Milliman Financial Risk Management
London Market Monitor – 31 January 2018
Data sources: Bloomberg; Barclays; EIOPA; Oxford-Man Institute; ONS; Milliman FRM

Market Price Monitor

Local Equity Markets

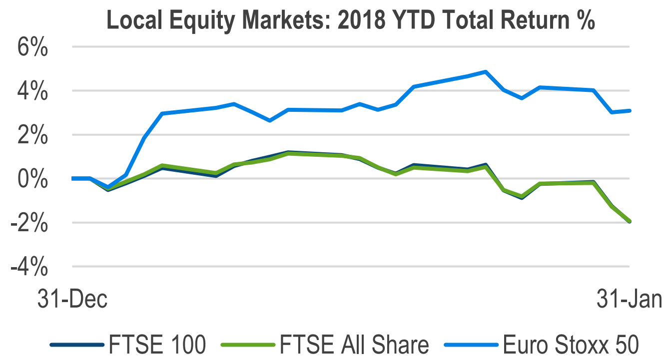
- There has been a noticeable gap between Eurozone and UK equities this month.
- While Eurozone equity markets returned just over 3% in January, continuing their positive momentum from 2017, UK equities remained relatively flat to begin before declining to a 2% loss by the end of the month.

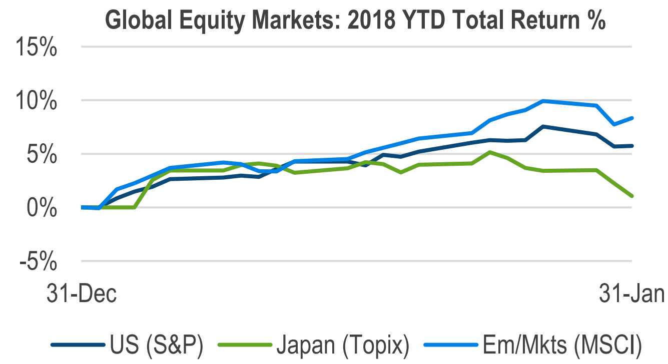
Global Equity Markets

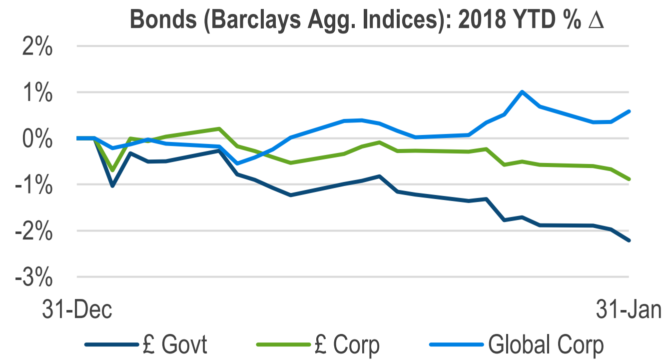
- Outside of Europe, most equity markets made a positive start to the year.
- Emerging markets equity continued to make impressive gains. The main index returned more than 8% during the month. It is now 40% higher than one year ago.

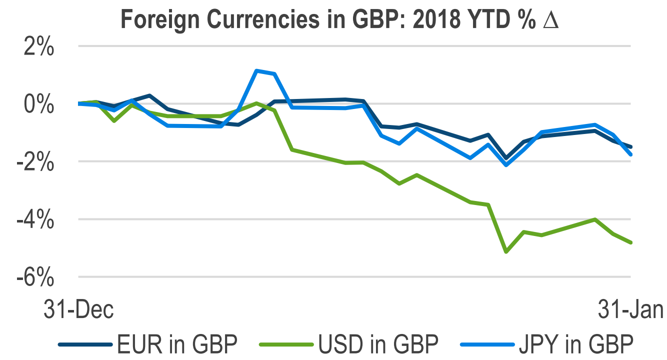
Bond/FX Markets

- UK bonds also started the year off poorly, with gilts posting over a 2% loss and corporates close to a 1% loss.
- Outside the UK, global corporate bonds made a more positive start with a small gain.
- £ Sterling however has had a strong January, making up ground against all the major currencies. In particular it gained close to 5% against the US Dollar.









Total Returns as of January 31, 2018

	FTSE 100	FTSE All Share	Euro Stoxx 50	US (S&P)	Japan (Topix)	Em/Mkts (MSCI)	£ Govt	£ Corp	Global Corp	EUR in GBP	USD in GBP	JPY in GBP
1 Month	-2.0%	-1.9%	3.1%	5.7%	1.1%	8.3%	-2.2%	-0.9%	0.6%	-1.5%	-4.8%	-1.8%
3 Month	1.1%	1.0%	-1.5%	10.2%	4.2%	12.4%	-0.4%	0.8%	2.0%	-0.2%	-6.4%	-2.6%
1 Year	10.4%	11.3%	14.5%	26.4%	23.3%	41.0%	1.6%	5.0%	8.8%	1.9%	-11.4%	-8.4%
YTD	-2.0%	-1.9%	3.1%	5.7%	1.1%	8.3%	-2.2%	-0.9%	0.6%	-1.5%	-4.8%	-1.8%

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Solvency II Monitor - Rates

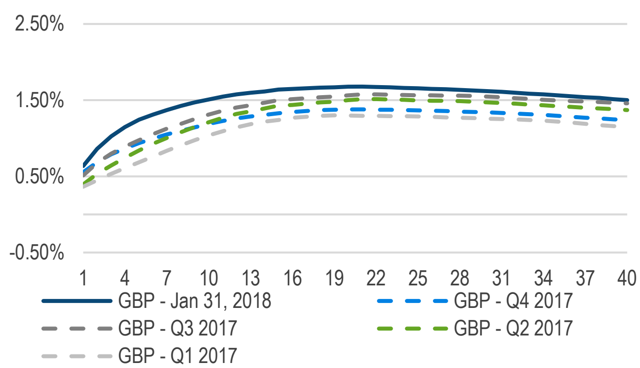
Risk Free Rates

- There has been a significant increase in the GBP Solvency II discount curve in January, with most terms seeing close to a 30 basis point increase.
- The EUR Solvency II discount curve also saw an increase across most terms. The middle of the term structure shows an increase of between 10 and 20 basis points, driven by an increase in underlying swap rates. The change becomes dampened at the long end of the curve.
- On 1 January, the Ultimate Forward Rate (UFR) for EUR and GBP curves reduced from 4.20% to 4.05%. This reduction has had an offsetting effect on both curves.
- Further information on the UFR change is provided in the following Milliman briefing note (http://www.milliman.com/uploadedFiles/insight/2017/ultimate-forward-rate-ie.pdf?lng=1048578).

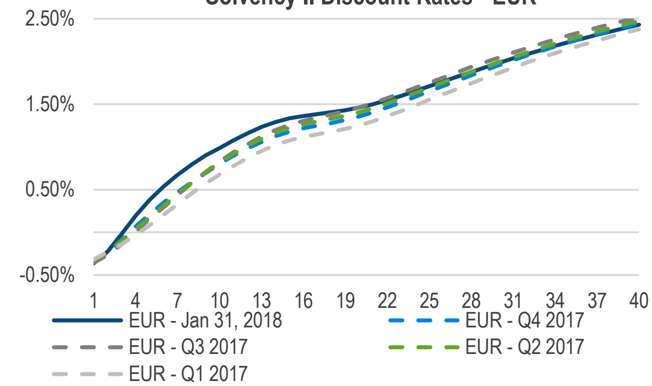
Credit Risk Adjustment

- LIBOR-OIS spread levels continue to be tight, meaning the CRA remains at its 10 basis point floor for both GBP and EUR.

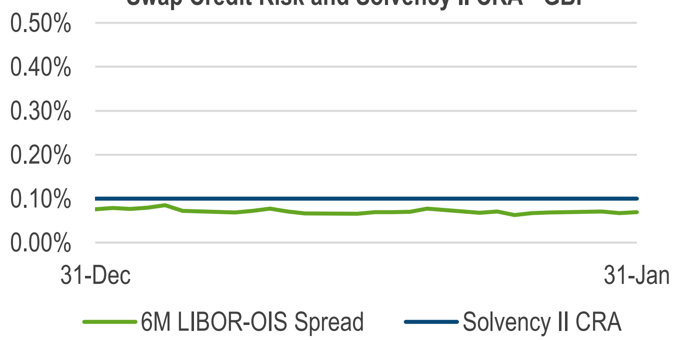
Solvency II Discount Rates - GBP



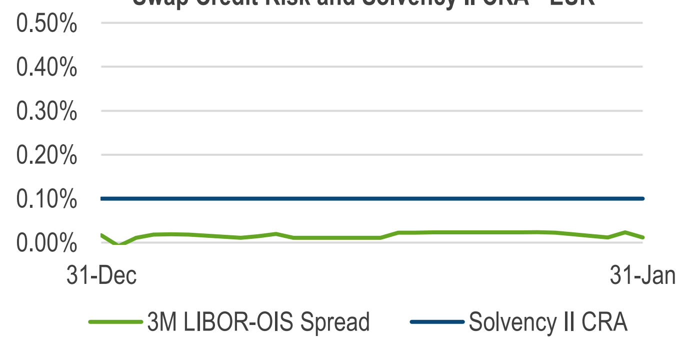
Solvency II Discount Rates - EUR



Swap Credit Risk and Solvency II CRA - GBP



Swap Credit Risk and Solvency II CRA - EUR



Change in GBP Discount and CRA (bps)

	1Y	Y5	Y10	Y20	Y30	CRA
Since Q4 2017	8	31	32	30	28	0
Since Q3 2017	12	27	20	11	7	-3
Since Q2 2017	24	40	30	18	15	-6
Since Q1 2017	27	56	47	38	36	-7

Change in EUR Discount and CRA (bps)

	1Y	Y5	Y10	Y20	Y30	CRA
Since Q4 2017	-1	17	19	10	3	0
Since Q3 2017	-1	22	16	0	-7	0
Since Q2 2017	-3	21	17	5	-1	0
Since Q1 2017	-5	30	31	21	11	0

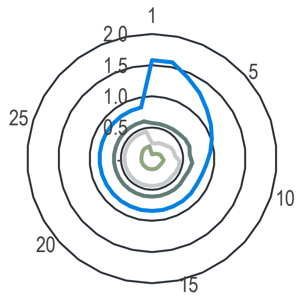
Solvency II Monitor - Spreads

Fundamental Spreads

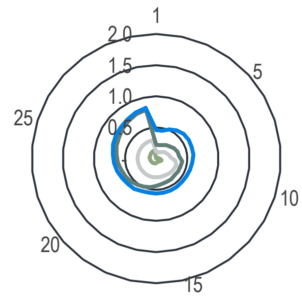
- The fundamental spread data shown is for end of December.
- There were no material changes compared to the end of November.

Fundamental Spreads %

GBP - Financial



GBP - Non-Financial



GBP Financial Fundamental Spread %

	1Y	Y5	Y10	Y20	Y30
AAA	0.07	0.11	0.18	0.17	0.2
AA	0.25	0.31	0.45	0.44	0.44
A	0.57	0.59	0.62	0.61	0.61
BBB	1.58	1.18	0.84	0.84	0.84

GBP Financial 'Before Floor' %

	1Y	*Y5*	*Y10*	*Y20*	*Y30*
AAA	*0*	*0.04*	*0.07*	*0.14*	*0.2*
AA	*0.04*	*0.07*	*0.11*	*0.19*	*0.28*
A	*0.07*	*0.14*	*0.22*	*0.37*	*0.51*
BBB	*0.18*	*0.29*	*0.4*	*0.57*	*0.7*

GBP Non-Financial Fundamental Spread %

	1Y	Y5	Y10	Y20	Y30
AAA	0	0.02	0.09	0.09	0.13
AA	0.11	0.16	0.34	0.3	0.3
A	0.22	0.29	0.41	0.55	0.8
BBB	0.46	0.59	0.57	0.61	0.83

GBP Non-Financial 'Before Floor' %

	1Y	*Y5*	*Y10*	*Y20*	*Y30*
AAA	*0*	*0.02*	*0.04*	*0.09*	*0.13*
AA	*0*	*0.04*	*0.08*	*0.17*	*0.26*
A	*0.04*	*0.15*	*0.29*	*0.55*	*0.8*
BBB	*0.12*	*0.24*	*0.38*	*0.61*	*0.83*

The **Solvency II risk-free discount rates** are based on applying the Smith-Wilson Extrapolation to LIBOR swap rates sourced from Bloomberg (current curve is for 31/01/18) and applying the Credit Risk Adjustment as defined in the Technical Specs.

The **Credit Risk Adjustment** is a component of the risk-free discount curve defined by EIOPA. It is calculated from actual experience in the 'LIBOR-OIS' spread (3 months for EUR, 6 months for GBP), and is bounded between 0.10 and 0.35. We show actual LIBOR-OIS spread levels and the defined CRA, for both GBP and EUR.

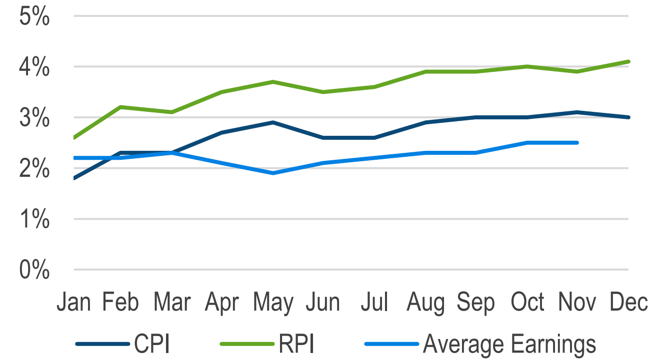
EIOPA fundamental spreads show the credit spread corresponding to the risk of default or downgrading of an asset. This is shown here across financial and non-financial assets, credit quality steps 0-3 and durations of 1-30 years. The data is provided by EIOPA and as of 31/12/17. **Fundamental spread** = maximum (probability of default + cost of downgrade; 35% of long-term average spread). In the tables we show the '**before floor**' measure = probability of default + cost of downgrade.

Data sources: Bloomberg; Barclays; EIOPA; Oxford-Man Institute; ONS; Milliman FRM

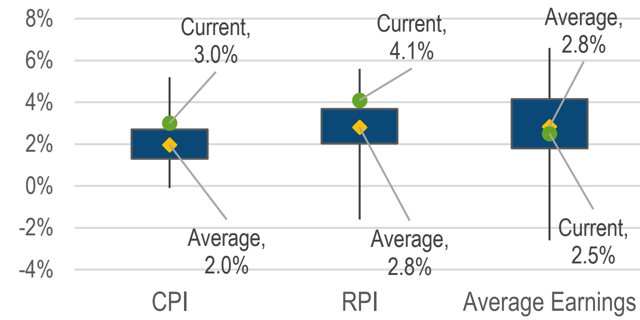
UK Inflation Monitor

- UK CPI price inflation rate dropped back to 3.0% in December, after its November peak.
- According to ONS: *The downward effect came mainly from air fares, along with a fall in the prices of a range of recreational goods, particularly games and toys. The downward contributions were partially offset by an increase in tobacco prices, reflecting duty increases that came into effect following the Autumn Budget, along with an increase in petrol and diesel prices.*
- The annual earnings inflation stayed constant at 2.5% in November.
- The RPI price inflation ticked up to 4.1% in December. The market implied view shows expectation that RPI will remain in the range of 3% and 4% for some years to come. This is broadly consistent with the view at the start of 2017.

UK Inflation Rate: Experience over Past Year

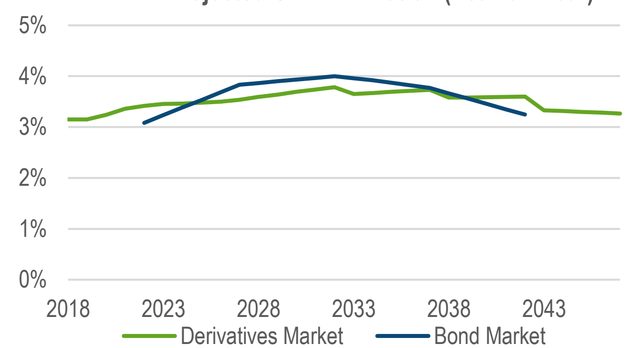


Max, Min and 50% Range: Since BoE Independence



Historical UK GDP Growth (Year-on-Year)

Projected UK RPI Inflation (Year-on-Year)



Historical year-on-year inflation rate is assessed by the % change on:
- **Consumer Price Index (CPI)** – measuring the monthly price of a basket of consumer goods and services
- **Retail Price Index (RPI)** – similar to CPI, but the main difference due the addition of mortgage payments, council tax and other housing costs
- **Average Earnings** – measuring the average total weekly employee remuneration over the previous 3 months.

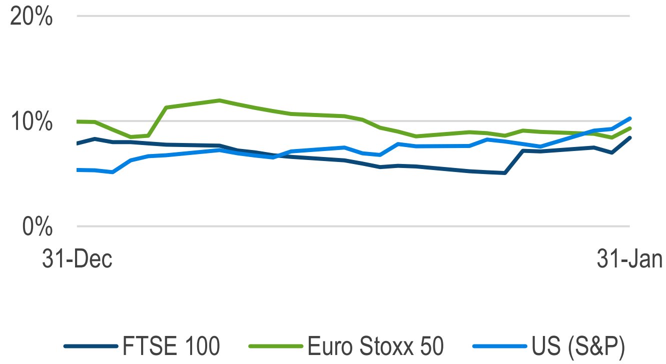
Projection year-on-year inflation rate is the forward rate calculated from market data:
- **Derivatives Market View** – constructed from zero coupon inflation par swap rates against the RPI index at various tenors
- **Bond Market View** – constructed from the difference between the nominal rates implied by the conventional gilts and the real rates implied by the index-linked (RPI) gilts.

Data sources: Bloomberg; Barclays; EIOPA; Oxford-Man Institute; ONS; Milliman FRM

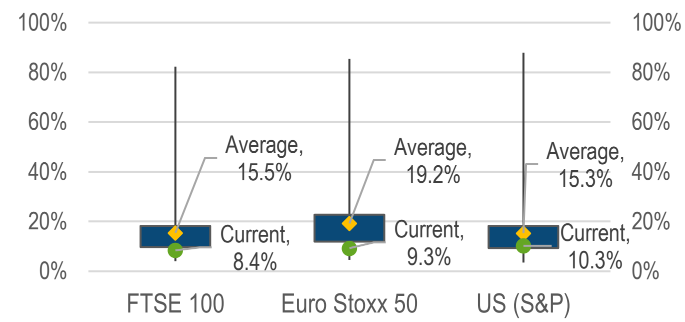
Volatility and Hedging Cost Monitor

- January 2018 has seen a continuation of the historically low realised volatility levels seen in 2017 well below their historical average levels.
- However, we do see a pick-up in volatility on the main US benchmark towards the end of the month, as well as a pick-up in volatility risk premiums (i.e. the premium of implied volatility over realised volatility) to go above 3% for both the S&P 500 and FTSE 100.

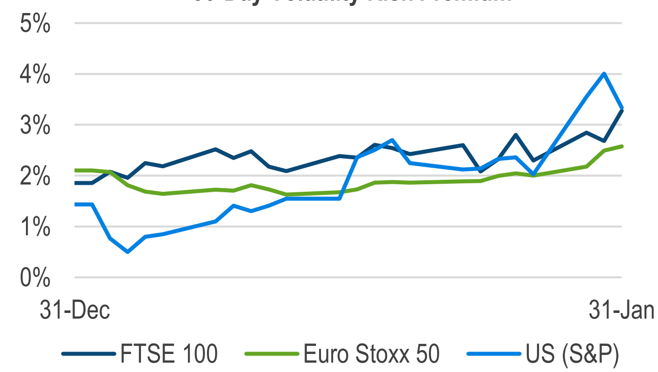
Realised 1-Month Equity Volatility (EWMA)



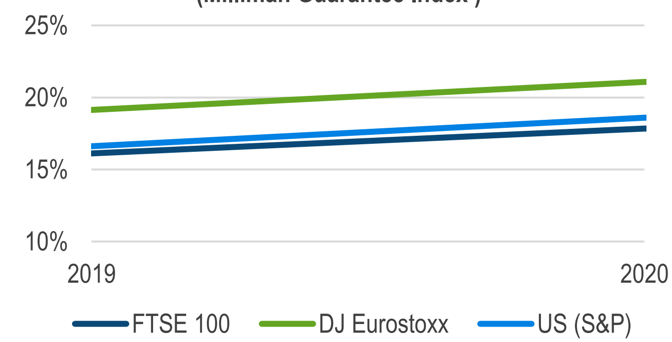
Max, Min and 50% Range: Last 25 Years



30-Day Volatility Risk Premium



Expected Volatility (Milliman Guarantee Index)



Actual realised equity volatility is measured by the weighted standard deviation of 1 month daily index change. The Exponentially Weighted Moving Average (EWMA) methodology places more importance to the recent returns in the calculation of the volatility.

Volatility Risk Premium is estimated as the difference between 30-day implied volatility and projected realised volatility (on data from the Oxford-Man Institute). This reflects the additional cost of hedging from purchasing a basket of options, in comparison to managing a dynamic delta hedge with futures (ignoring rolling transaction costs).

Expected realised volatility is an intermediate result from the Milliman Guarantee Index™ (MGI), which provides volatility parameters for variable annuity guarantee (VA) valuation and risk management. The levels shown are on an expected basis, and do not reflect any risk adjustment.

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