis	8	6	16	15

The analysis highlights that the impact of using 6 month rather than 3 month deposit period is around 1 basis point.

[4] See for example: (i) Li (2004) Decomposing the Default and Liquidity Components of Interest Rate Swap Spreads; (ii) Feldhutter & Lando (2004) Decomposing Swap Spreads; and (iii) Liu, Longstaff & Mandell (2000) The Market Price of Credit Risk.

Further, the quotation conventions for inter-bank rates (offer) and repo rates (mid) may exaggerate the spread slightly – making it a conservative estimate. Although in normal market conditions we would expect half of the bid-offer spread to be relatively small. We illustrate this in the table below using GBP data based on 3 month deposit period. We have not been able to source this data for other currencies.

Median spread (bps)	GBP	
	Offer - mid	Mid - mid
Inc Crisis	16	11
Pre Crisis	15	10

Conclusion

Given the relatively short history, the mean value is heavily influenced by the recent financial market crisis. Moreover, especially during the crisis other elements than credit risk might have driven the increase, so the difference can be interpreted as an upper boundary for the credit risk adjustment. In general, where we make long-term estimates these are based on very long-term behaviour of the economic variable. This is much more stable over time and less influenced by recent events. The median value is a better representation of a long run historical average or through-the-cycle-view at this time.

Considering the difference between inter-bank and repo rates for EUR, GBP, USD and JPY over the last ten years suggests a long-term through-the-cycle estimate for the credit risk priced into inter-bank rates is around 10 bps. However, given the magnitude of the reduction for credit risk, we question whether it is required.

For the other currencies, it is not been possible to perform an analysis comparing secured and unsecured inter-bank lending due to data constraints. We believe that a practical, simple and pragmatic method for dealing with this matter is necessary, especially when you consider the range of currencies needing to be covered. Further, this is consistent with the fact that it is the major international banks that trade in all these instruments.

We propose that the inter-bank swap rates for QIS 5 purposes are reduced by 10 bps for all currencies to reflect the impact of credit risk. The 10bps deduction for credit risk is applied as a parallel shift to the simply compounded forward rates. Further analysis is required for full Solvency II implementation.

Associated to this paper is a spreadsheet ("CFOF_CROF_QIS 5 RFR Curves.xls") which as noted in Section 2 contains the fitted curves, which are adjusted by 10bps for credit risk.

4. Assessing the entry point into the yield curve extrapolation

Methodology

While it may be possible to see quotes and access data for very long swap contacts, often the markets in these rates will not be deep or liquid. It is a requirement to assess the last observed liquid market data point which will serve as an entry point into the extrapolated part of the curve. Establishing which point on the curve is the last liquid point is not an easy task as data on volume of trades is not directly available by duration and the liquidity of long term swap rates may vary under different market conditions.

We have considered a range of methods to assess the last liquid market data point. These methods have allowed conclusions to be reached for QIS 5 purposes. However, given the importance of the selection and the key interaction with the extrapolation method and assumptions, further analysis is required for full Solvency II implementation.

1. Current market practice

In order to gain some insight into the liquidity of long term swap rates, we have performed two surveys. Firstly, a CRO Forum member's views[5] survey on the last liquidity point used internally by those firms at end December 2009 and secondly, a survey of investment banks conducted by Barrie & Hibbert.

The Barrie & Hibbert survey was based on the responses of three investment banks who were asked to provide their views of market conditions at time of survey (early 2010) and also general feedback on conditions as at end 2008. Responses ranged from explicit statements of a last liquid point through to general comments on swap market dynamics. The survey provides an insight, but the results should be treated with caution given the small sample size.

One message to come out of the feedback is that there is a relatively strong link between the last liquid swap and the longest available government bond for a sizeable transaction. This is because banks will often hedge a swap transaction by buying a matching government bond. Under benign market conditions, banks may be prepared to trade at longer terms as they can "warehouse" the swap until they find an offsetting transaction or they may hedge in another currency and accept some basis risk. However, both of these approaches are capital intensive and given the pressures on banks capital positions at the end of 2008 they would have been less likely to enter into such transactions.

2. Quantitative measures

Traditional quantitative techniques of assessing swap liquidity, such as bid-offer spreads and transaction volumes can provide insight and reliable independent measures. However, these are currently not available from standard sources of financial data. For example, transactions volume data is not sufficiently granular to provide meaningful results. A bottom up data collection exercise to assess these measures may add further insight.

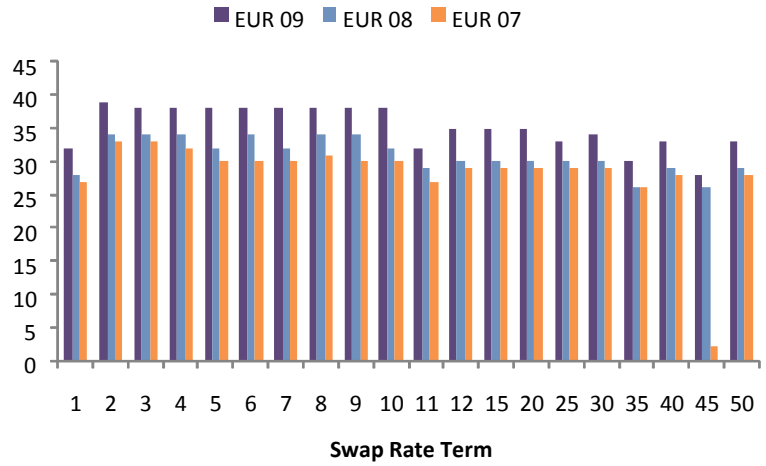
[5] There are currently 20 member firms of the CRO Forum

Data providers, in particular Bloomberg, allow you to drill down to see quotes from individual contributors. Two possible measures can be considered from this dataset, firstly, a contributor count and secondly, the quote dispersion. Perhaps counter-intuitively the dispersion generally decreases as you move to longer terms, which calls this measure into question.

The contributor count measure shows the number of institutions that contribute quotes for each rate and appears more reliable. A lower number of contributors for each point may represent a reduction in liquidity. As liquidity is a relative measure we looked at the percentage of total contributors rather than looking at the absolute number of contributors. The analysis presented is based on a snap-shot of contributions as at end December 2009.

We have also looked at the contributor analysis as at end 2008 and end 2007. In general we have seen an increase in the number of contributions over time. One point of note is that the number of quotes on long term instruments did not seem to be seriously affected by the financial crisis at the end of 2008. However, it is worth noting that these are only quotes of mid-prices and may not represent a price that a bank would actually trade. An example of the contributor analysis over time for the EUR swap market is shown below. The results are similar for other currencies.

Number of contributions to EUR swap rate (end 2007-end 2009)



3. Impact of stress market conditions

In stress market conditions the number of liquid market data points may be reduced. For example, reduced supply from banks due to change in risk appetite or increased demand by market participants due to hedging activities. In particular, we have considered the following conditions as potential evidence of reduced liquidity at the longer swap tenors:

- **Excess volatility in forward curve:** Volatility in longer tenor forward rates is significantly in excess of the level in "normal" market conditions. Further, the longer tenor volatility is disproportionately higher than the volatility of shorter tenor forward rates (where in normal market circumstances a lower volatility would be expected).

- **Forward rate curve becomes more downward sloping:** It can already be observed that forward curves are slightly downward sloping for longer tenors due to convexity, but in stress markets the downward slope can become more extreme as participants charge a negative term premium for the longest tenors.

- **Forward rates drop significantly below the ultimate long-term forward level:** One would expect that longer tenor forward rates do not significantly deviate from their long-term level (unless limited market data is available) and a significant drop versus the ultimate long-term level could be a sign of reduced liquidity of such market data points.

- **Swap rates drop significantly below longest maturity government bonds of high credit rating:** When swap rates drop significantly below AAA government bonds in a currency, this may indicate stressed market conditions, as long term government bonds are used to hedge long term swaps.

Proposed swap curve entry point into the yield curve extrapolation for QIS5

Appendix 1 displays the results of the surveys and quantitative methods detailed in the previous section. **For simplicity, we propose a single set of entry points for both 2008 and 2009. The entry points are based on the level of liquidity observed at end 2008.**

There is general market consensus that there was less liquidity in the swap market at end 2008 than 2009. As we propose the 2008 entry points for 2009 in QIS 5, it will be important to recognise the information that may exist in market prices beyond the entry points in the extrapolation technique. This is consistent with the principles developed by the CEIOPS working party on the risk-free interest rate term structure [6] (notably: *"Techniques should be developed regarding the consideration to be given to observed market data points situated in the extrapolated party of the interest curve")*. **We caution that this would be particularly true for EUR, JPY, CHF and CZK.**

Proposed entry points into yield curve extrapolation for QIS 5

Currency	Entry point for extrapolation
EUR	30
GBP	50
USD	30
JPY	20
CHF	15
SEK	10
DKK	30
NOK	10
CZK	15
PLN	15
HUF	15
BGN	10
RON	10
TRY	10
ISK	5

The entry points were selected based on the range of estimates provided from the surveys and quantitative methods. A brief explanation for each currency is contained in Appendix 1, including where potential liquidity may exist beyond these points.

We would expect that the entry points can change over time depending on market conditions and how different markets develop. For full Solvency II implementation, further analysis is required to develop the quantitative measures of assessing swap curve liquidity (for example, the interaction with the availability of bond prices) and the interaction of the entry points with the extrapolation method and assumptions.

[6] "Task Force in the Illiquidity Premium – Report – 1 March 2010"

Importance of entry point into the yield curve extrapolation in stressed market conditions

The extrapolation of market data has an important role in avoiding too much pro-cyclicality in the Solvency II framework. A solvency regime based on market values, already has built in mechanisms that in times of stressed market conditions there is an extra tendency to de-risk and therefore put extra pressure on financial markets, which could worsen again the solvency on a market value basis. The nature of, in particular, life insurance companies is such that in general their liabilities have longer durations than the available assets in the markets. This results in supply-demand pressure on interest rates for longer tenors. In a crisis situation where both insurance companies and pension funds try to de-risk such pressure can result in unbalanced markets. A clear example of this is the period end-2008 to mid-2009 in the EUR interest rate market, where interest rate forward rates dropped significantly. Similar issues also arose in the equity implied volatility market with forward volatilities increasing significantly. The role of extrapolation in such situations is to reduce the reliance on data points where the market is significantly unbalanced and promote stability in liability valuation to avoid that additional pro-cyclical effects worsen the solvency position of insurance companies.

How can this be achieved?

Firstly, the fact that the long-term unconditional forward rate is set in a stable manner and is not impacted by economic cycles is a good basis condition. However, extrapolation starts from the last observed liquid market data point. So any instability in such point is extended to longer tenors. The mechanism that provides stability is that in a crisis situation the transition point of where market data is used and where extrapolation starts is moved to an earlier point. This is also in line with the extrapolation principles agreed in the CEIOPS working party on the risk-free interest rate term structure as long-tenor swap points in such market conditions would be assessed as being illiquid. So while in liquid times the EUR swap market would be considered somewhat liquid up to a long term, in a crisis such as end-2008 this would reduce to 30 years. The stable long-term forward rate will then ensure enough stability in the remaining tenors.

How can such an unbalance be observed?

We refer to the methodology outlined previously. Furthermore, the significant drop in long-term swap rates below traded AAA government bonds in times of crisis could also be seen as an indication of demand-supply mismatch.

5. Liquidity premium

Principles over the derivation of the liquidity premium

In setting the liquidity premium for the range of currencies in scope of the calibration, we apply the relevant principles from the CEIOPS working party report ("Task Force on the Illiquidity Premium – Report" – 1 March 2010). In summary:

- ***The risk-free reference rate applicable to the valuation of a liability should be the sum of a basic risk-free reference rate and a liquidity premium depending on the nature of the liability.***
- ***The liquidity premium should be independent of the investment strategy adopted by the company.***
- ***The liquidity premium applicable to a liability should not exceed the extra return which can be earned by the insurer by holding illiquid assets free of credit risk, available in the financial markets and matching the cash flows of the liability.***
- ***The liquidity premium should be calculated and published by a central EU institution with the same frequency and according to the same procedures as the basic risk-free interest rate.***
- ***The liquidity premium should be assessed and quantified by reliable methods based on objective market data from the relevant financial markets and consistent with solvency valuation methods.***
- ***No liquidity premium should be applied to liabilities in the absence of a corresponding liquidity premium evidenced in the valuation of assets.***

Proposed liquidity premium term structure for QIS 5

The proposed liquidity premium term structure for QIS 5 purposes in each currency relative to the basic risk-free interest rates in Appendix 1 is details below.

*Liquidity premium term structure in per annum bps **relative to swaps less 10bps**:*

Currency	Liquidity Premium (bps)		Liquidity premium cut-off (Term)
	31/12/08	31/12/09	
EUR	179	53	15
GBP	221	82	30
USD	231	71	30
CHF	42	15	10
JPY	32	9	10
SEK	84	54	10
DKK	62	40	15
NOK	70	20	10
CZK	63	19	15
PLN	63	19	15
HUF	63	19	10
RON	0	0	Not applicable
BGN	0	0	Not applicable
TRY	0	0	Not applicable

ISK	0	0	Not applicable
EEK, LTL, LVL	63	19	15

The liquidity premium is applied additively to the basic forward swap curve up to the cut-off point where the addition applied to the forward rate is reduced linearly to zero over the next 5 years.

For all currencies, the cut-off point for the liquidity premium is less than or equal to the entry point into the basic risk-free yield curve extrapolation.

The following appendices are included to support the assessment:

- Appendix 2 – Derivation of the EUR, GBP and USD liquidity premium term structure
- Appendix 3 – Full calculation of the liquidity premium proxy measure for EUR, GBP and USD
- Appendix 4 – Liquidity premium for YEN and CHF currencies
- Appendix 5 – Liquidity premium for SEK, DKK and NOK currencies
- Appendix 6 – Liquidity premium for other currencies

In determining the liquidity premium for QIS 5 purposes a number of simplifications have been made due to data limitations and time constraints in preparing the calibration. **For full Solvency II implementation, the following aspects require further investigation as a minimum:**

- **Method to determine the credit spread measure used in the proxy formula for all currencies, where applied.**

- **Direct measures of liquidity premium outside of EUR, GBP and USD.**

- **Indices used as the reference portfolio of assets outside of EUR, GBP and USD.**

- **The term that liquidity premium can be earned considering the full range of investments available to earn the liquidity premium in financial markets for each currency not just the subset of potentially more liquid assets used in the reference portfolio of assets to derive the liquidity premium estimate.**

We will continue to refine our analysis in these areas.

Appendix 1:

Currency by currency basic risk-free rate curve and proposed cut-off points for entry into extrapolation for QIS 5

Notes on presented data

- The fitted curves shown in the following currency by currency assessment use the Barrie & Hibbert standard yield curve fitting methodology. The method uses a regression spline with smoothing constraints. This method produces swap rates that are very close to but not exactly equal to market rates quoted by Bloomberg. The average absolute error is generally less than 1 basis point[7].

- The fits presented use all available data and do not apply the proposed cut-off points for entry into extrapolation for QIS 5. We show spot and forward rates for swaps and government bonds as at end December 2008 and 2009. In addition, the "Swap + Adj" curves show the swap rates adjusted for through-the-cycle credit risk. In this case we have used the QIS 5 proposal of a minus10bps parallel shift to the simply compounded forward swap rates.

- All contributor counts are sourced from Bloomberg.

[7] See: http://www.barrhibb.com/documents/downloads/A_Framework_for_Estimating_and_Extrapolating_the_Term_Structure.pdf

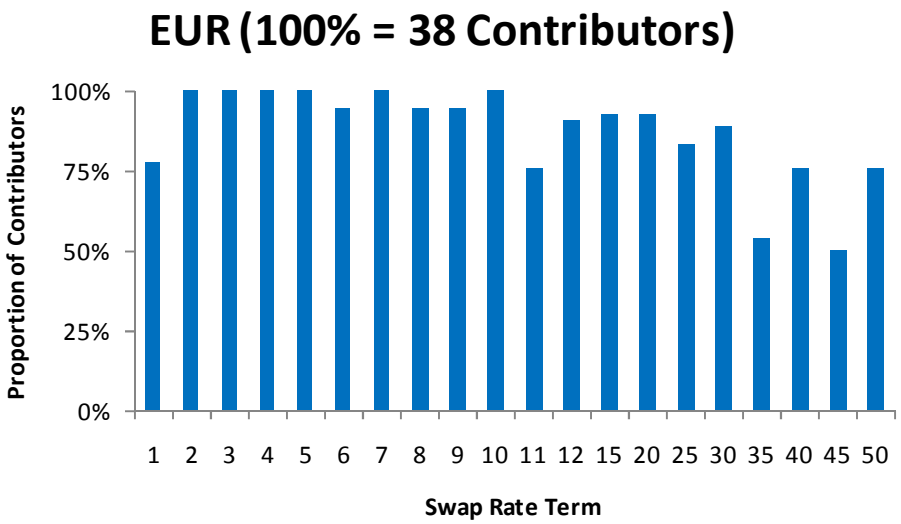
European Euro – EUR

Swap Tickers: EUSATT = Annual Settlement vs. 6 month EURIBOR

Swap Curve Liquidity:

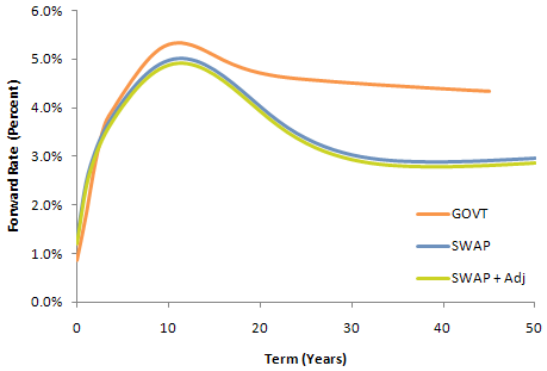
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
45.3	50	50	50

Contributor Count (Snap-shot as at end December 2009):

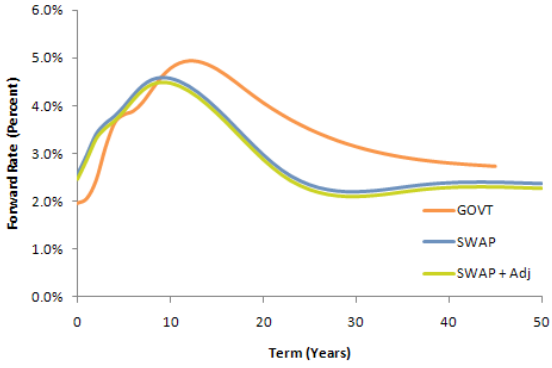


Fitted Curves:

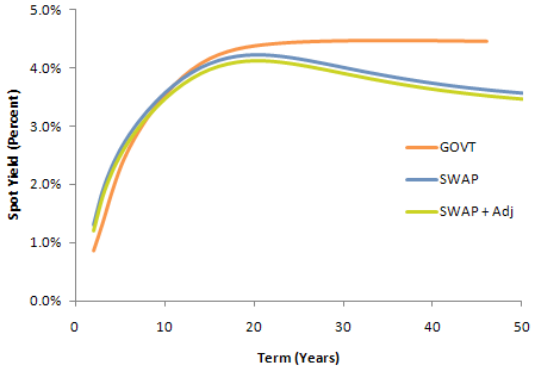
Forward Curves End Dec 2009



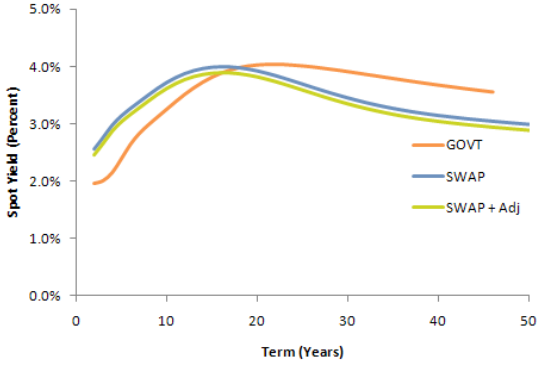
Forward Curves End Dec 2008



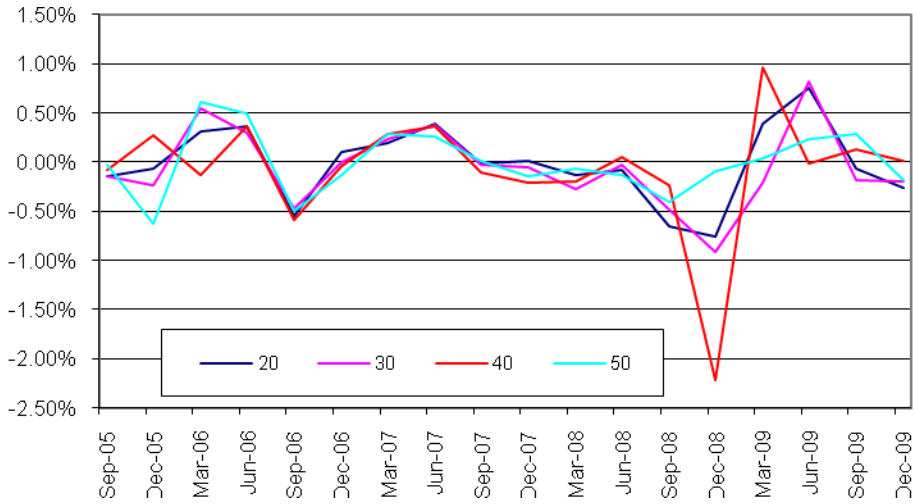
Spot Curves End Dec 2009



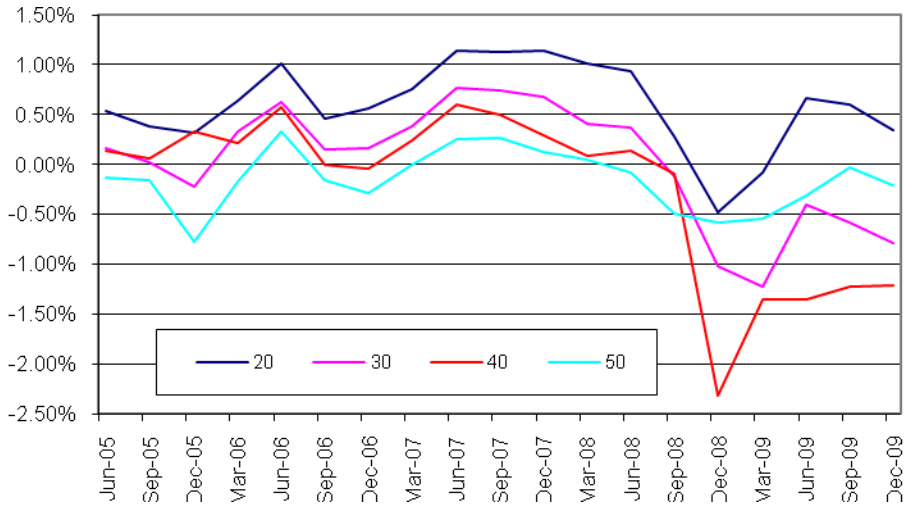
Spot Curves End Dec 2008



Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 30 years.
- Government bonds are available in significant volumes up to 30 years. Further, there are some government bonds up to 50 years in issue; however, the volumes are reduced.
- Volatility in long-term forward rates increase in Q4 2008 (up to 2% quarterly movement).
- Long-term forward rates dropped to extreme levels with 40-50 year forward rates dropping more than 30 year forwards.
- Long-term forward rates dropped significantly below the ultimate rate (up to 2% for 40 year forwards).
- **Propose 30 years entry point. There appears some liquidity up to 50 years in 2009.**

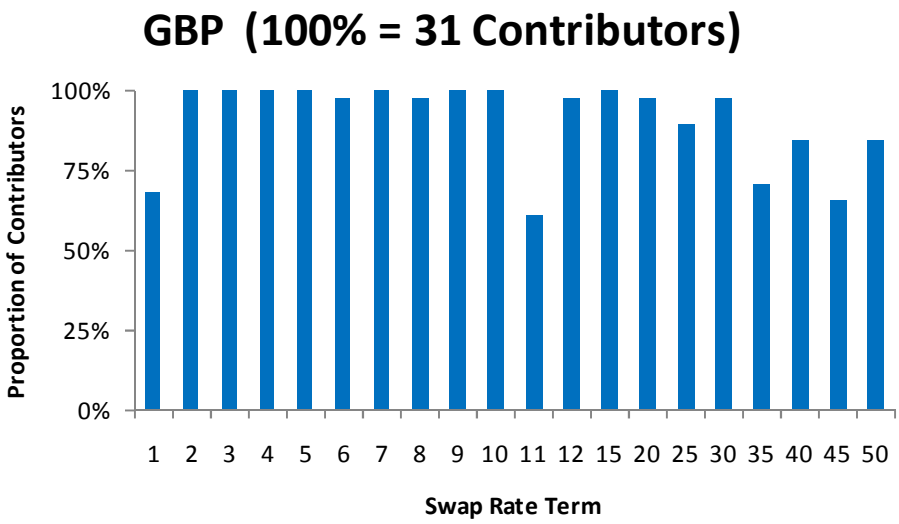
UK Pound Sterling - GBP

Swap Tickers: BPSWTT = Semi-Annual settlement & compounding vs. 6 month Sterling LIBOR

Swap Curve Liquidity:

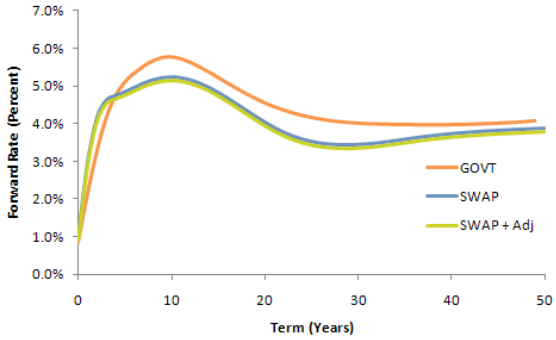
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
49.8	50	50	50

Contributor Count (Snap-shot as at end December 2009):

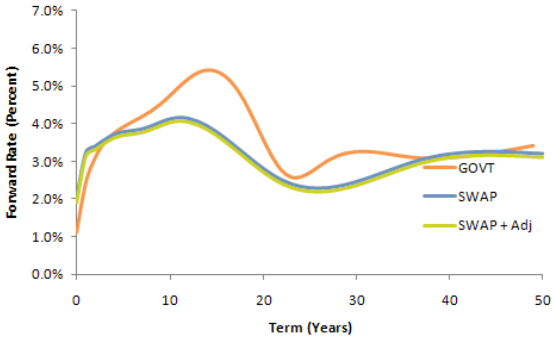


Fitted Curves:

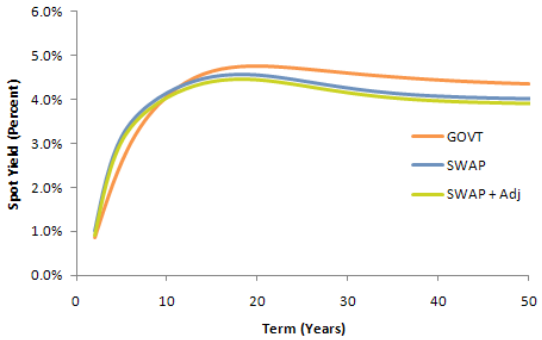
Forward Curves End Dec 2009



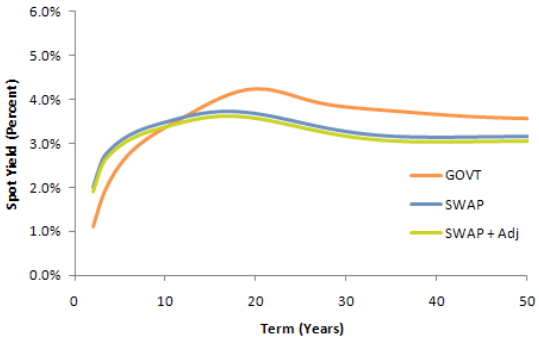
Forward Curves End Dec 2008



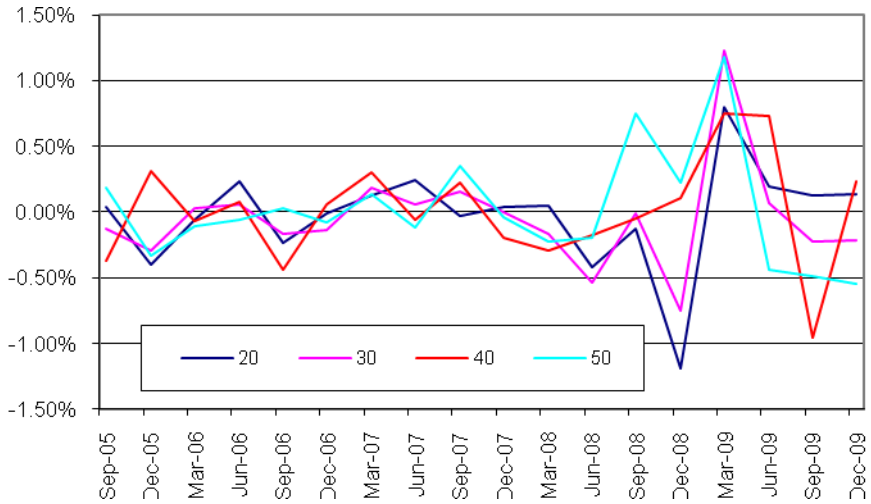
Spot Curves End Dec 2009



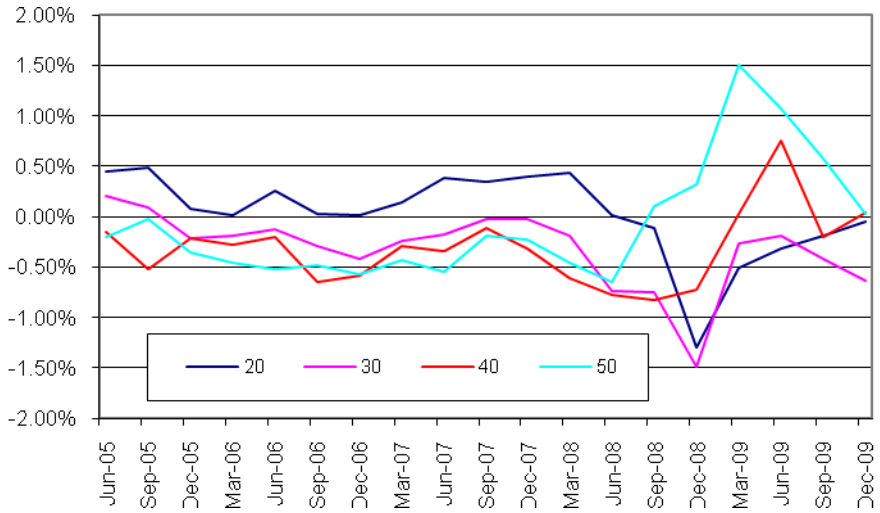
Spot Curves End Dec 2008



Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is above 75% up to 50 years.
- Volatility in long-term forward rates increased in Q4 2008 (up to 1% quarterly movement).
- However, no significant reduction in longer tenor forward rates and these remain relatively close to the ultimate forward rate.
- **Propose 50 years entry point.**

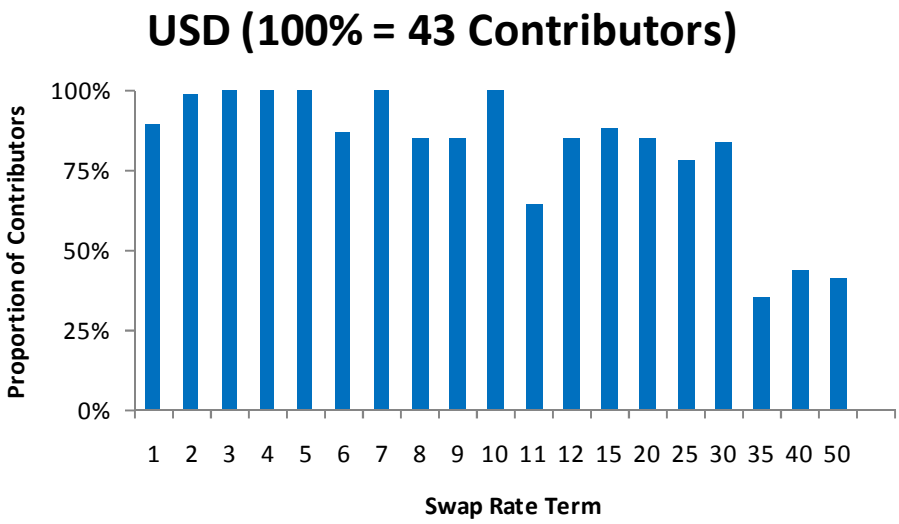
US Dollar – USD

Swap Tickers: USSWTT = Semi-Annual fixed rate vs. 3 month USD LIBOR

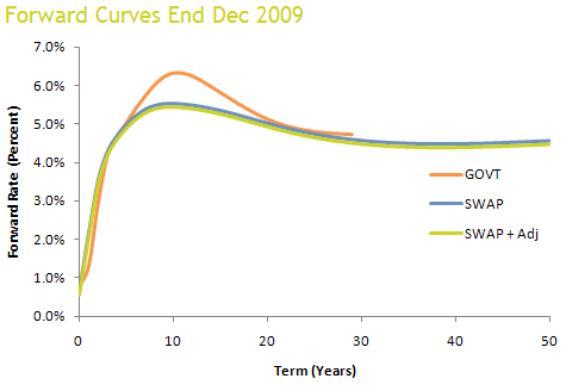
Swap Curve Liquidity:

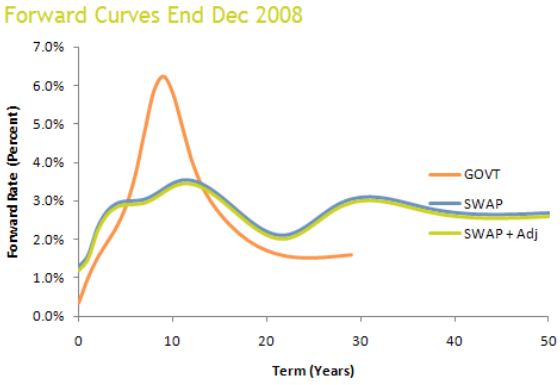
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
29.9	50	50	30

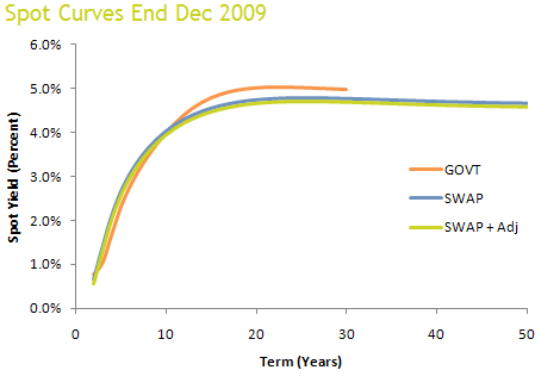
Contributor Count (Snap-shot as at end December 2009):

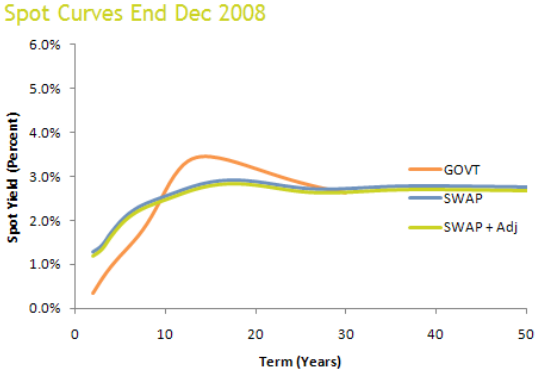


Fitted Curves:

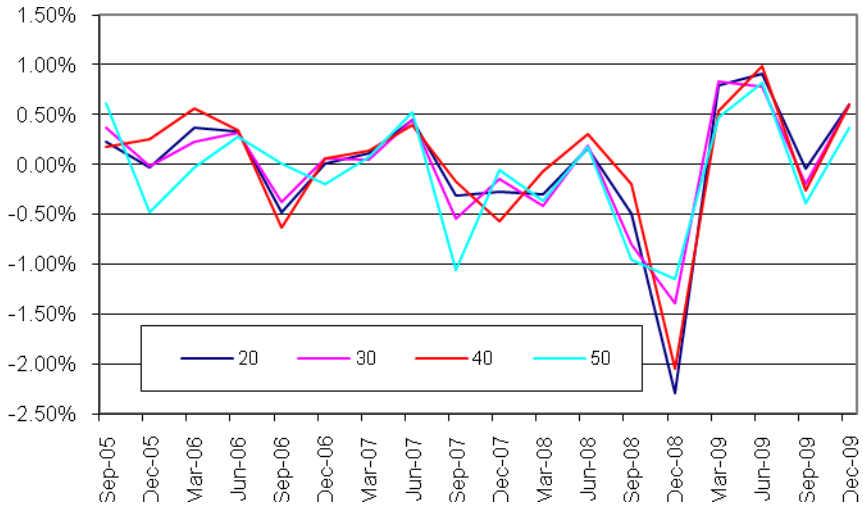




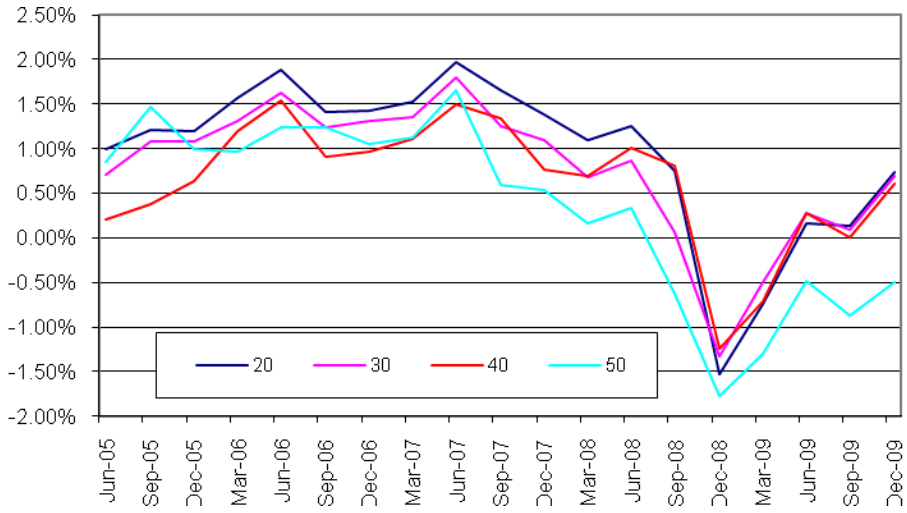




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 30 years.
- Volatility in long-term forward rates increased in Q4 2008 (up to 2% quarterly movement).
- Long-term forward rates dropped to extreme levels with 40-50 year forward rates dropping more than 30 year forwards.
- Long-term forward rates dropped significantly below the ultimate rate (up to 1.5% for 50 year forwards).
- **Propose 30 years entry point. There appears some liquidity up to 50 years in 2009.**

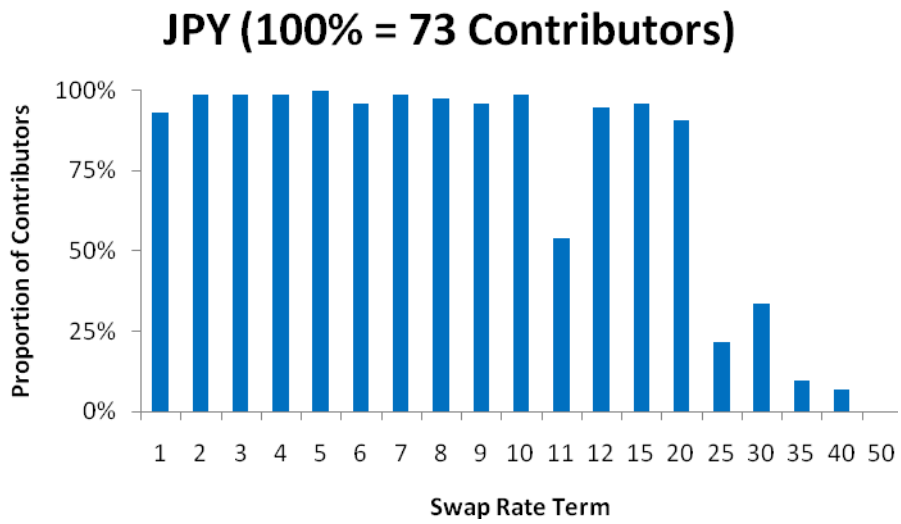
Japanese Yen - JPY

Swap Tickers: JYSWTT = Semi-annual fixed rate vs. 6 month Yen LIBOR

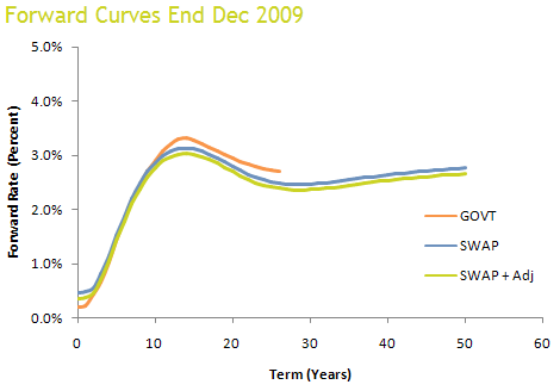
Swap Curve Liquidity:

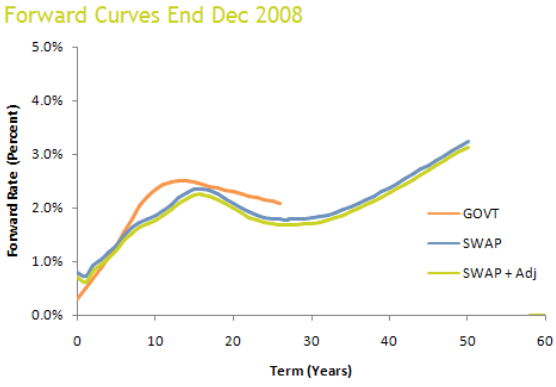
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
26.7	50	50	40

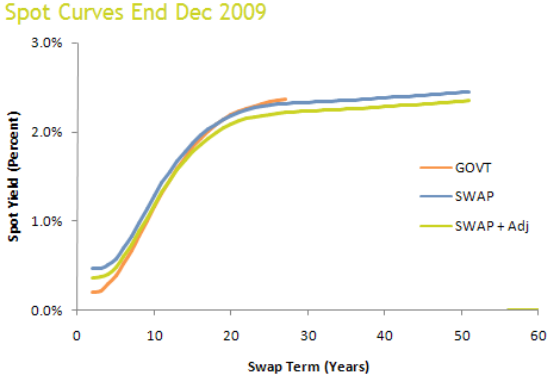
Contributor Count (Snap-shot as at end December 2009):

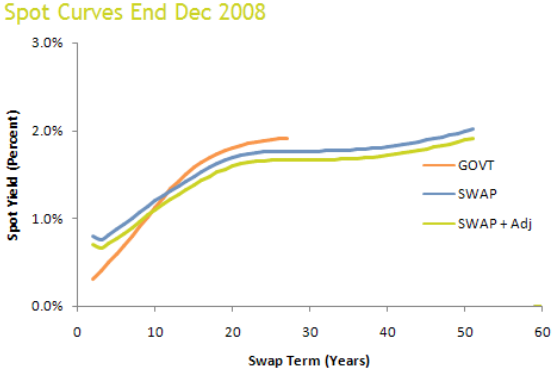


Fitted Curves:

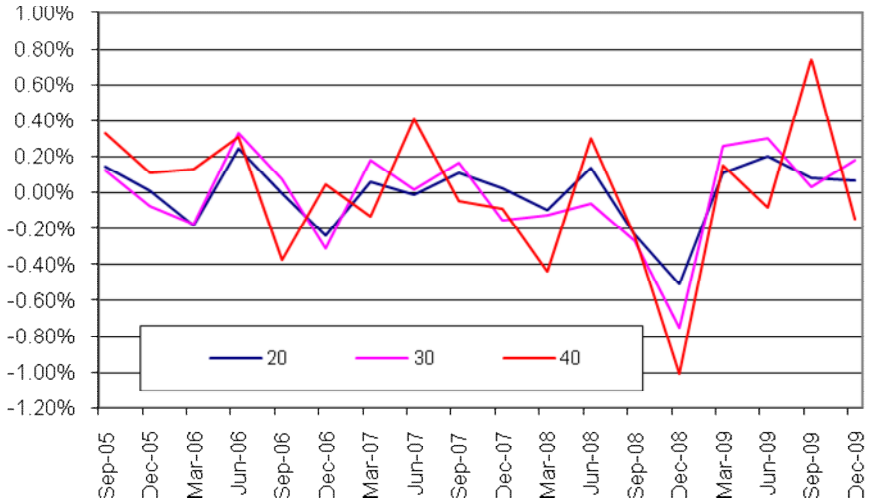




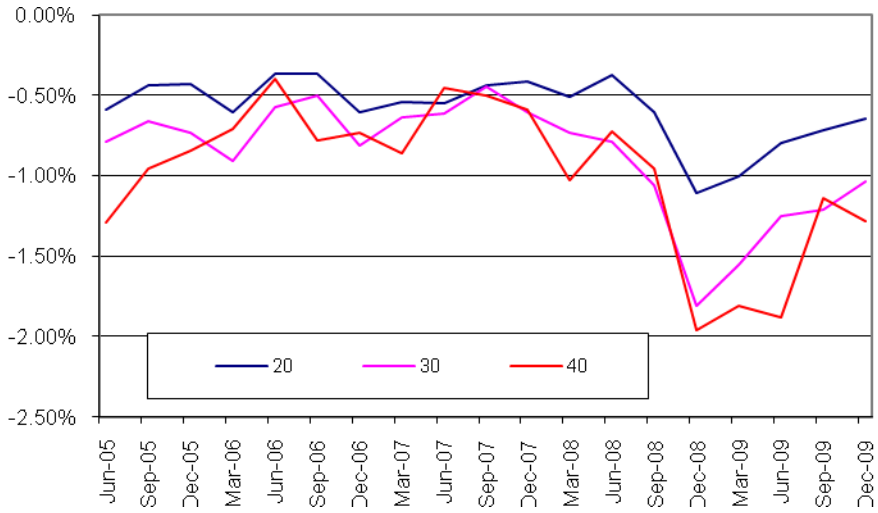




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 50% after 20 years.
- Volatility in long-term forward rates increased in Q4 2008 (up to 1% quarterly movement).
- Long-term forward rates dropped to extreme levels with 30-40 year forward rates dropping more than 20 year forwards.
- Long-term forward rates dropped significantly below the ultimate rate (up to 2% for 30-40 year forwards).
- **Propose 20 years entry point. There appears some liquidity up to 40 years in 2009.**

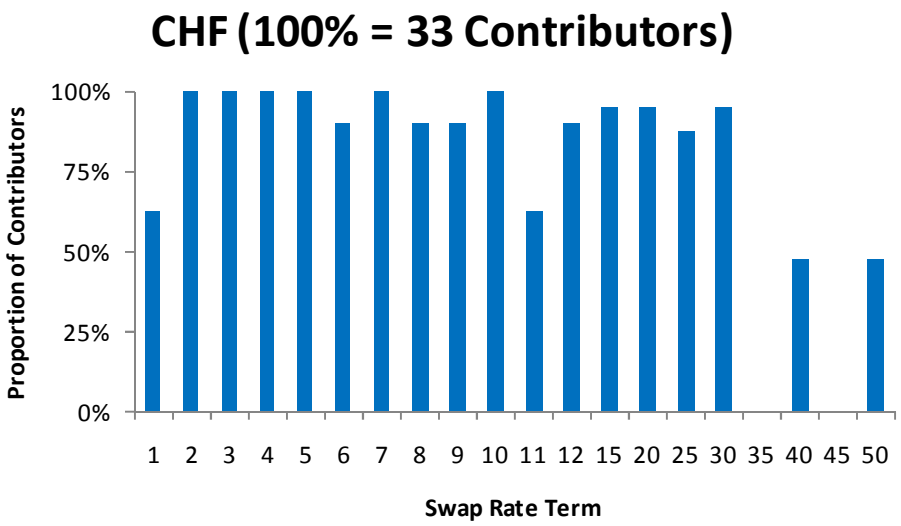
Swiss Franc – CHF

Swap Tickers: SFSWTT = Annual Settlement & Compounding vs. 6 month Swiss LIBOR

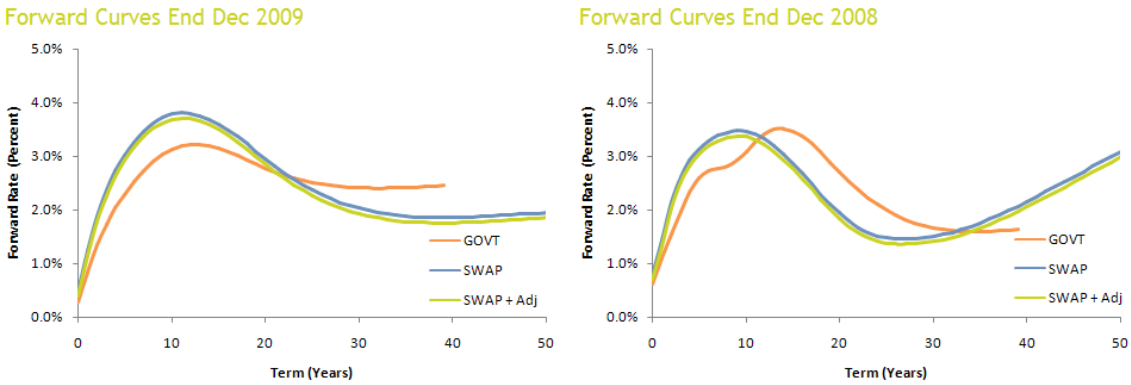
Swap Curve Liquidity:

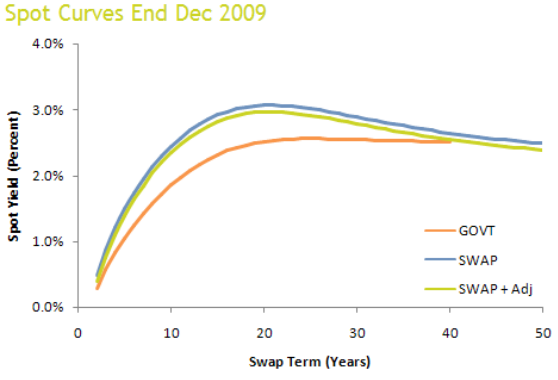
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
39	50	30	20

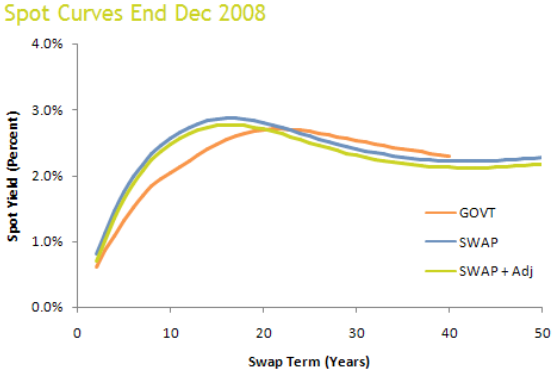
Contributor Count (Snap-shot as at end December 2009):



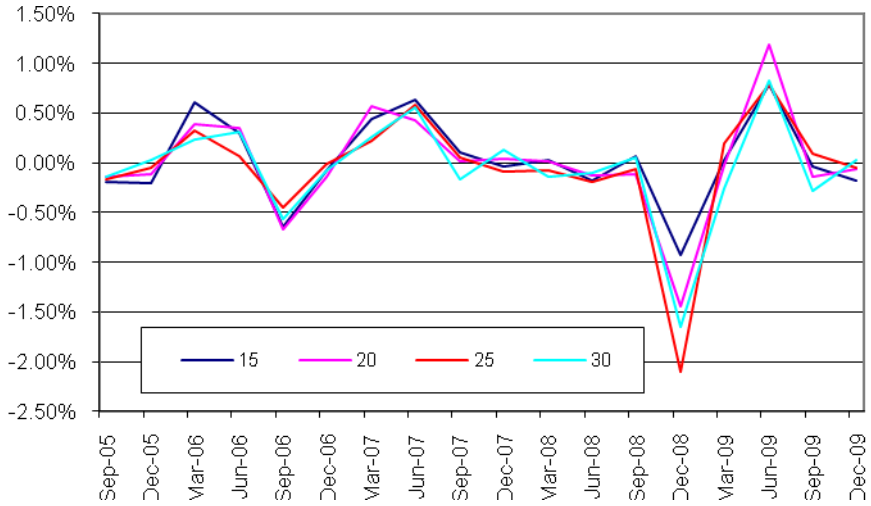
Fitted Curves:



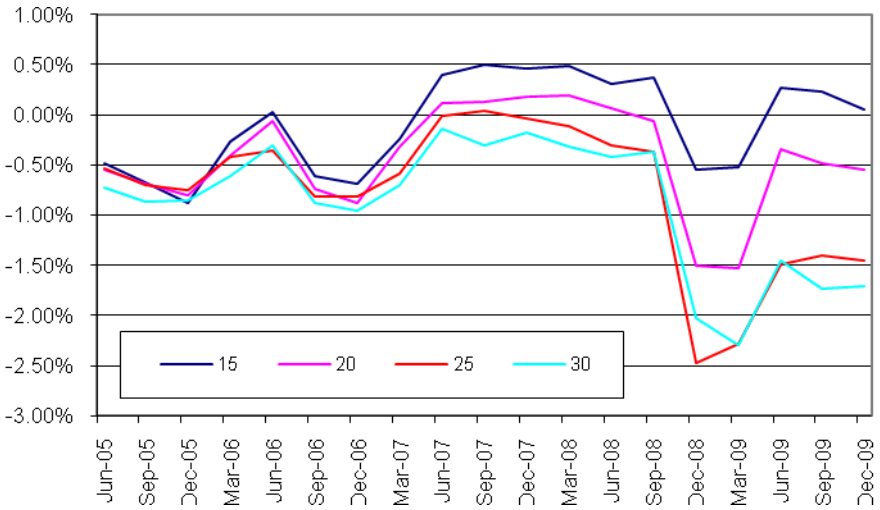




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 30 years.
- Volatility in long-term forward rates increased in Q4 2008 (up to 2% quarterly movement).
- Long-term forward rates dropped to extreme levels with 20-30 year forward rates dropping more than 15 year forwards.
- Long-term forward rates dropped significantly below the ultimate rate (in excess of 1.5% for 20-30 year forwards).
- **Propose 15 years entry point. There appears some liquidity up to 30 years in 2009.**

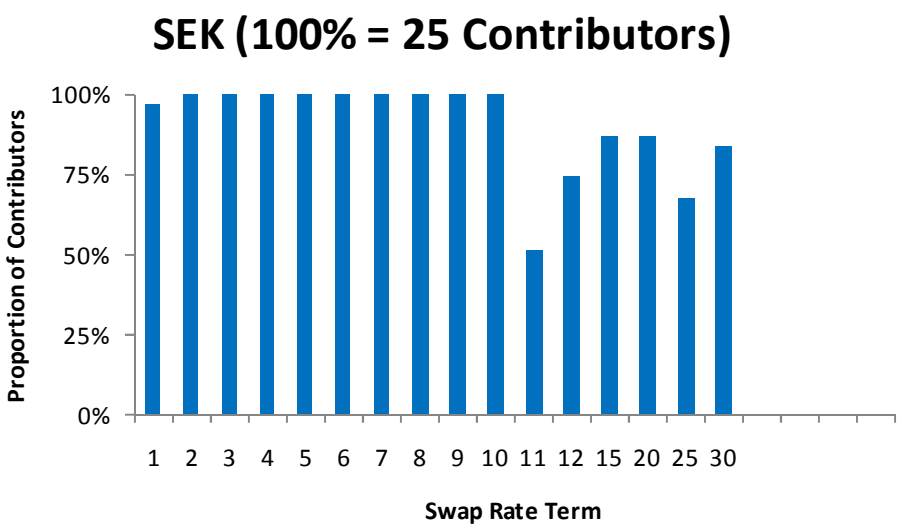
Swedish Krona – SEK

Swap Tickers: SKSWTT = Annual Settlement & Compounding vs. 3 month STIBOR

Swap Curve Liquidity:

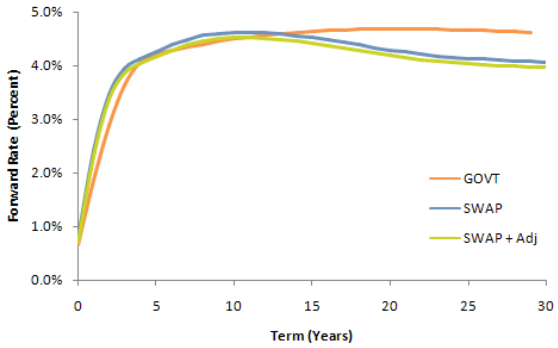
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
29.2	30	30	15

Contributor Count (Snap-shot as at end December 2009):

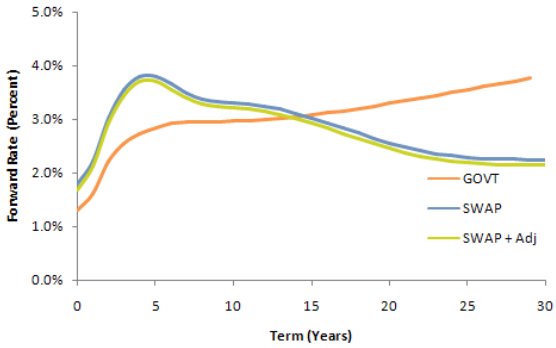


Fitted Curves:

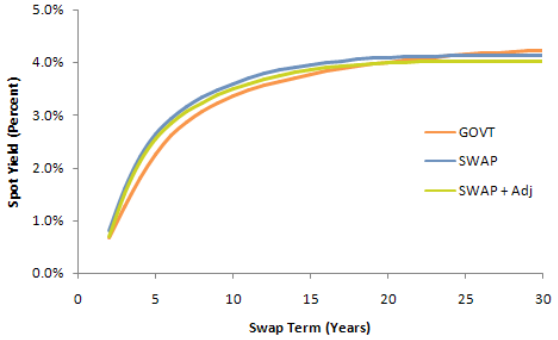
Forward Curves End Dec 2009



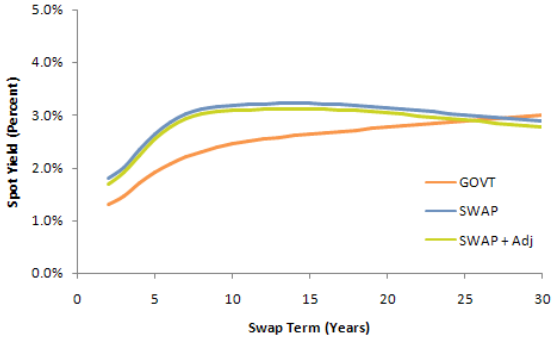
Forward Curves End Dec 2008



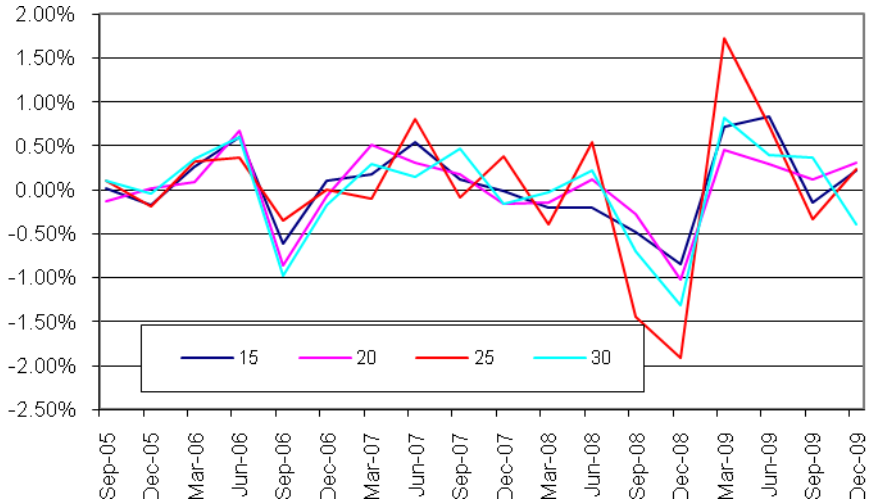
Spot Curves End Dec 2009



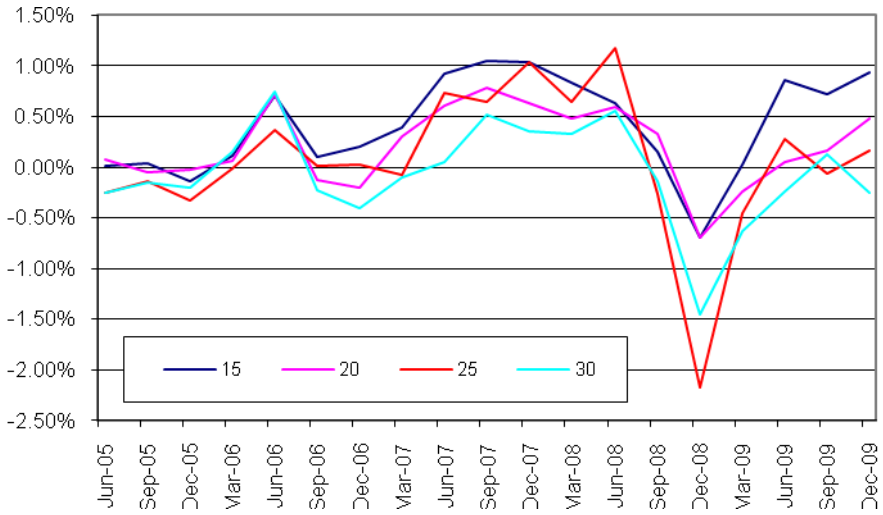
Spot Curves End Dec 2008



Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis does not provide a clear conclusion.
- Volatility in long-term forward rates increased in Q4 2008 (up to 1.5% quarterly movement).
- Long-term forward rates dropped to extreme levels with 20-30 year forward rates dropping in excess of the 15 year reduction.
- Long-term forward rates dropped significantly below the ultimate rate (in excess of 1% for 25-30 year forwards).
- **Propose 10 years entry point reflecting factors examined and understanding of market participants. There appears some liquidity up to 30 years in 2009.**

Danish Krone – DKK

Swap tickers:

- EUSATT = Annual Settlement vs. 6 month EURIBOR
- DKSWTT = Annual Settlement and Compounding vs. 6 month CIBOR

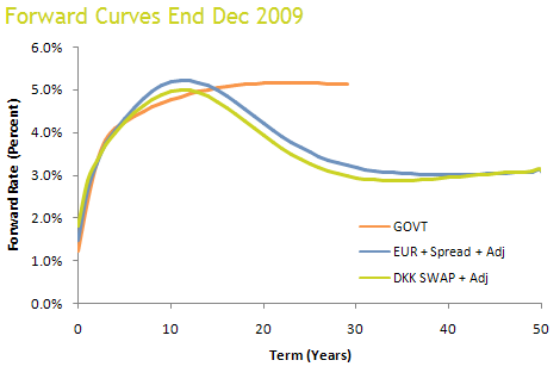
Government bond tickers:

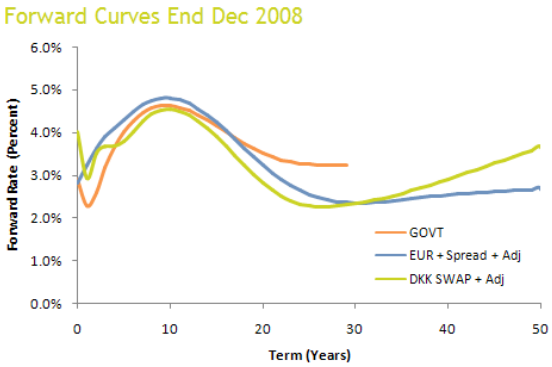
- GDBR10 = Generic German Government bond index – bid side yields
- GDGB10YR = Generic Danish Government bond index – bid side yields

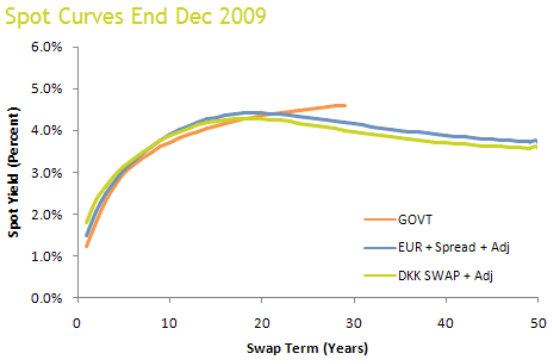
Note: The Bloomberg Danish yield index did not update for a period of around 6 months from July 2008 while the German index did in standard manner. This could introduce a distortion to the adjustment. To avoid this we have used the equivalent Data Stream index for the end December 2008 calculation.

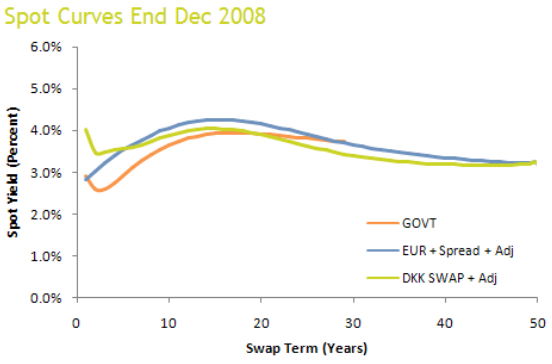
Fitted Curves:

The following charts show the proposed risk-free interest rate curve based on the adjusted EUR swap curve. It is noted that the adjustment is made to the EUR market swap rates prior to the fitting of the regression spline. In addition, the DKK swap curve (adjusted for credit risk) and the DKK government curves are presented for reference.









Conclusion:

- **Propose the adjusted EUR swap curve with a 30 years entry point which is consistent with the EUR curve.**

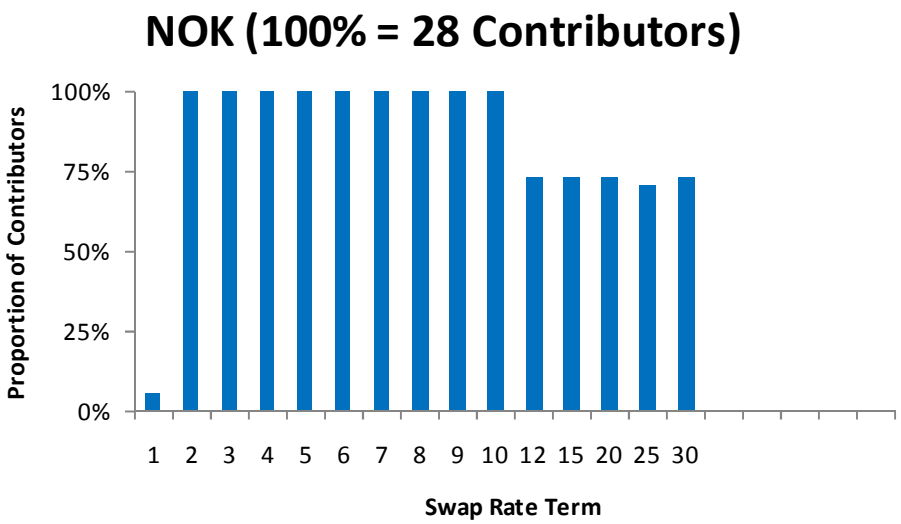
Norwegian Krone - NOK

Swap Tickers: NKSWTT = Annual fixed rate vs. 6 month NIBOR

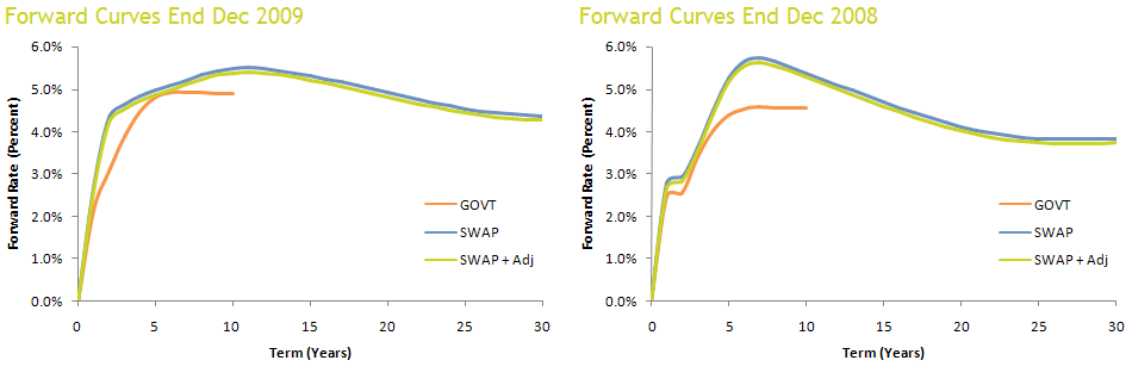
Swap Curve Liquidity:

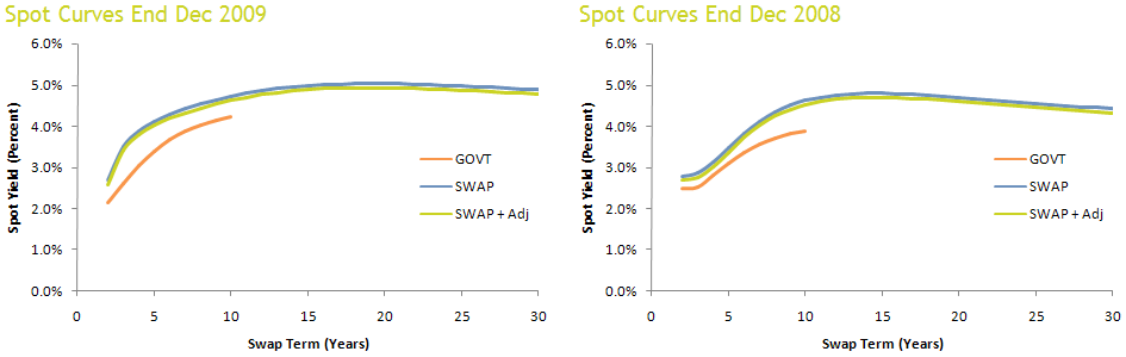
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
9.4	30	30	15

Contributor Count (Snap-shot as at end December 2009):

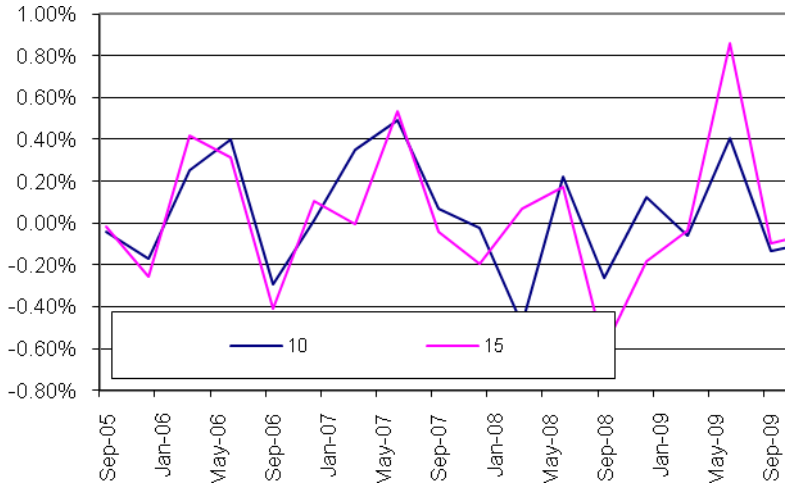


Fitted Curves:

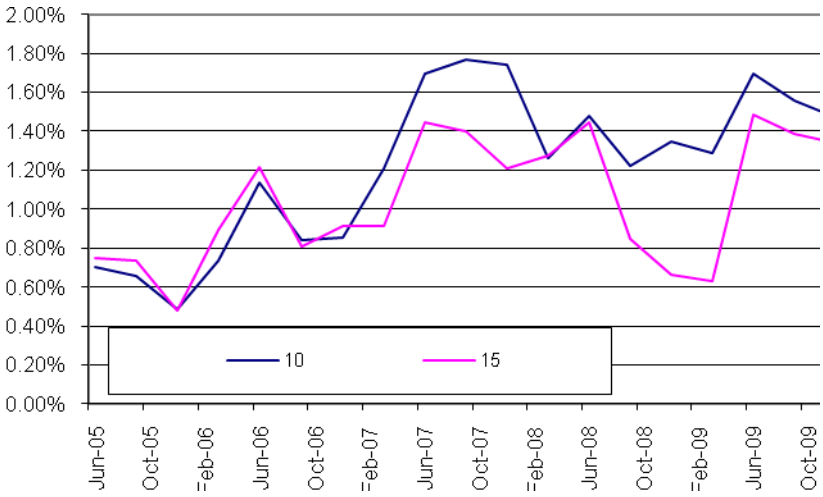




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 10 years.
- Significant drop in 15 year forward rate at end 2008 compared to 10 year forward.
- **Propose 10 years entry point. There appears some liquidity up to 15 years in 2009.**

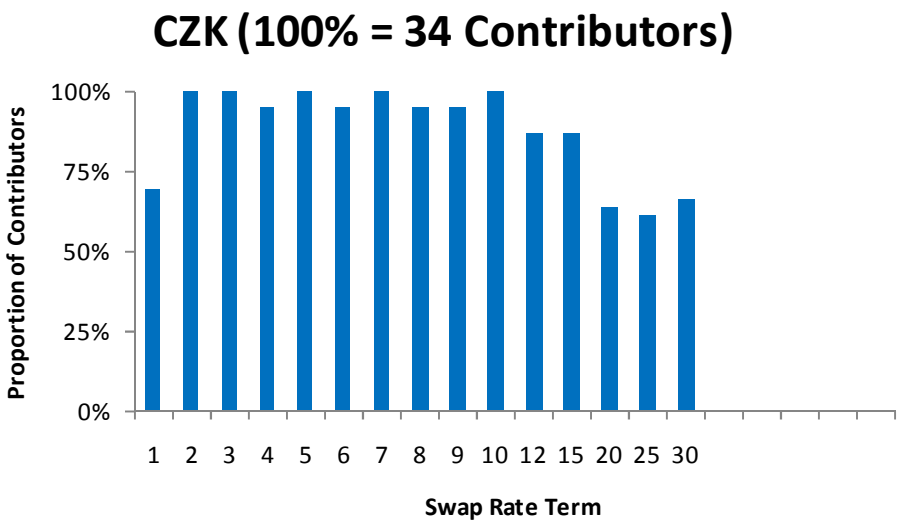
Czech Koruna – CZK

Swap Tickers: CKSWTT = Annual fixed rate vs. 6 month PRIBOR

Swap Curve Liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
47.8	30	30	15

Contributor Count (Snap-shot as at end December 2009):



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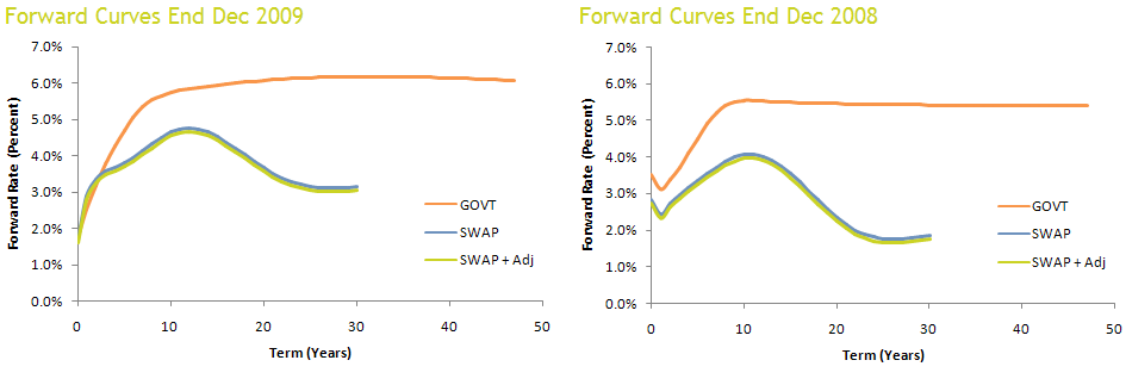
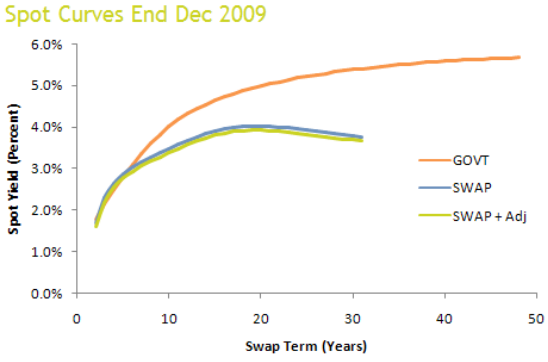
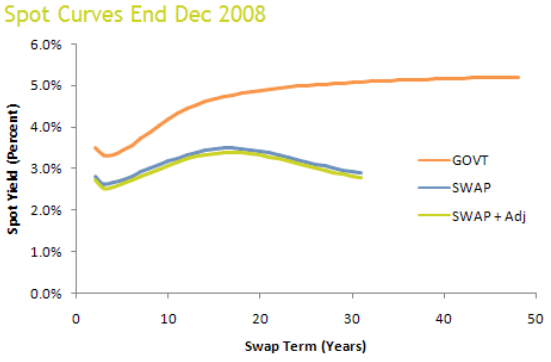
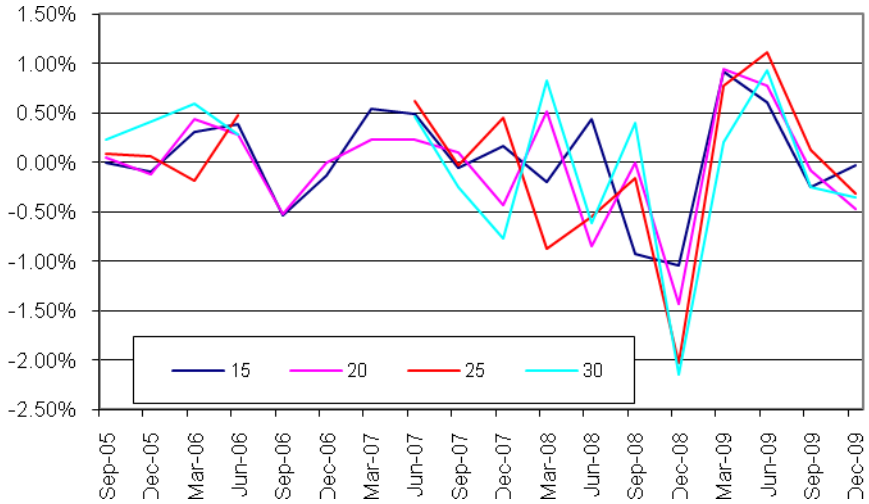






Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:

Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 15 years, consistent with investment bank survey.
- Volatility in long-term forward rates increased in Q4 2008 (up to 2% quarterly movement).
- Long-term forward rates dropped to extreme levels with 20-30 year forward rates dropping significant more than the 15 year forward.
- Long-term forward rates dropped significantly below the ultimate rate (in excess of 1% for 20-30 year forwards).
- **Propose 15 years entry point. There appears some liquidity up to 30 years in 2009.**

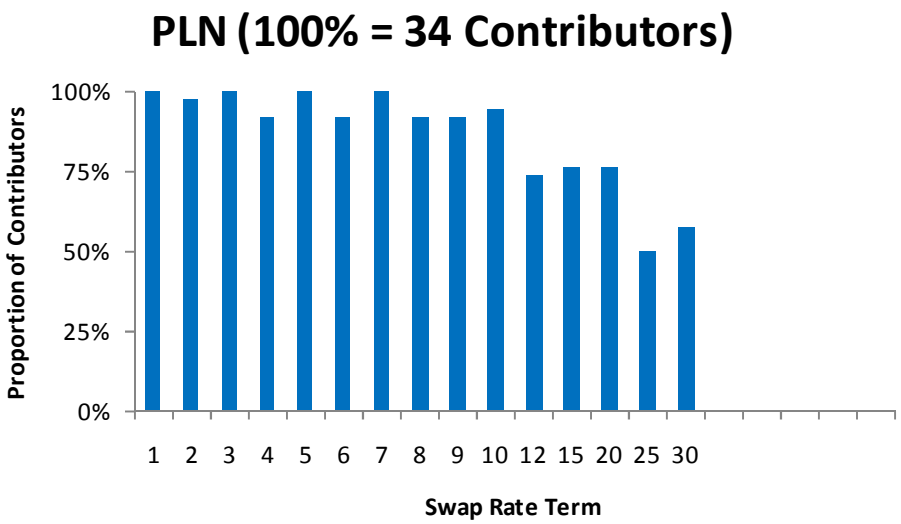
Polish Zloty – PLN

Swap Tickers: PZSWTT = Annual Settlement & Compounding vs. 6 month WIBOR

Swap Curve Liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
27.3	20	20	15

Contributor Count (Snap-shot as at end December 2009):



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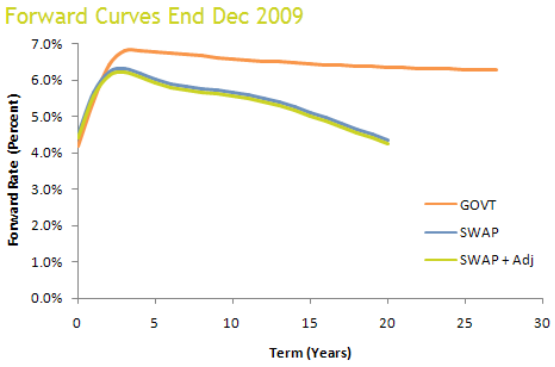
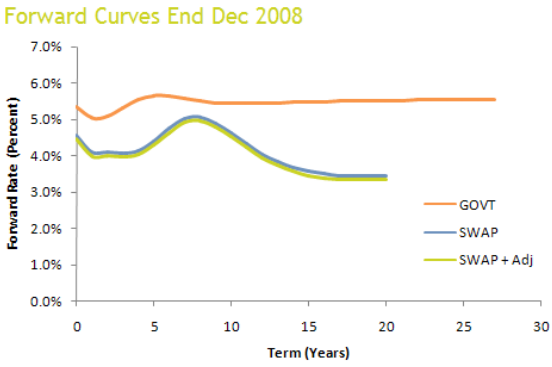
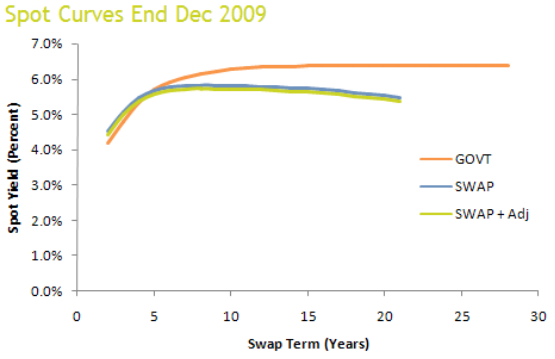
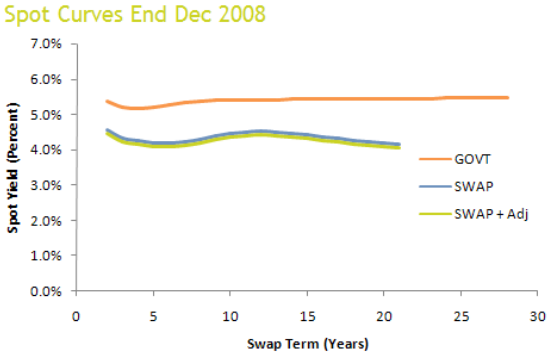
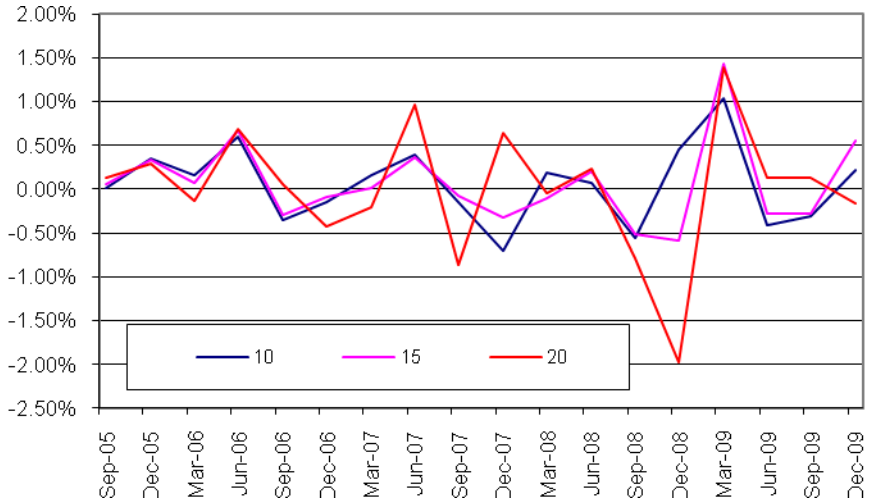




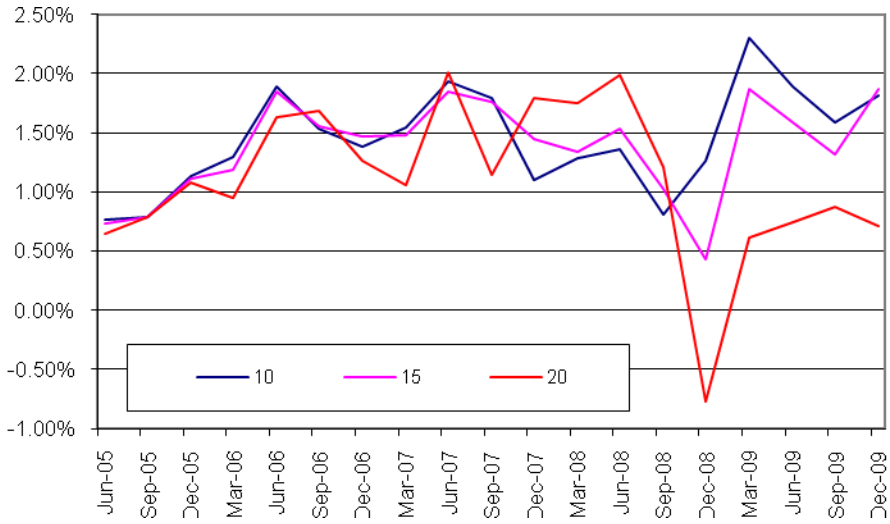




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 20 years
- Volatility in long-term forward rates increased in Q4 2008 (up to 2% quarterly movement).
- Long-term forward rates dropped to extreme levels with 20 year forward rates dropping significant more than the 15 year forward.
- **Propose 15 years entry point. There appears some liquidity up to 20 years in 2009.**

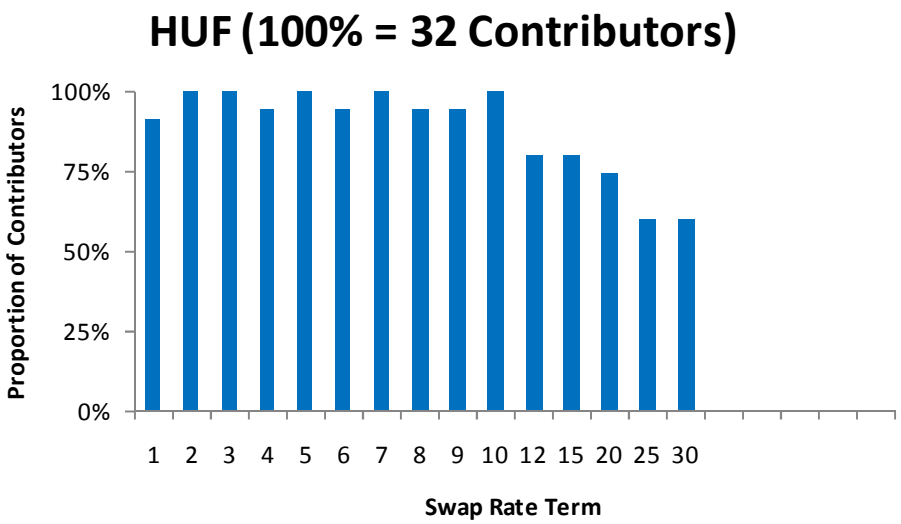
Hungarian Forint – HUF

Swap Tickers: HFSWTT = Annual Settlement & Compounding vs. 6 month BUBOR

Swap Curve Liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
13.9	20	20	15

Contributor Count (Snap-shot as at end December 2009):



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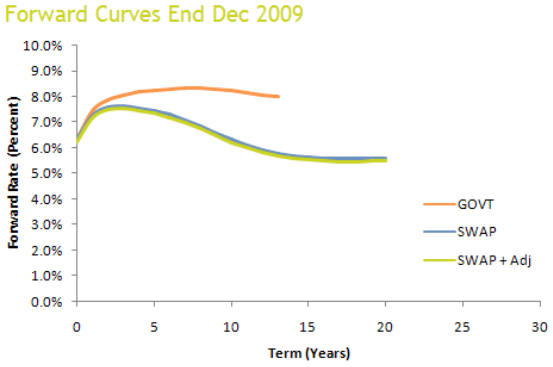
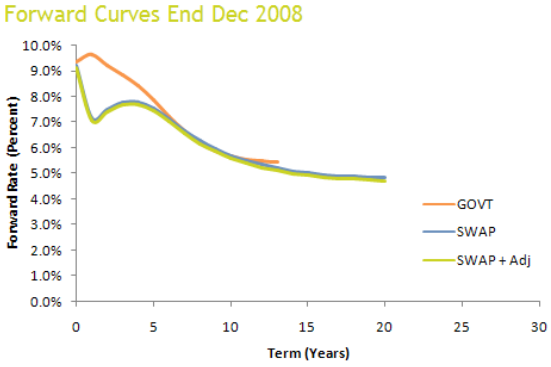
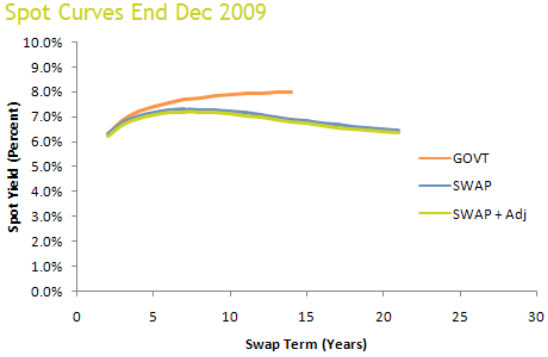
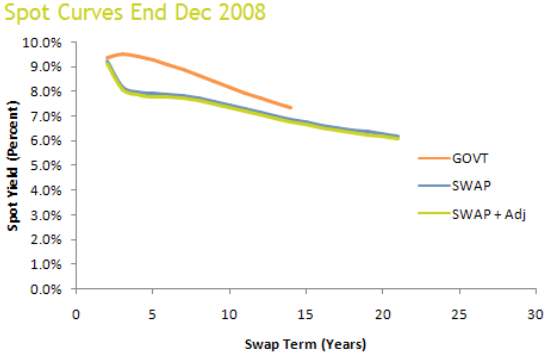
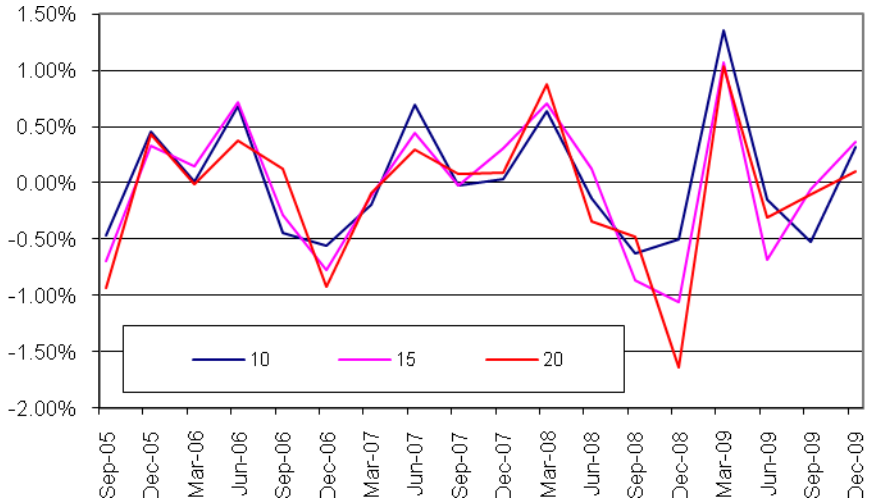




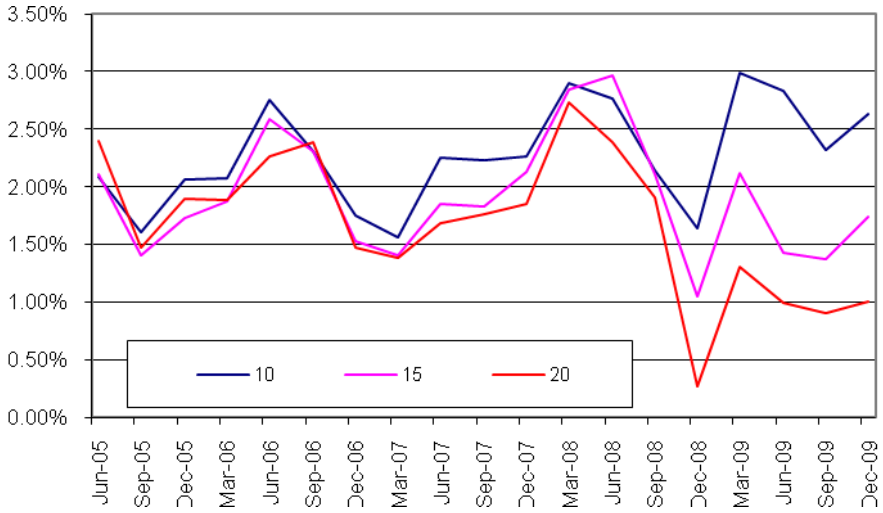




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Contributor analysis is less than 75% after 15 years, consistent with investment bank survey
- Volatility in long-term forward rates increased in Q4 2008 (up to 1.5% quarterly movement).
- Long-term forward rates dropped to extreme levels with 20 year forward rates dropping significant more than the 15 year forward.
- **Propose 15 years entry point. There appears some liquidity up to 20 years in 2009.**

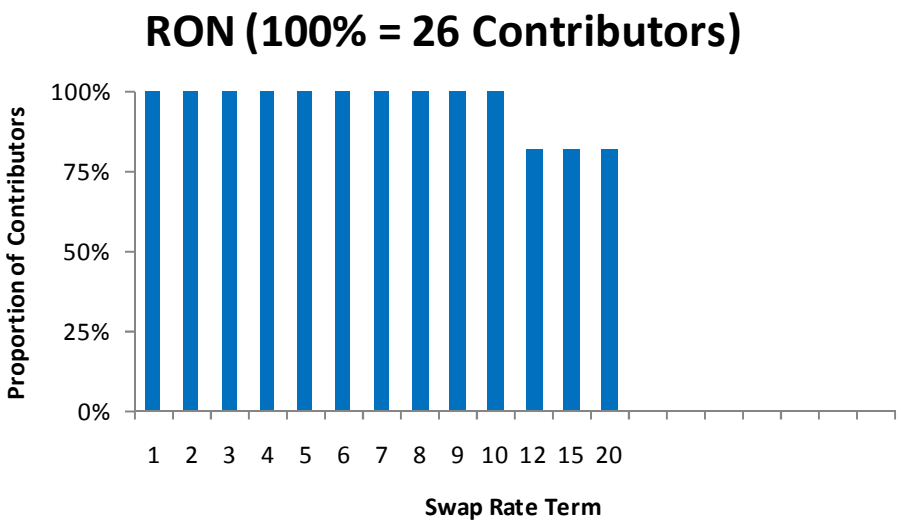
Romanian Lei – RON

Swap Tickers: RNSWTT = Semi-annual Settlement vs. 6 month BUBOR

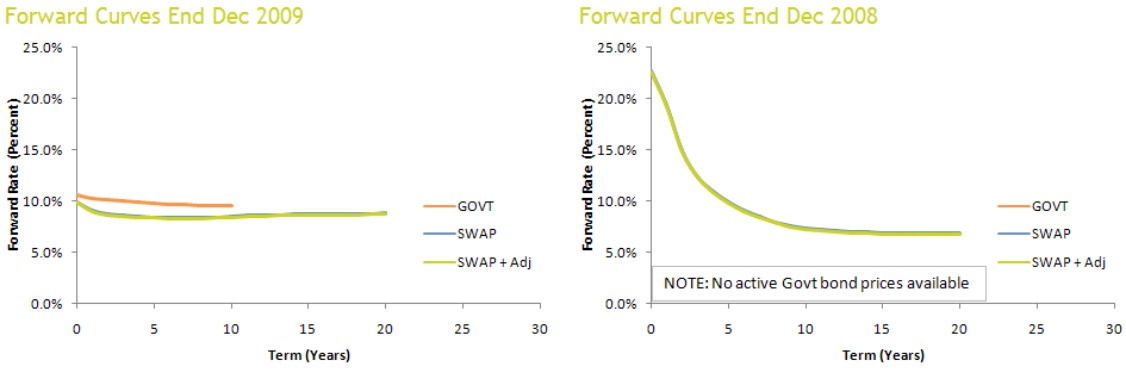
Swap Curve Liquidity:

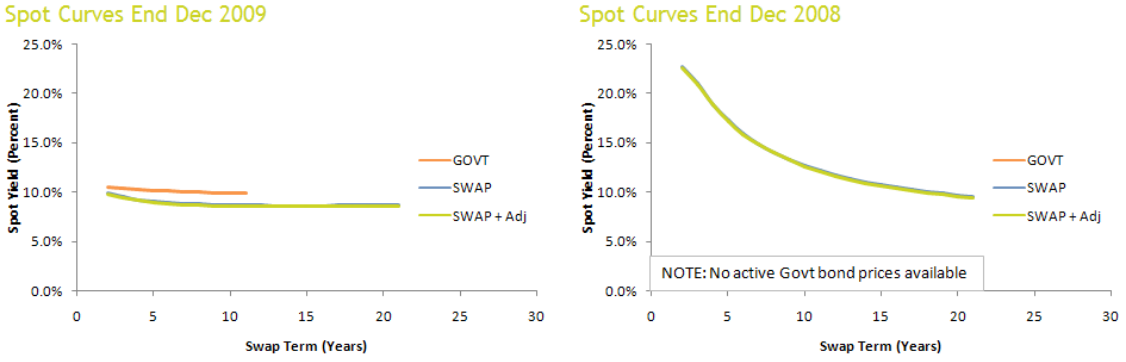
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
10.5	20	20	0

Contributor Count (Snap-shot as at end December 2009):

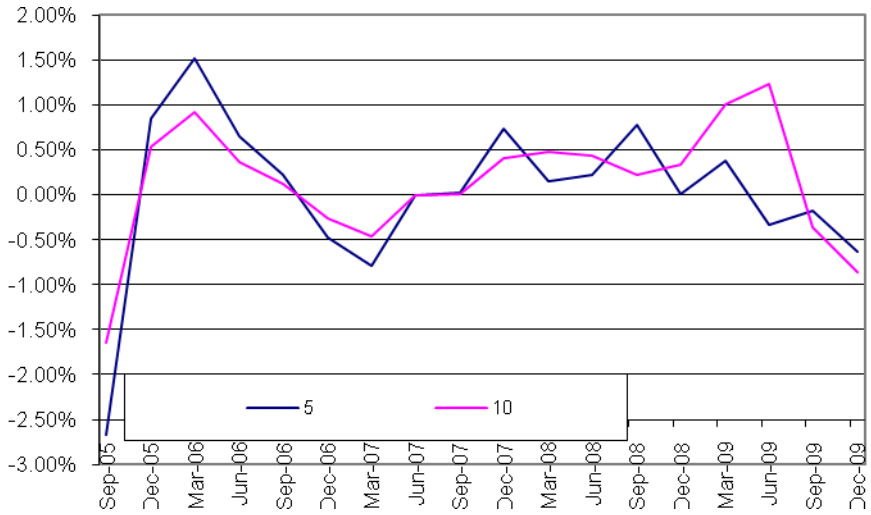


Fitted Curves:

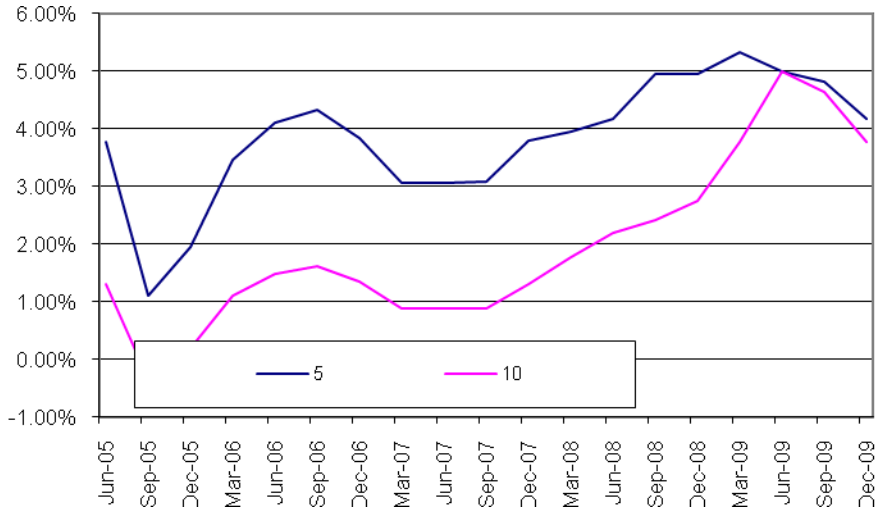




Percentage quarterly movement in forward rates over time at specific tenors:



Percentage difference between the observed forward rate and the ultimate long term forward rate over time at specific tenors:



Note: The ultimate long term forward rate is used for extrapolation. The rate used for this analysis is based on a draft assessment.

Conclusion:

- Movements of 5 and 10 year forwards were in line in Q4 2008 and were not extreme.
- **Propose 10 years entry point which is consistent across 2008 and 2009.**

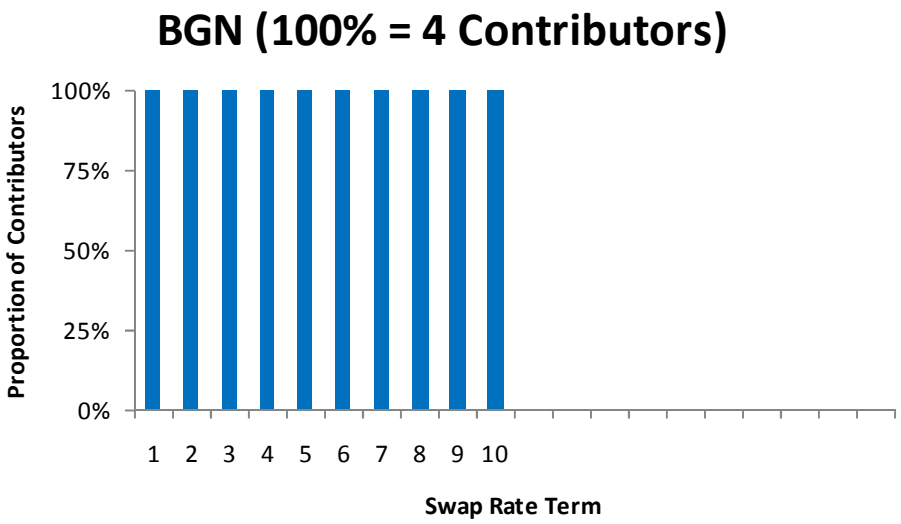
Bulgarian Lev – BGN

Swap Tickers: BLSATT

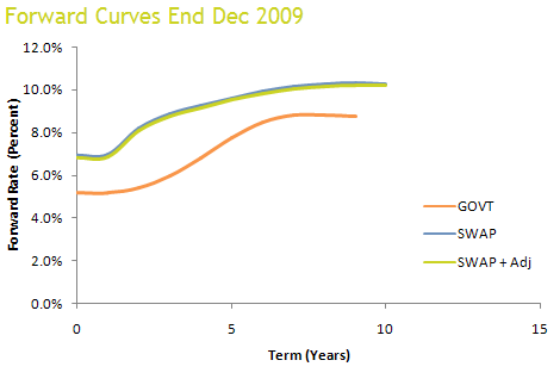
Swap Curve Liquidity:

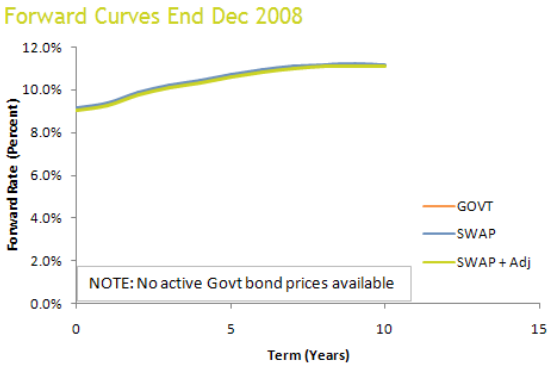
Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
9.1	10	10	0

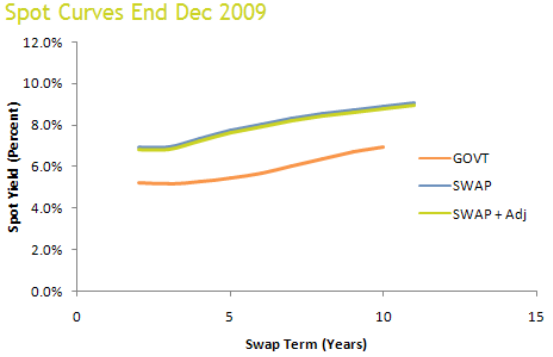
Contributor Count (Snap-shot as at end December 2009):

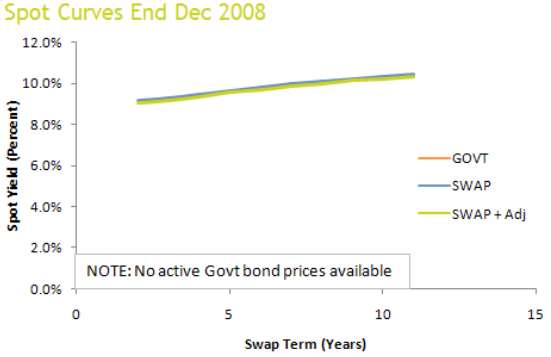


Fitted Curves:









There is insufficient data in BGN to prepare the forward rate analysis as for other currencies.
Conclusion: Propose 10 years entry point which is consistent across 2008 and 2009.

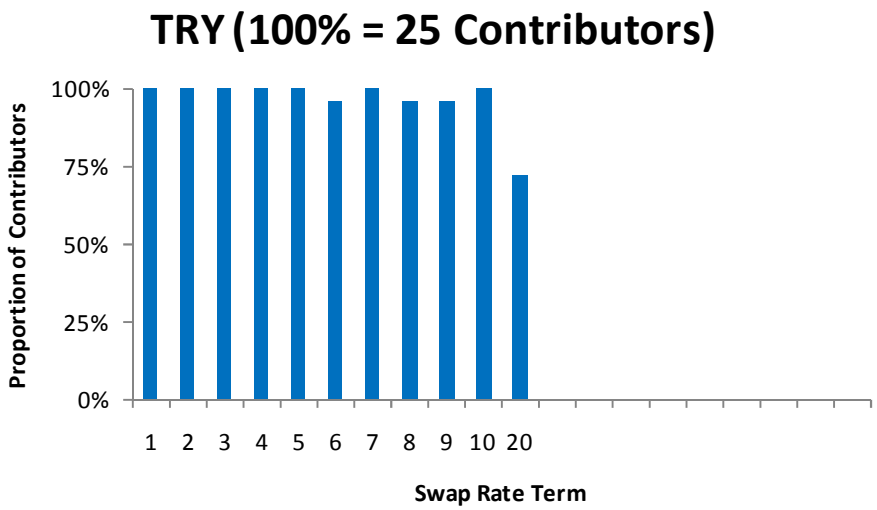
Turkish Lira – TRY

Swap Tickers: TYSWTTV3

Swap Curve Liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
4.4	10	10	0

Contributor Count (Snap-shot as at end December 2009):



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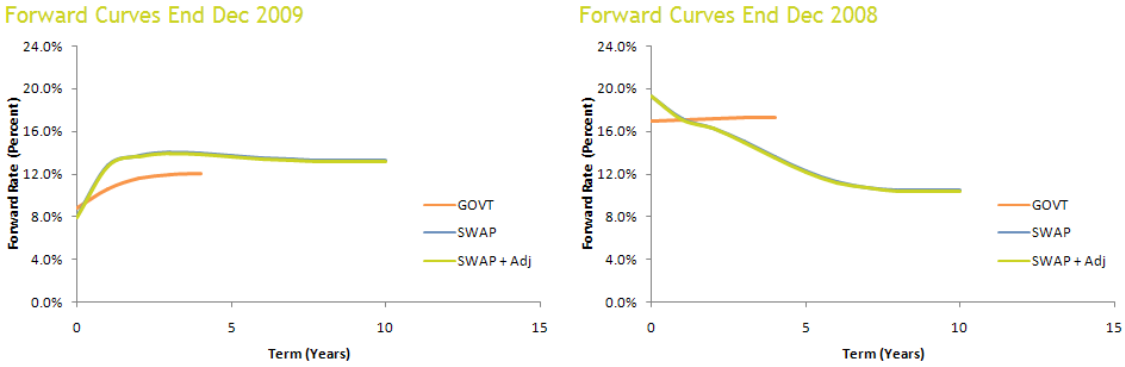
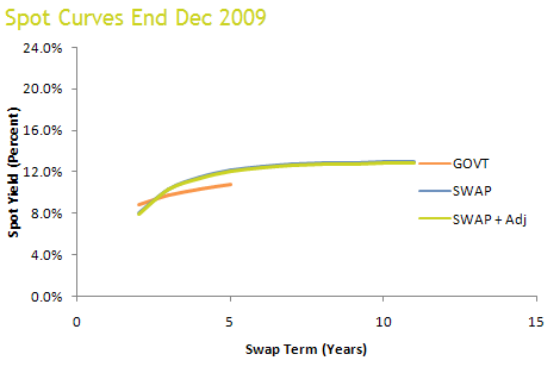
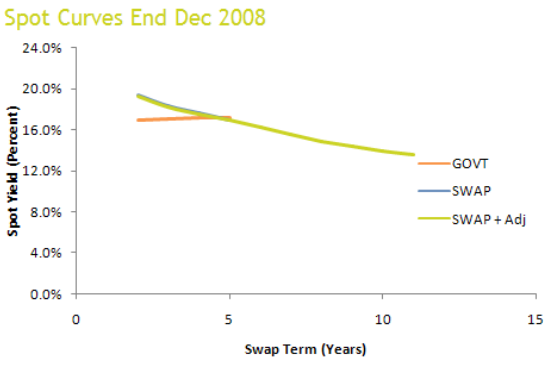






There is insufficient data in TRY to prepare the forward rate analysis as for other currencies.
Conclusion: Propose 10 years entry point which is consistent across 2008 and 2009.

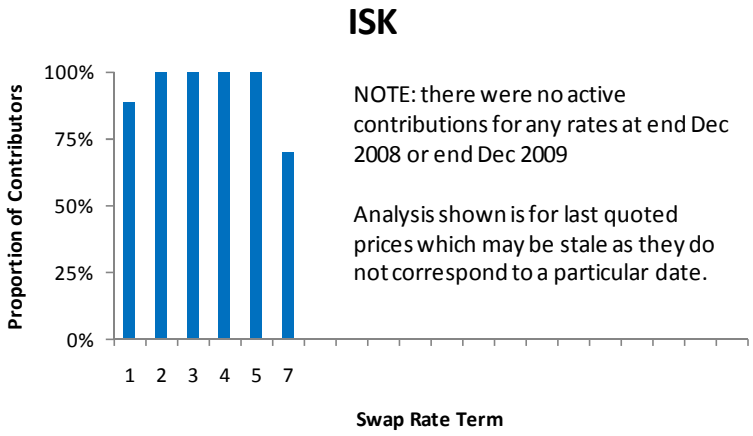
Iceland Krona – ISK

Swap Tickers: IKSWTT = Annual Settlement vs. 3 month REIBOR

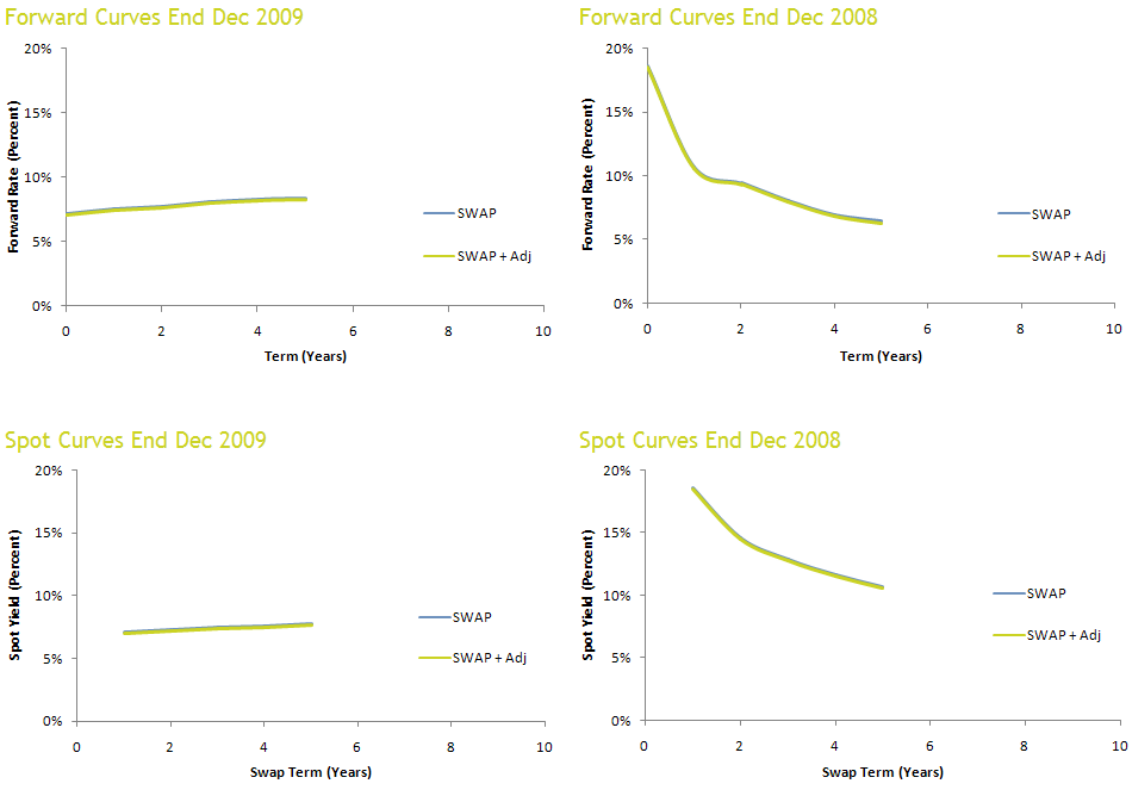
Swap Curve Liquidity:

Maximum bond term available	Maximum swap term available	Maximum swap term (CRO Forum)	Maximum swap term (Bank survey)
15.3	5	5	0

Contributor Count (Snap-shot as at end December 2009):



Fitted Curves:



There is insufficient data in ISK to prepare the forward rate analysis as for other currencies. Further, no government curves could be readily evidenced in 2008 or 2009.
Conclusion: Propose 5 years entry point which is consistent across 2008 and 2009.

Estonian Kroon – EEK, Latvian Lats – LVL and Lithuanian Litas – LTL

For these three currencies, no active swap rates or government bond prices could be reliably sourced. As these currencies are pegged to the EUR, the proposal is to use the EUR risk-free curve without adjustment.

Appendix 2:

Derivation of the EUR, GBP and USD liquidity premium term structure

Methods of calculating the liquidity premium for assets

There are three primary methods currently used by practitioners to estimate the liquidity premium in these financial markets:

- **CDS Negative-basis Method.** The method compares the spread on a corporate bond with the spread of a Credit Default Swap for the same issuing entity, same maturity, same seniority and same currency.

- **Covered Bond Method –** The method involves choosing a pair of assets which, besides liquidity, are assumed to offer equivalent cash flows and equivalent credit risk. The primary example is an index of covered bonds versus swaps.

- **Structural Model Method** – The method involves the use of option pricing techniques to calculate a theoretical credit spread which compensates only for credit (default and spread) risk. The difference between the theoretical spread and the actual market spread is typically taken to be liquidity premium.

A full analysis of the three methods including the quantum of the liquidity premia from corporate bonds over 2005 to 2009, the key assumptions and practical implementation considerations is contained in: "Summary of Liquidity Premium Estimation Methods" – October 2009 - John Hibbert et al[8].

Selection of the reference portfolio of assets

There is a wide spectrum of liquidity premia available from different asset markets which match the wide range of trading liquidity of different asset types. As a result, any estimate of liquidity premium needs to reference a specific asset or asset pool. The specific asset or asset pool will need to be no more illiquid than the liabilities. Liquidity premium principle 2 from the CEIOPS working party report[9] provides guidance that the pool of assets should be independent of those held by the company. Further, principles 3 and 6 note the use of financial market data.

It is proposed that the reference portfolio of assets is a corporate bond index which is representative of the investment grade market in each currency. This represents a practical and pragmatic solution given the range of potential reference portfolios.

There are a variety of providers of corporate bond indices including investment banks and independent companies. The formal criteria for the selection of the selection of the corporate bond index for each currency would be:

- Representative of the available investment grade tradable corporate bonds in each currency.
- Available on a real-time basis from public data sources with formal published criteria for when and how constituents of the index are changed.
- Prepared by an independent, reliable and objective third party.

[8] Available from: http://www.barrhibb.com/documents/downloads/Barrie_Hibbert_Summary_of_LP_Methods.pdf

[9] "Task Force in the Illiquidity Premium – Report – 1 March 2010"

- Operated in a transparent manner and expected to be prepared for the foreseeable future.
- Unchanged unless the index is no longer representative of the market in that currency.

It proposed to use Markit Iboxx indices as these are widely regarded by practitioners as the industry standard for EUR, GBP and USD currencies. Markit is an independent, reliable and objective third party. Further, the Iboxx indices are available on a real-time basis with formal published criteria for when and how constituents of the indices change.

The reference portfolio is defined by the following corporate bond indices sourced from Markit[10]:

- EUR: iBoxx € Corporates ISIN for TRI: DE0006301161
- GBP: iBoxx £ Corporates ISIN for TRI: DE0005993174
- USD: iBoxx $ Corporates ISIN for TRI: GB00B0598748

Derivation of the liquidity premium estimate

Whilst the three illustrated estimation methods provide a generally consistent message regarding both the absolute level and changes in level of liquidity premia, it is still possible to criticise the robustness of individual methods and specific estimates. However, by making use of estimates derived from a number of different methods together we can create a more robust overall estimate.

To do this a "proxy" method based on a simple transformation of the observed credit spread is proposed:

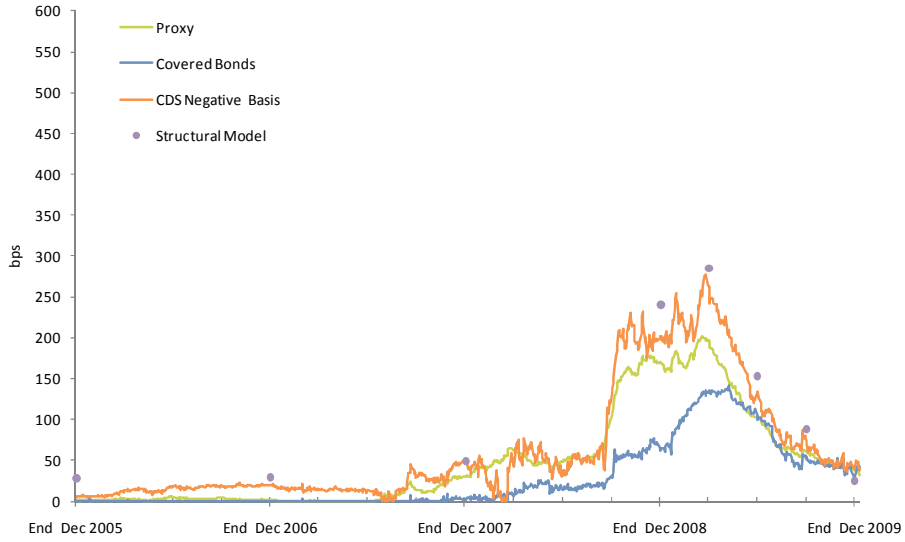
$$LP_{currency} = MAX(0, x\% * (Spread - y\ bps))$$

The proxy does have a fundamental interpretation. The corporate bond spread is considered to be comprised of three components: an allowance for the cost of default; a risk premium to compensate bond holders for bearing credit risk and a liquidity premium to compensate for the costs and associated uncertainty of trading illiquid bonds. Expected default costs over long horizons can be expected to be reasonably stable and we can interpret the deduction (y) as such an allowance for long-term expected losses. By setting the proportion (x) we split the remainder of the spread between the liquidity premium and the credit risk premium.

In the following charts presented we use values of x = 50% and y = 40bps to compare the proxy method to the three directly observable methods currently used by practitioners. **All the results presented use Iboxx annual benchmark credit spreads adjusted for swap spread to give a spread over swaps.**

[10] http: // indices.markit.com

EUR – Derivation of liquidity premium

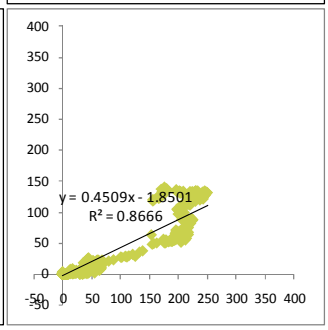
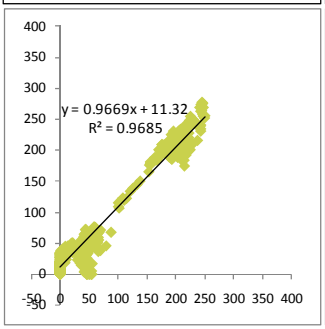
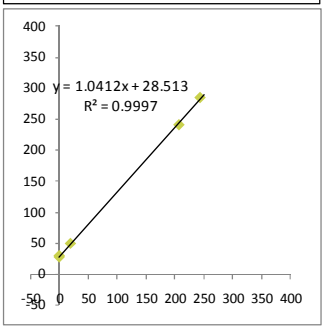
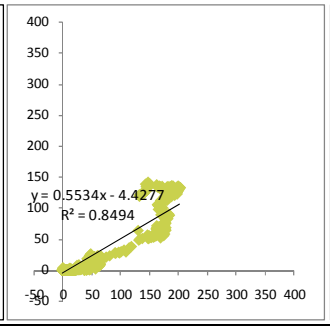
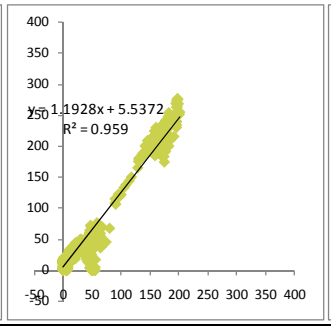
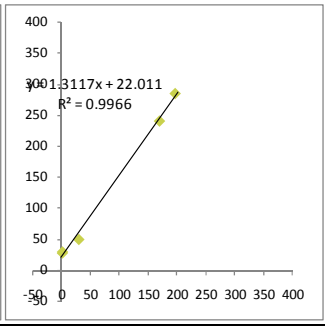


In summary, it can be seen that all methods (including the proxy) present a consistent pattern for movements in EUR liquidity premia over the period analysed. It is worth noting that:

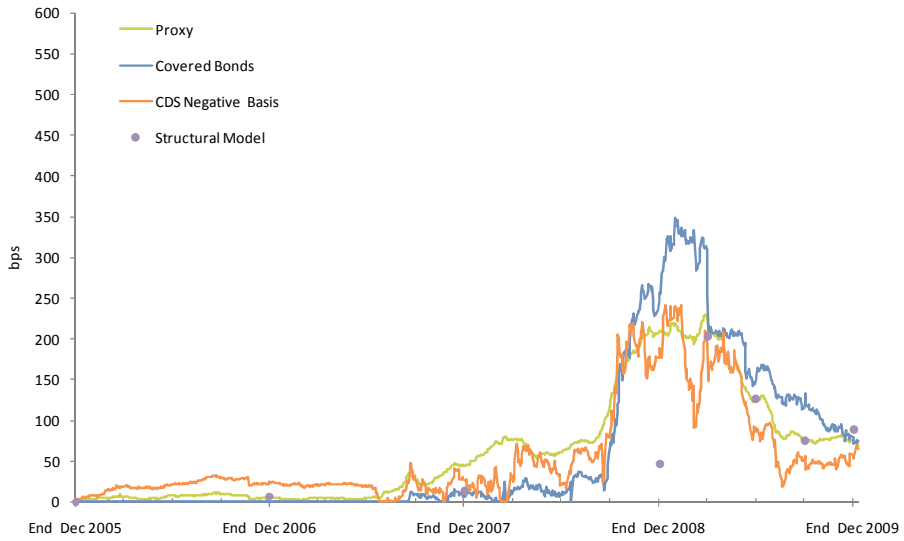
- The covered bond index measures a set of bonds which are generally more liquid (and of higher creditworthiness than the investment grade corporate bond portfolio we are interested in). As a consequence, we believe it will provide a more conservative (i.e. biased low) estimate for corporate bond liquidity premia.

- The proxy (using x=50% and y = 40bps) is generally conservative compared to the structural and CDS negative-basis methods.

In the following figure the time series are plotted as scatter plots comparing the proxy method (x-axis) to each of the other methods (y-axis), with R-squared calculated to measure correlation. The first row shows the results of choosing optimal parameters to minimise an objective function based on the sum of average square errors of the three methods. The second row shows the original parameters (x=50% and y = 40bps) highlighting that, while not optimal, this parameterisation provides very similar fits.

	Covered Bond Method	CDS Negative-Basis Method	Structural Model Method
Best Fit Parameters			
Original Parameters			

GBP – Derivation of liquidity premium



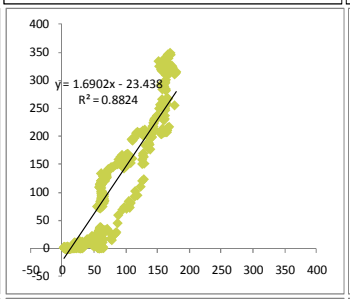
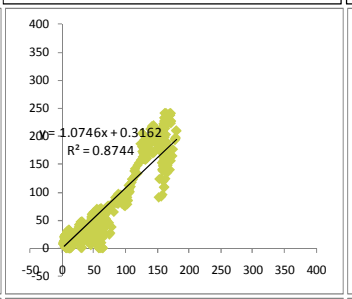
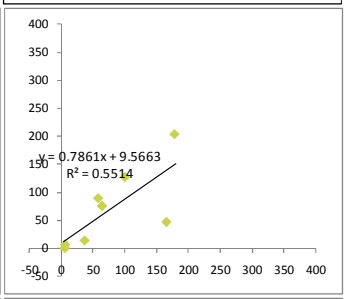
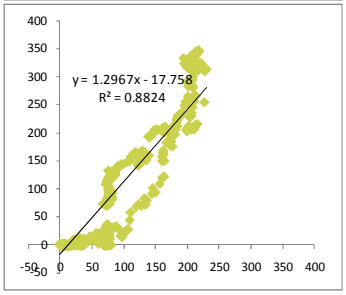
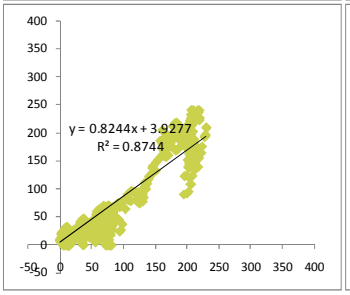
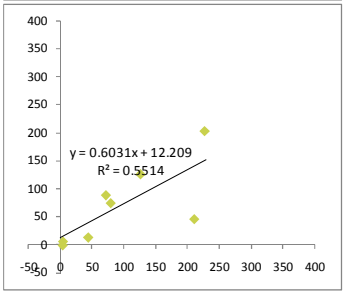
As for the EUR, it can be seen that there is considerable similarity between results from these methods. It is worth noting that:

- Covered bonds are not as common in GBP, consequently there is a very limited choice of established index measures. The index used here is provided by Merrill Lynch and only contains 15 bonds, some of which have a rating less than AAA. Consequently the observed spread will not be a pure estimate for LP since it will contain a credit risk component.

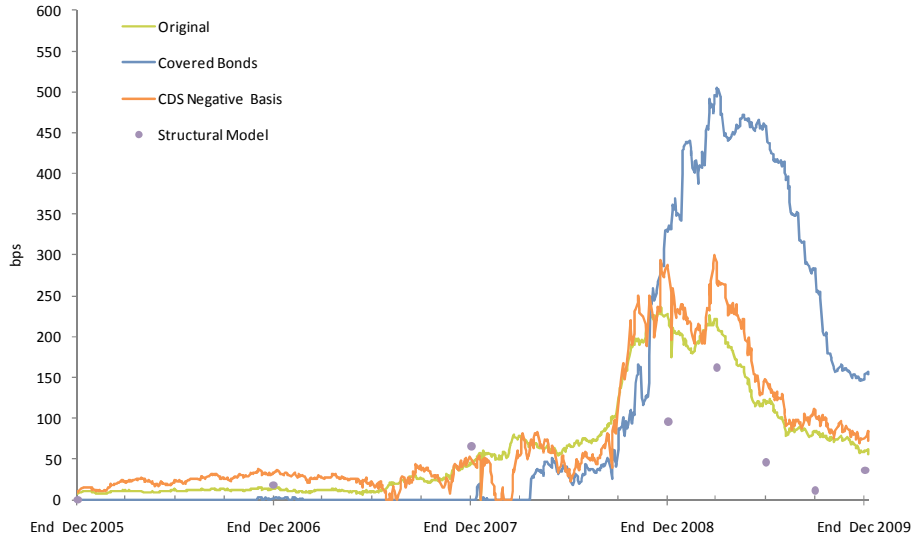
- In Q1 2009 the CDS measure drops significantly. Due to lack of availability of CDS indices in markets outside EUR and USD we have used indices published by Thomson/Reuters. It is not clear how well used this index is or the rules used to maintain it. We expect that, over this period, the price of protection for certain names grew materially and had a big impact on the measure. We saw similar, but more severe, results when considering USD and EUR. We speculate that the iTraxx and CDX indices, which are comprised of CDS at the liquid end of the market, are better managed and remove these anomalies.

- The end of Dec 2008 structural model estimate is clearly lower than all the rest. Driven by stressed ultra-high option-implied equity market volatility and other assumptions the model produces a very large estimate for the credit risk premium resulting in lower liquidity premium.

In the following figure the time series are plotted as scatter plots comparing the proxy method (x-axis) to each of the other methods (y-axis), with R-squared calculated to measure correlation. The first row shows the results of choosing optimal parameters to minimise an objective function based on the sum of average square errors of the three methods. The second row shows the original parameters (x=50% and y = 40bps) highlighting that, while not optimal, this parameterisation provides very similar fits.

	Covered Bond Method	CDS Negative-Basis Method	Structural Model Method
Best Fit Parameters			
Orginal Parameters			

USD – Derivation of liquidity premium

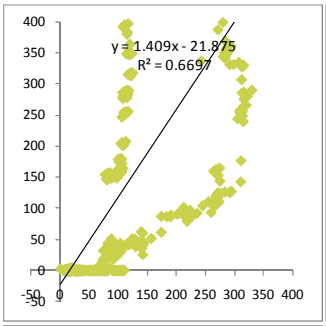
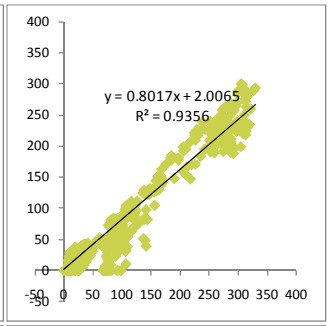
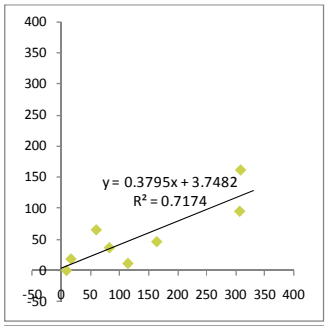
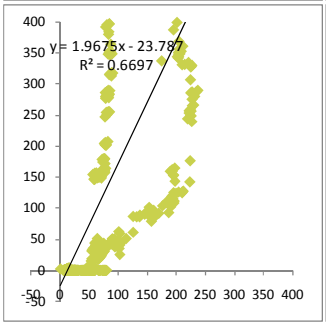
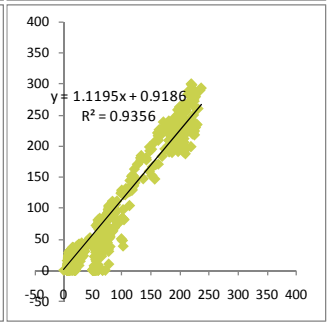
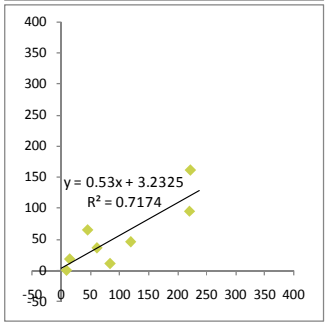


For the USD the results are a little more varied, with the proxy following the CDS method fairly closely.

- Again, covered bonds are not as common in USD, consequently a broad index is more difficult to identify. The index used here is provided by Merrill Lynch and only contains 11 bonds, 5 of which have a rating less than AAA. Consequently the spread here will not be a pure estimate of LP as it will contain credit risk, so the spread may not always be on the conservative side. Over 2009 we believe this provides an absolute estimate which is biased high relative to the "true" liquidity premium.

- From the end of Dec 2008 the structural model provides relatively low estimates compared to other methods and the proxy. This will be driven primarily by the elevated level of long-term equity option implied volatility as well as other assumptions.

In the following figure the time series are plotted as scatter plots comparing the proxy method (x-axis) to each of the other methods (y-axis), with R-squared calculated to measure correlation. The first row shows the results of choosing optimal parameters to minimise an objective function based on the sum of average square errors of the three methods. The second row shows the original parameters (x=50% and y = 40bps) highlighting that, while not optimal, this parameterisation provides very similar fits.

	Covered Bond Method	CDS Negative-Basis Method	Structural Model Method
Best Fit Parameters			
Original Parameters			

Conclusion

The results of the proxy measure of the liquidity premium in per annum bps (using x=50% and y = 40bps) relative to swaps are detailed below.

*Liquidity premium in per annum bps **relative to swaps**:*

Date	EUR	GBP	USD
End December 2005	1	4	8
End December 2006	1	5	13
End December 2007	30	44	44
End December 2008	169	211	221
End March 2009	197	227	222
End June 2009	103	126	119
End September 2009	61	80	83
End December 2009	43	72	61

Appendix 3 explicitly illustrates the derivation of the proxy measure from base market data at end December 2008 and 2009.

In theory, the calibration of the proxy measure for the liquidity premium across EUR, GBP and USD may not be the same, for example, there could be structural differences in each market. However, applying the same calibration across currencies is a pragmatic and simple solution which currently provides a relatively good fit as illustrated by the statistical tests. It is noted that the central EU institution in charge of calculating and publishing the liquidity premium would need to regular monitor the three basic measurement methods and the proxy formula in line with other aspects of the Solvency II framework.

As detailed early in the calibration paper, the basic risk-free interest rate is the inter-bank swap curve reduced by 10bps applied as a parallel shift to the simply compounded forward rates. The reduction in the basic risk-free interest rate increases the direct measures of the liquidity premium and consequently the proxy by 10bps. It is noted that due to time constraints it has not been possible to formally prepare the QIS 5 analysis based on the revised basic risk-free interest rate.

*Liquidity premium in per annum bps **relative to swaps less 10bps**:*

Date	EUR	GBP	USD
End December 2005	11	14	18
End December 2006	11	15	23
End December 2007	40	54	54
End December 2008	179	221	231
End March 2009	207	237	232
End June 2009	113	136	129
End September 2009	71	90	93
End December 2009	53	82	71

We proposed that for QIS 5 the liquidity premium estimate for EUR, GBP and USD is determined using the proxy measure calibrated with x=50% and y = 40bps, where the spread measures is relative to swaps. To allow for the basic risk-free interest rate being with reference to swaps less 10bps rather than swaps, the liquidity premium results are increased by 10bps. In formulaic terms, the result is a change in the "y" parameter to 30bps when the spread measure is relative to swaps less 10bps and the "x" parameter remains at 50%. If the "x" parameter was to change from 50% then the adjustment to the "y" parameter would need to be changed.

Derivation of the liquidity premium term structure

In accordance with liquidity premium principle 3, the addition of a liquidity premium should be limited to maturities where an additional liquidity return may be earned in the financial markets. However, academic literature and theory is inconclusive over the liquidity premium term structure. In particular, there is no consensus from examining covered bond methods, structural methods or detailed bond level studies by academics[11].

A relatively simple term structure, in forward rate space, designed to meet the requirements of liquidity premium principle 3 is proposed:

Forward $LP_{T, currency} = F(T, currency) * LP_{currency}$

The function F(T, currency) is determined as:

F (T, currency)	= 1; where 0 <= T < $\mathbf{N_{currency}}$ -5
	= ($\mathbf{N_{currency}}$ -T)/5; where $\mathbf{N_{currency}}$ -5 <= T <= $\mathbf{N_{currency}}$
	= 0; where T > $\mathbf{N_{currency}}$, $\mathbf{N_{currency}}$ designating the longest maturity where assets relating to this currency may be purchased to earn a liquidity premium.

$\mathbf{LP_{currency}}$ is as defined in the previous section for EUR, GBP and USD.

Further, for products whose term is one year or less no liquidity premium is applied. There is clear economic rationale to show that for short terms the liquidity premium vanishes since at maturity an illiquid bond is redeemed in the same manner as a liquid bond.

The proposal requires the selection of $\mathbf{N_{currency}}$ at which point the liquidity premium estimate applied in forward rate space is reduced linearly to zero over 5 years. There are alternative patterns that could be used to reduce the estimate, such as setting the forward liquidity premium to zero immediately, a shorter or longer linearly reduction or a proportionate reduction over a set period. A relatively simple linear approach was selected on pragmatic grounds. The term structure would be re-examined by the central EU institution in charge of calculating and publishing the liquidity premium as further academic research is performed.

The selection of $\mathbf{N_{currency}}$ is to reflect that the liquidity premium can be applied only where there are sufficient illiquid instruments in the market. As a practical method, it is proposed to use the reference portfolio of assets, the Markit Iboxx indices, to determine $\mathbf{N_{currency}}$.

Based on the constituents from the Markit Iboxx indices and associated bond data from Bloomberg the following charts plot the outstanding amount of bonds available in that year to maturity. The labels denote the number of bonds. If, for QIS 5 purposes, we consider that the market is deep up to 99% of the outstanding amount available as captured by Markit Iboxx constituents then the time-to-maturity cut-offs are:

- EUR – 24 years
- GBP – 48 years
- USD - 30 years

For the purposes of QIS 5, we propose that $N_{currency}$ is 15 years for EUR and 30 years for GBP and USD.

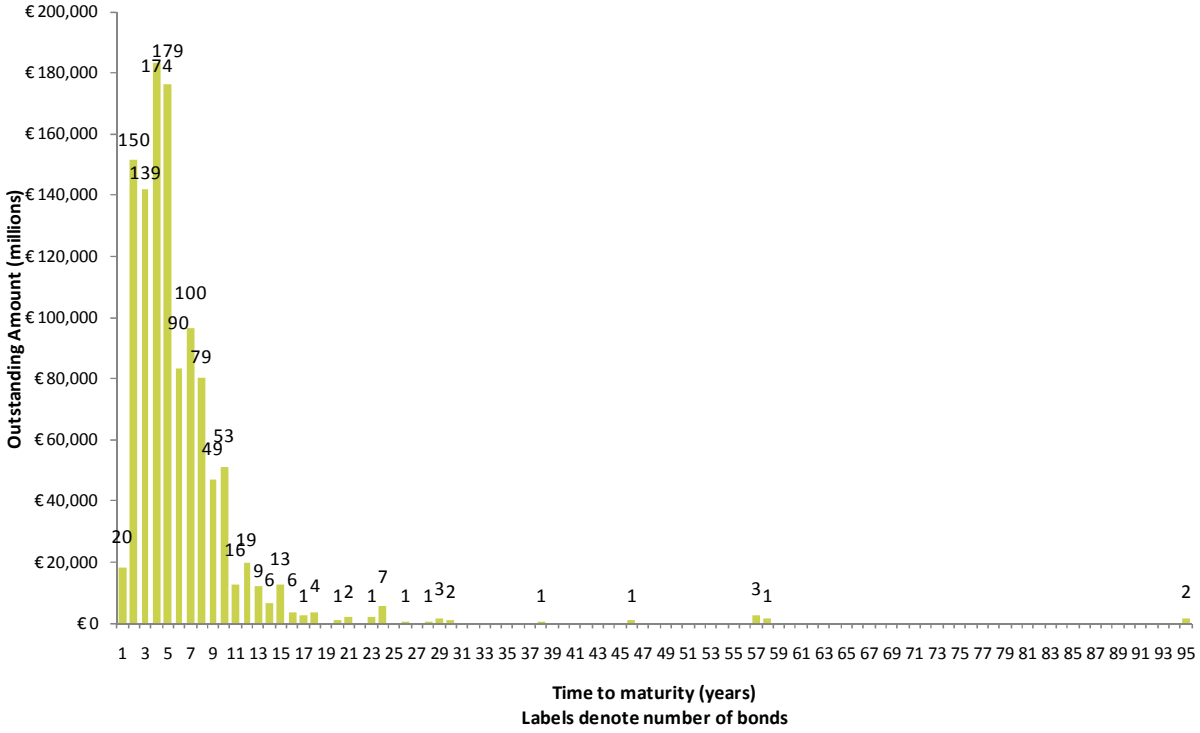
We note that the corporate bond markets are larger than the subset of the most liquid used for the Markit Iboxx indices and there are other illiquid instruments available with longer terms, so the cut-off points could be longer. A potential simplification could be to set the cut-

[11] Corporate bond liquidity before and after the onset of the subprime crisis, Dick-Nielsen, Feldhutter, Lando (2009)

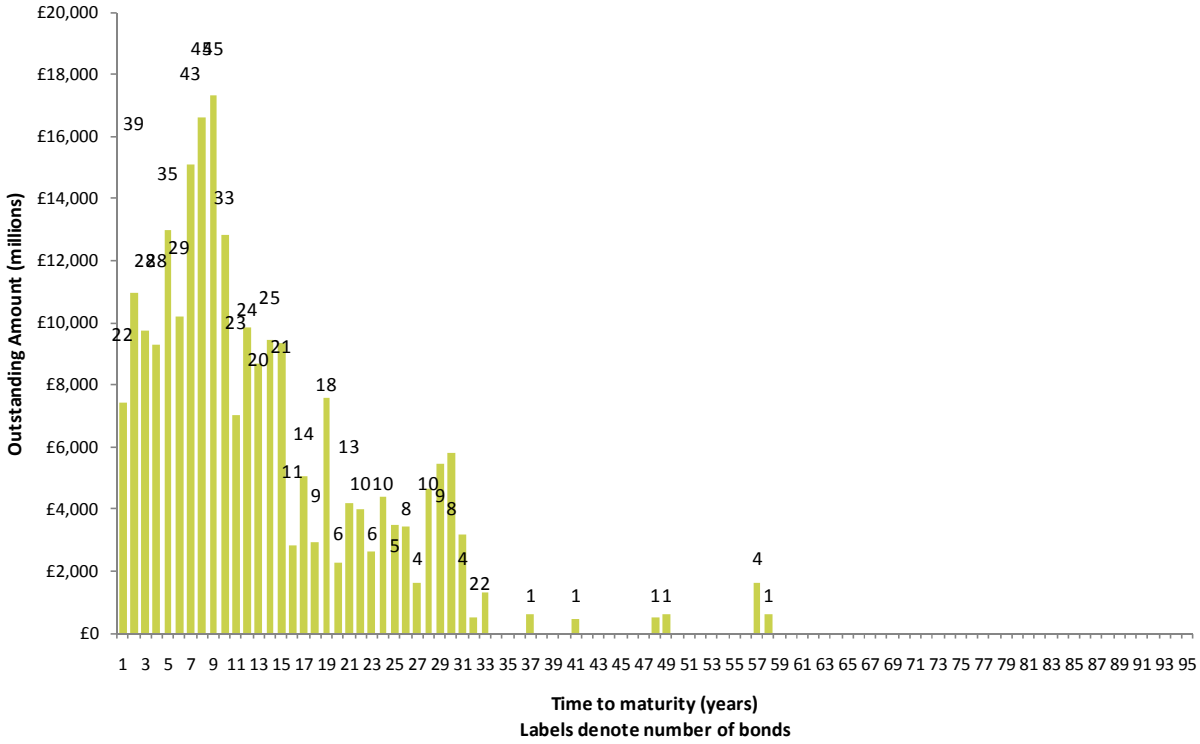
off points equal to the entry point used for the extrapolation of the basic risk-free interest rate. Further, it could be argued that when extrapolating the hypothetical pricing of assets beyond traded horizons a liquidity premium should be reflected at all points.

For full Solvency II implementation, further work is required to consider the full range of investments available to earn the liquidity premium in financial markets for each currency not just the subset of potentially more liquid assets used for the reference portfolio of assets.

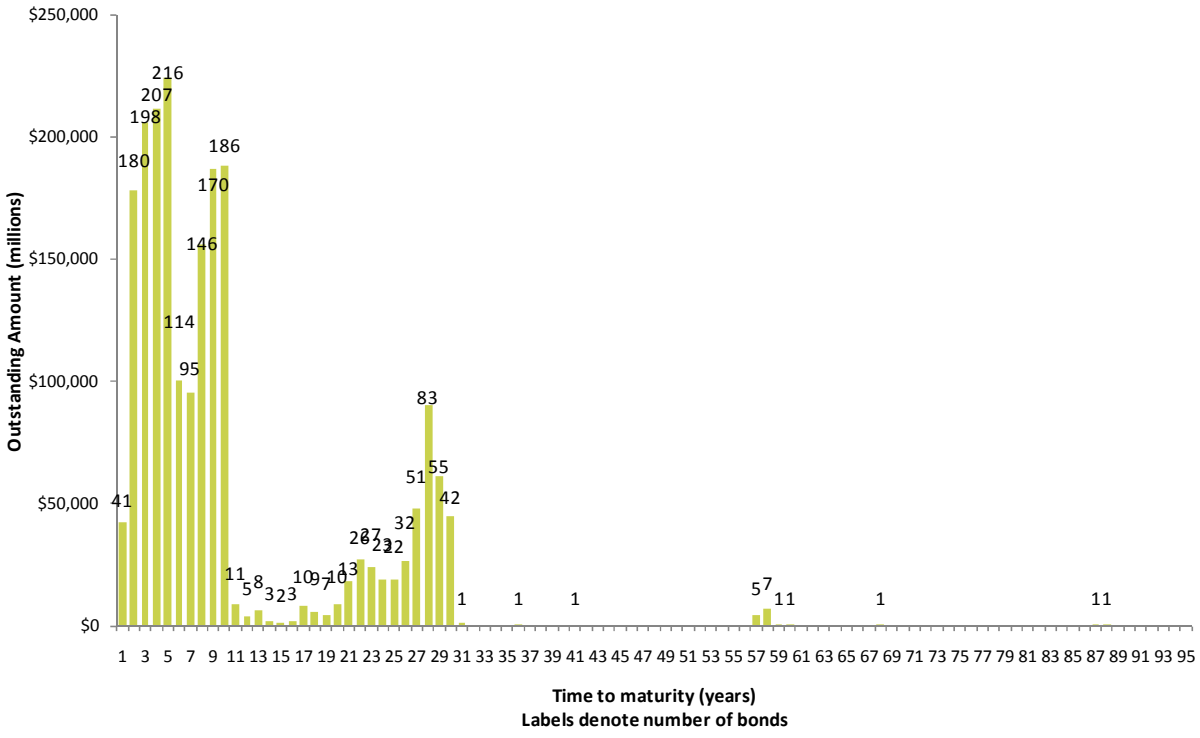
Outstanding amount of bonds available in that year to maturity for EUR Iboxx constituents



Outstanding amount of bonds available in that year to maturity for GBP Iboxx constituents



Outstanding amount of bonds available in that year to maturity for USD Iboxx constituents



Appendix 3:

Full calculation of the liquidity premium proxy measure for EUR, GBP and USD

Methodology

The proxy calculation method for EUR, GBP and USD uses Markit Iboxx corporate bond indices. These indices quote information on the annual benchmark spread over governments. The underlying index data is not available so an adjustment for the change in benchmark at the index level is required. Any method adjusting at this level will be approximate and ideally a spread measure (for example a z-spread) using swaps as the benchmark should be constructed from the components of the index.

We use the annual modified duration of the index to determine which tenor swap spreads should be used to adjust the reported benchmark spread. Other options are available such as interpolating using years to maturity, or by using the index yield directly.

We use linear interpolation to derive a swap spread of the same term as the duration of the index. The calculation is:

InterpolatedSwapSpread = SSB + (SSA - SSB) * (IndDur - TenorB) / (TenorA - TenorB)

Where:
- IndDur – Duration of the index
- TenorA – Smallest tenor above IndDur at which a swap spread is quoted
- TenorB – Largest tenor below IndDur at which a swap spread is quoted
- SSA – SwapSpread at tenor TenorA
- SSB – SwapSpread at tenor TenorB

This gives an interpolated swap spread at this duration which we subtract from the spread:

CreditSpreadSwaps = CreditSpreadGovs – InterpolatedSwapSpread

We have proposed a relatively simple spread measure for QIS 5 purposes given the timescales for the calibration. For full Solvency II implementation other more sophisticated measures (for example, a z-spread) would need to be investigated.

Data

The swap spread data is sourced from Bloomberg. The following tickers can be used to get the 5 year spreads (replace the 5 to get other tenors):
- EUR - EUSS5 CMPL Curncy
- GBP - BPSS5 CMPL Curncy
- USD - USSS5 CMPL Curncy

For convenience, we used these swap spreads, though the spreads may differ slightly from the rates used in constructing the basic risk-free interest rate. However, the difference is less than 1bp.

Iboxx credit spreads are available from Markit. See http://indices.markit.com
- EUR - DE0006301161 Markit iBoxx € Corporates

- GBP - DE0005993174 Markit iBoxx £ Corporates
- USD -GB00B0598748 Markit iBoxx $ Corporates

Worked example for USD at 31 December 2009

We illustrate the calculation with a worked example for USD at 31 December 2009:

- CreditSpreadGovs = 186.51 (iBoxx $ Corporates Annual Benchmark Spread)
- IndDur = 5.78 (iBoxx $ Corporates Annual Modified Duration)
- TenorA = 6
- TenorB=5
- SSA= 24.50 (USSS6 CMPL Curncy)
- SSB = 27.75 (USSS5 CMPL Curncy)

InterpolatedSwapSpread = 27.75 + (((24.50 – 27.75) * (5.78 - 5)) / (6 - 5)) = 25.215

CreditSpreadSwaps = 186.51 – 25.215 = 161.295

Liquidity premium proxy = 0.5*(161.295 – 40) = 60.6475 = 61 bps

It is noted that the results presented are relative to a swap curve. Consequently, 10bps is required to be added to derive the QIS 5 liquidity premium.

Calculations for EUR, GBP and USD at 31 December 2008 and 2009

We illustrate the source data and calculations at 31 December 2008 and 2009:

Date	Currency	CreditSpreadGovs	IndDur	SSA	SSB	TenorA	TenorB	InterpolatedSwapspread	CreditSpreadSwaps	LP proxy
31/12/2008	EUR	470.04	3.93	89.64	111.05	4	3	91.08	378.96	169
	GBP	509.11	6.05	36.25	48.25	7	6	47.65	461.46	211
	USD	540.19	5.56	58.25	59.00	6	5	58.58	481.61	221
31/12/2009	EUR	170.75	4.00	50.77	45.25	5	4	45.25	125.50	43
	GBP	220.90	6.77	33.25	50.25	7	6	37.16	183.74	72
	USD	186.51	5.78	24.50	27.75	6	5	25.22	161.30	61

It is noted that the results presented are relative to a swap curve. Consequently, 10bps is required to be added to derive the QIS 5 liquidity premium.

Appendix 4:

Liquidity premium for CHF and JPY currencies

In this Appendix, we propose liquidity premium for CHF and JPY for QIS5 purposes.

Swiss Franc - CHF

Methodology

In order to derive a liquidity premium estimate for CHF we have applied the proxy method for EUR, GBP and USD to a SIX Swiss Exchange Swiss Bond Index (SBI). Several indices are available which categorise the bonds by term and rating. We have chosen the AAA-BBB 1-15 year index due to its broad coverage of the market.

The liquidity premium estimate is calculated as follows: MAX (0, 50% * (BondIndexYield – InterpolatedSwapRate) – 40bps))

We use linear interpolation to derive a swap spread of the same term as the duration of the index. The calculation is: InterpolatedSwapRate = SRB + (SRA – SRB) * (IndDur – TenorB) / (TenorA – TenorB)

Where:

- IndDur – Duration of the index
- TenorA – Smallest tenor above IndDur at which a swap rate is quoted
- TenorB – Largest tenor below IndDur at which a swap rate is quoted
- SRA – SwapRate at tenor TenorA
- SRB – SwapRate at tenor TenorB

The approach is similar to that for EUR, GBP and USD although there are some key differences. For the EUR, GBP and USD, we used Iboxx indices as one of the outputs available is the average spread to government bond yields. This is calculated at an individual security level then averaged. We then adjusted this credit spread by the government to swap spread to get a spread relative to swaps. For CHF, we take the average yield and subtract a swap rate to give the spread over swaps directly. The major difference between the two approached is for CHF we calculate the spread relative to the average yield as opposed to the average of the individual spreads. **For full Solvency II implementation, we would seek to align the definition of the credit spread measure.**

Data

We have used index redemption yield and duration and swap rates from DataStream for the calculations.

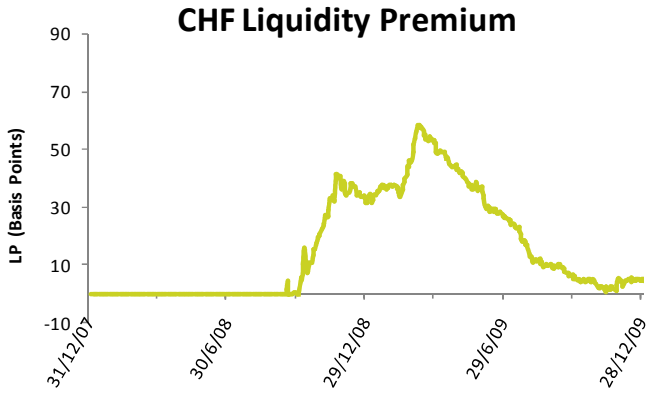
- SBI Redemption yield = SWAB115(RY)
- SBI Duration = SWAB115(DU)
- 4 Year Swap Rate = ICCHF4Y
- 5 Year Swap Rate = ICCHF5Y

We have verified that the DataStream swap rates match the Bloomberg rates SFSW4 and SWSF5. The change of source from the basic risk-free interest rate has no impact on the calculation as at 31 December 2008 and 2009.

Results

Date	31/12/08	31/12/09
Index yield %	2.90	2.09
Index duration	4.62	4.49
Swap 4 year %	1.73	1.47
Swap 5 year %	1.96	1.71
Interpolated swap rate %	1.87	1.59
Liquidity premium (bps)	32	5

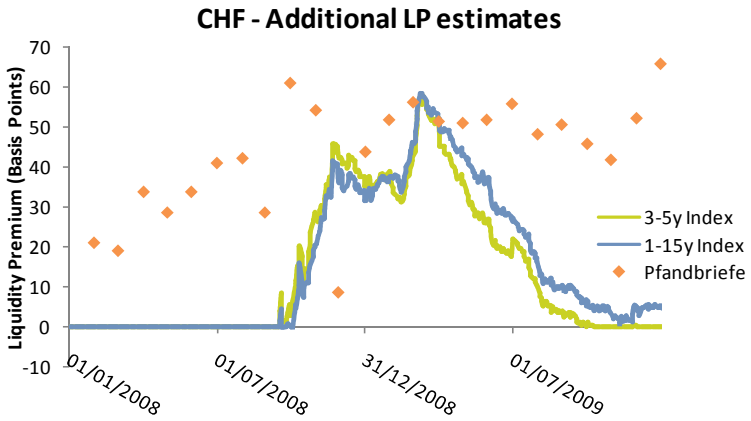
It is noted that the results presented are relative to a swap curve. Consequently, 10bps is required to be added to derive the QIS 5 liquidity premium. The liquidity premium is 42bps and 15bps at end December 2008 and 2009.



Supporting analysis of direct measures

For comparison we have also calculated the liquidity premium using the 3-5 year bond index (which is the most densely populated index) and Swiss Pfandbriefe (a direct covered bond method). The 3-5 year bond index provided comparable results to the 1-15 year index. The Pfandbriefe give similar liquidity premia during the recent economic crisis but the yields started increasing earlier than credit spreads and have yet to fall.

In the time required for QIS5, we were not able to source the required data for the negative CDS method and the structural model results were not credible due to a lack of appropriate input data.



Where available the direct measures support the use of the proxy method calibrated as for EUR, GBP and USD.

Term structure of the liquidity premium

We examine a maturity analysis of the SBI 1-15year index:

Maturity Band	Number of bonds
31/12/09 – 31/12/14	279
01/01/15 – 31/12/19	150
01/01/20 – 31/12/24	14
01/01/25 – 31/12/29	6
01/01/30 +	6

Given that there are relatively few bonds beyond 10 years, we propose a cut-off of 10 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point.

Japanese Yen – JPY

Methodology

In order to derive a liquidity estimate for JPY we have applied the proxy method for EUR, GBP and USD to the Merrill Lynch Japan Corporate Bond Index. This is believed to be a representative index for JPY. The credit spread measure applied is the same as for CHF.

We have not been able to calculate reasonable looking direct measures of the liquidity premium due to a lack of reliable data and time constraints for QIS 5. However, it is clear that there is a significant JPY corporate bond market to access the liquidity premium.

Data

We have used index redemption yield and swap rates from DataStream for the calculations below assuming a constant duration of 4.4 years (value at calculation date).

- ML Redemption yield = MLJPCPL(RY)
- 4 Year Swap Rate = ICJPY4Y
- 5 Year Swap Rate = ICJPY5Y

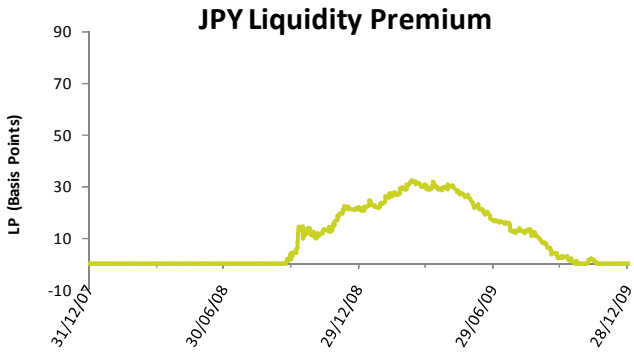
It is noted that for the end 2008 and end 2009, we have used Bloomberg swap rates JYSW4 and JYSF5 (as for the basic risk-free interest rate) and updated the duration to specific day values using the Macaulay duration output on index JC00.

Results

Date	31/12/08	31/12/09
Index yield %	1.73	1.00
Index duration	4.53	4.38
Swap 4 year %	0.87	0.59
Swap 5 year %	0.93	0.69
Interpolated swap rate %	0.89	0.63
Liquidity premium (bps)	22	0 [-1bps floored at zero]

It is noted that the results presented are relative to the swap curve. Consequently, 10bps is required to be added to derive the QIS 5 liquidity premium. The liquidity premium is 32bps and 9bps at end December 2008 and 2009.

The liquidity premium appears relatively low for JRY compared to other currency. For full Solvency II implementation, further analysis into direct measures of assessing the liquidity premium is required. This would include the accessibility of the USD liquidity premium as such denominated assets are commonly held by firms in Japan.



Term structure of the liquidity premium

We examine a maturity analysis of the Merrill Lynch Japan Corporate Bond Index:

Maturity Band	Number of bonds
31/12/09 – 31/12/14	532
01/01/15 – 31/12/19	310
01/01/20 – 31/12/24	25
01/01/25 – 31/12/29	28
01/01/30 +	4

Given that there are relatively few bonds beyond 10 years, we propose a cut-off of 10 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point.

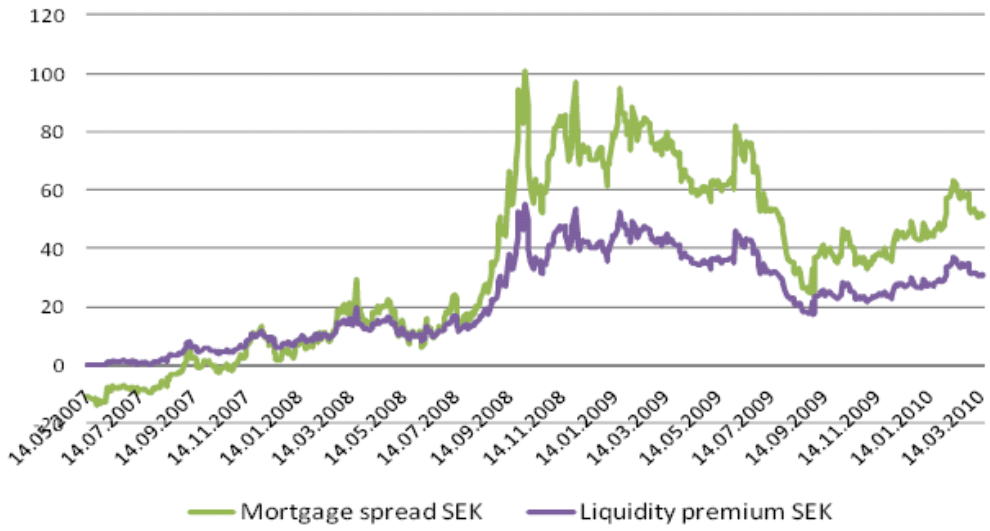
Appendix 5:

Liquidity premium for SEK, DKK and NOK currencies

In this Appendix, we propose liquidity premium for SEK, DKK and NOK for QIS5 purposes. These are initial estimates and further analysis on both the calibration and on which indices to use would need to be performed for full Solvency II implementation.

Swedish Krona – SEK

For the liquidity premium estimation for SEK an index of Swedish covered bonds is used. The index is currently published by the Swedish bank Handelsbanken and is available on Bloomberg (HMSMDU Index). There are several reasons why this index is chosen. Firstly, this represents a significant part of the Swedish bond market and all bonds in this index are AAA rated. Moreover, covered bonds are made use of when constructing the current discount curve for solvency purposes in Sweden. Currently, half the spread is applied. The graph below shows the spread and the calculated liquidity premium over time for current solvency purposes in Sweden.



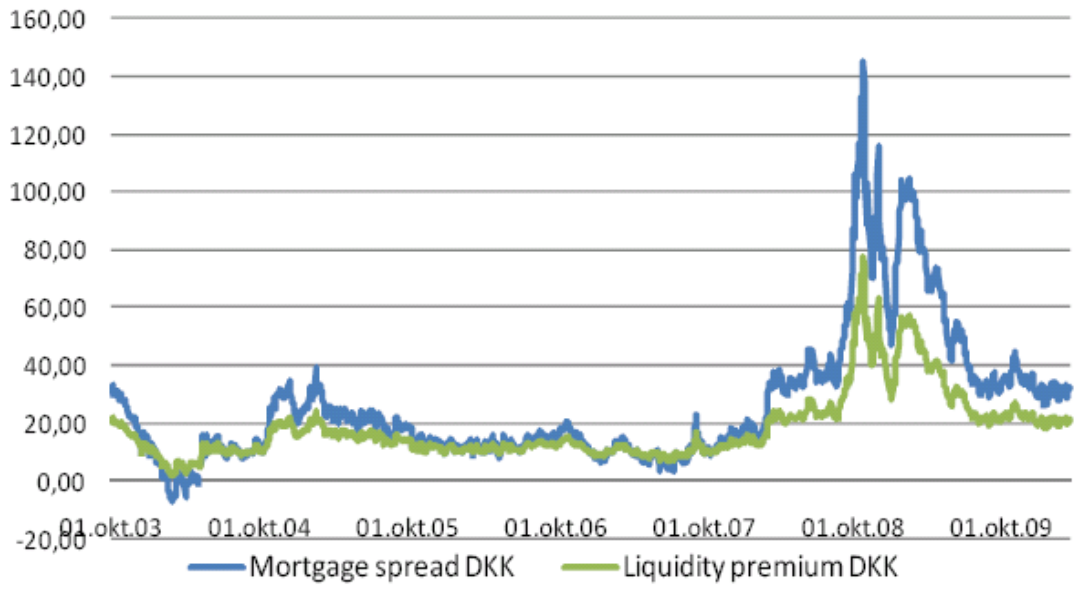
The same methodology is proposed for QIS5. However, for consistency with the methodology proposed for EUR, GBP and USD, the full covered bond spread rather than half is used. The covered bond spread is taken as a spread above swap less 10bps.

Specifically, the liquidity premium is estimated to be 54bps at 31 December 2009 and 84bps at 31 December 2008.

For QIS5 purposes the liquidity premium cut-off point is set to the same as the last liquid point in the basic risk-free interest rate, notably 10 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point.

Danish Krone – DKK

For the liquidity premium estimation for DKK an index of Danish covered bonds is used. The index is currently published by the Danish bank Nykredit and is available on their webpage (www.nykredit.dk) and on Bloomberg. Covered bonds represent a significant part of the Danish bond market and this index consists mostly of AAA rated bonds (which only a few AA rated). Moreover, the same covered bond index is made use of when constructing the current discount curve for solvency purposes in Denmark. Currently, use is made of half the spread. The graph below shows the spread and the calculated liquidity premium over time on this basis.



We note that the methodology that is currently being used by the Danish regulator is more detailed and there is a term structure of liquidity premium. For simplicity in QIS 5, this has not been applied. Instead a methodology similar to SEK is proposed where the full covered bond spread is used. The covered bond spread is taken as a spread above the DKK swap curve less 10bps.

Specifically, the liquidity premium is estimated to be 40bps at 31 December 2009 and 62bps at 31 December 2008. The risk-free interest rate used in this assessment is the DKK local swap curve less 10bps rather than the adjusted EUR curve less 10bps as proposed in Appendix 1. Due to time constraints, it was not possible to re-perform the analysis using the correct rates, however, this will not significant distort the liquidity premium for QIS 5 purposes.

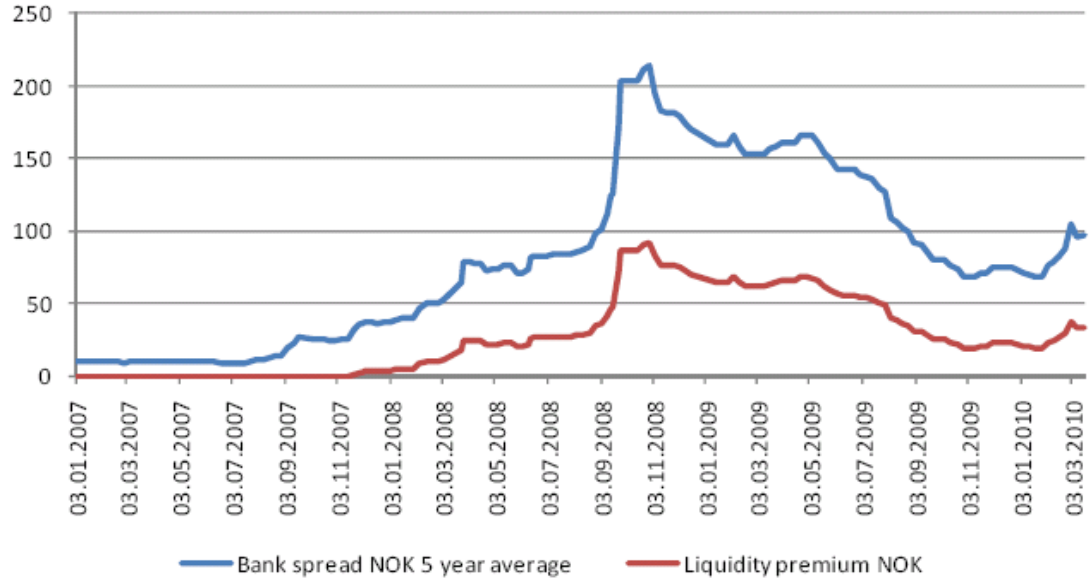
For QIS5 purposes the liquidity premium cut-off point is 15 year based on the constituents of the index. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point.

Norwegian Krone - NOK

For the liquidity premium estimation for NOK an index of bonds from Norwegian banks is used. The index is currently published weekly by the Norwegian bank DnB Nor Markets. The index is distributed to clients on a weekly basis and the index is available on Bloomberg as a total return index. Bonds from Norwegian saving and commercial banks represent a significant part of the Norwegian bond market.

The methodology proposed for QIS5 is the same as for EUR, GBP and USD and is as follows: Liquidity premium NOK = max (0, 50%* (NOK bank bond spread – 40bps)). The bank bond spread is taken as a spread above swap less 10bps.

The graph below shows the spread and the calculated liquidity premium over time.



Specifically, the liquidity premium is estimated to be 20 bps at 31 December 2009 and 70 bps at 31 December 2008.

For QIS5 purposes the liquidity premium cut-off point is set to the same as the last liquid point in the basic risk-free interest rate, notably 10 years. The liquidity premium is then applied using the same method as for EUR, GBP and USD including the 5 year linear run-off from this point.

Appendix 6:

Liquidity premium for other currencies

In this Appendix, we propose liquidity premium for the other currencies for QIS5 purposes.

Czech Koruna – CZK, Polish Zloty – PLN and Hungarian Forint – HUF

For CZK, PLN and HUF, we were able to source corporate bonds in excess of circa £1bn in each market. However, no readily available and reliably corporate bond indices could be evidenced.

In these three currencies, the following relationship between the government bond and swap curves is evidenced:

5 year spread of governments over swaps less 10bps in basis points

	CZK	PLN	HUF
Credit rating**	**A+**	**A**	**BBB**
31 December 2005	7	3	26
31 December 2006	2	-1	19
31 December 2007	10	2	33
31 December 2008	82	96	121
31 December 2009	40	54	72

****** Standard & Poor credit rating

The pattern is similar to that observed on corporate bond spreads in the larger currencies. There is evidence of an additionally liquidity premium through the investment in local government bonds. However, it is unclear the extent to which the additional spread relates to liquidity premium, credit default risk, compensation for bearing credit risk or potentially other aspects in these markets.

As an intermediate measure for QIS 5 purpose, we propose a liquidity premium of 35% of the EUR (relative to swaps less 10bps). This represents a workable and conservative allowance for QIS 5, but would clearly require significant further investigation for full Solvency II implementation.

Date	EUR liquidity premium (relative to swaps less 10bps)	35% of EUR liquidity premium (relative to swaps less 10bps)
End December 2008	179	63
End December 2009	53	19

For the liquidity premium cut-off point, we propose 15 years for CZK and PLN reflecting the entry point into the swap curve extrapolation and that the government bond market exists beyond this point. For HUF, we propose 10 years, reflecting the shorter government bond market.

Romanian Lei – RON

For RON, we were not able to find corporate bond markets on Bloomberg or other readily available sources for QIS 5. Further, the relationship between the swap curve and government curve has not been stable over the last 5 years – that is the government spread over swaps has sometimes been positive or negative. **We propose zero liquidity premium for QIS 5.**

Bulgarian Lev – RON

For BGN, we were not able to find corporate bond markets on Bloomberg or other readily available sources for QIS 5. Further, there is a positive swap spread over government bonds at end 2008 and 2009. **We propose zero liquidity premium for QIS 5.**

Turkish Lira – TRY

For TRY, we were able to source data for corporate bond markets of circa £2bn. However, very few bond issues were beyond 3 years so there is unlikely to be a liquidity premium to materially impact the valuation of technical provisions. Further, there is a positive swap spread over government bonds at end 2008 and 2009. **We propose zero liquidity premium for QIS 5.**

Iceland Krona – ISK

For ISK, in the absence of recent reliable government or swap data, **we propose zero liquidity premium for QIS 5.**

Estonian Kroon – EEK, Latvian Lats – LVL and Lithuanian Litas – LTL

As noted in the selection of the basic risk-free interest rate, no active swap rates or government bond prices could be reliably sourced and due to currency pegging the EUR risk-free curve was proposed. **For the liquidity premium, we propose to use 35% of the EUR liquidity premium for QIS 5.** The reduction is to reflect the risk that the currency peg maybe broken in future.