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Currency Weekly

The USD bulls' last hurrah

Market focus

pg 2

The USD bull run feels close to the end. The recent run may not be of the same scale as asset price bubbles in the past, but the lifecycles of these asset price bubbles and the current USD rally follow a similar pattern. The recent rapid USD move, although much smaller, exhibits similar features to booms of the past such as the NASDAQ in the 1990s. The features are comparable because as the end of the move approaches, the pace of ascent picks up markedly and we see a one-way mentality develop. The rise of the USD has exhibited all these qualities. Participants now seem to be buying the USD not based on a change in fundamentals but instead because they believe the rally will extend further. This is a classic mentality associated with unsustainable moves. This last hurrah idea is just one of the thorns in the side of the USD. The others include recent data developments, the limits of the US tolerance for currency strength, valuations, all-encompassing USD bullishness and the fact the USD does not perform when the Fed actually pulls the trigger. We continue to see EUR-USD at 1.10 by the end of 2016.

Quant indicators

pg 7

Regular updates of our quantitative indicators. This includes (i) our positioning indicators; (ii) correlation analysis, both multi-asset (RORO) and G10 FX high-frequency; and (iii) indices that quantify the market's appetite for risk.

Market focus

The USD party's nearly over

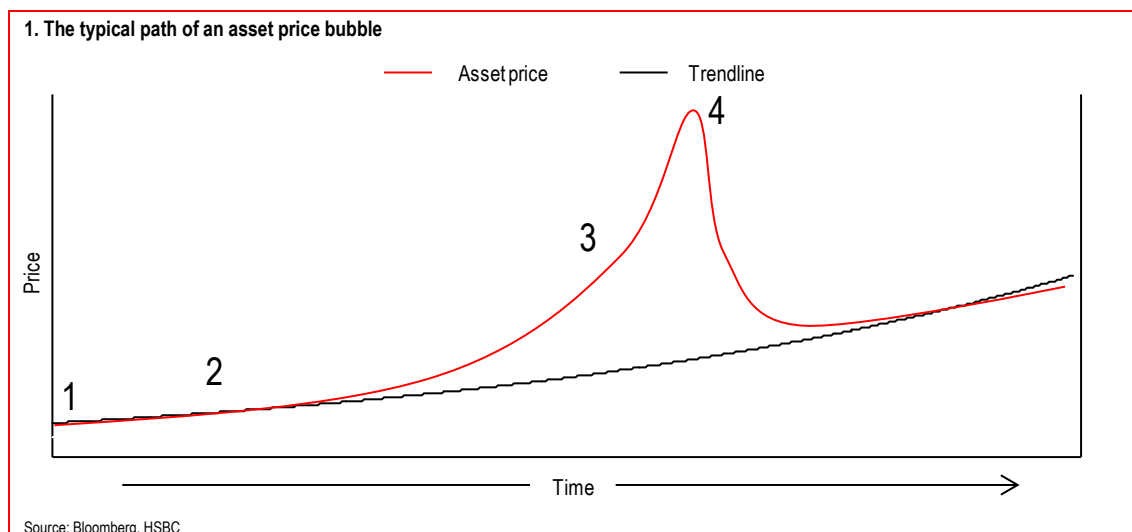
The current USD rally has accelerated since the start of the year, leaving the DXY index up over 25% since May 2014. This constitutes a significant move and major rallies tend to have similar life-cycles. In fact, such lifecycles tend to follow the typical phases of classic asset-price bubbles, just on a smaller scale.

The final surge of an asset price has generally been followed by a sizable retracement. This is the case for both huge asset price moves, or 'bubbles', or somewhat less dramatic but still significant moves. We feel that this current move is on its last legs and about to enter its final retracement stage. As we detail in our recent report, [*'Currency Special: USD bull run: the beginning of the end'*](#), 19 March, there is a possibility of a final temporary lurch higher for the dollar, with EUR-USD challenging parity, but that will be it. We continue to see EUR-USD at 1.10 by the end of 2016.

Of course, we are not suggesting the USD is lined up for a major crash. We are simply saying that a USD reversal is becoming imminent and an appreciation of bubble dynamics can help us understand the outlook for the USD.

Background to bubbles

A bubble involves a rapid, and ultimately unsustainable, increase in prices. One of the most dramatic examples in history was the tulip mania in 1636. At its peak, a single tulip bulb was sold for more than 10 times the annual income of a skilled craftsman. Another early example is the South Sea Bubble in 1720 where the share price in the South Sea Company rose from GBP128 in January 1720 to GBP1,050 in June of the same year. Whilst these are two extreme examples, the profile of the moves has an uncanny resemblance to the USD rally we have been experiencing, albeit on a completely different scale.



Regardless of the scale of the overall move, the profile of a rapidly accelerating move shows a similar broad pattern. We have divided the progression of the typical move into 4 distinct stages (as illustrated on Chart 1).

1. The new discovery

The cycle starts with a new discovery or story. In the dotcom boom of the 1990s, the change was the revolution in information technology and the subsequent improvements in communication. For currency moves, the trigger might be a rapid divergence in economic conditions between countries, or even just a change in sentiment.

2. The early rise

If the initial change is sufficiently large and influential, there will be an increase in the predicted outlook for the asset and anticipated profits that could come as a result. Those who realise this will enter early and make healthy gains and the prices start to gradually increase. At this stage, the increase is consistent with the backstory and seems to confirm its validity.

3. The pace picks up

As the price continues to rise, it starts to become divorced from reality. Investor behaviour is being driven not by the fundamental value of the asset but, rather, because they are simply anticipating further rises. A consensus starts to form that “this time it’s different” and that the rally will continue indefinitely. This phase is characterised by a final surge higher.

4. The subsequent fall

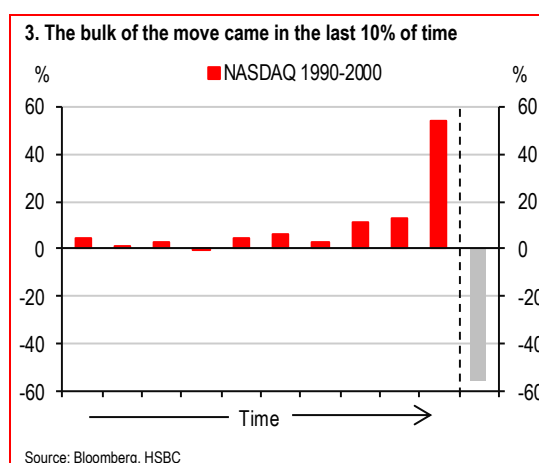
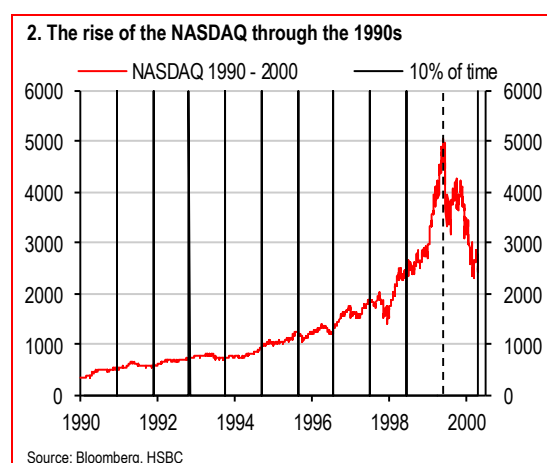
After a large pick up in price, a small change to sentiment can see the direction suddenly reverse. There is often no pause before the fall: asset prices decline immediately after they stop increasing. At the beginning of this stage, some will continue to hold to the belief that it is only temporary; however, as prices continue to decline, investors start to think they are unlikely to see a reversal and so sell to limit their losses, exacerbating the slide. Prices tend to stabilise only once this capitulation is complete.

An example in depth – NASDAQ in the 1990s

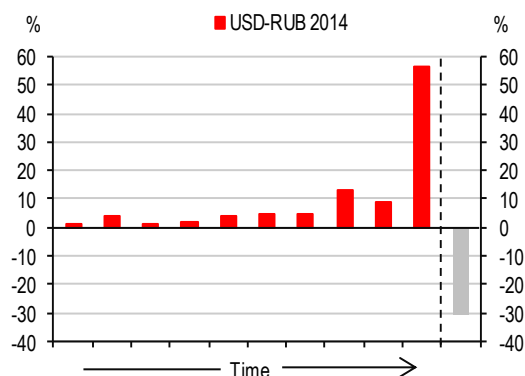
The rise of the NASDAQ through the 1990s is perhaps the most memorable example of a bubble in recent times. The initial trigger for the boom was the proliferation of the internet. The story driving the bubble was that the internet would revolutionise information technology and communication. The initial NASDAQ gains were relatively modest but as the decade progressed, investors were sucked in to buying internet stocks, under the mistaken belief that simply being internet-based would single-handedly make a company a success. The price action saw an increasingly strong, yet ultimately mistaken, consensus that the only direction for these stocks was up. At the start of the decade, the NASDAQ was at 454. It peaked on 10 March 2000 at 5132 on an intraday basis, before closing at 5049. The subsequent decline was substantial, with the NASDAQ retracing over half its total move since the start of the decade. This decline saw numerous tech companies go insolvent as the bubble burst.

Chart 2 shows the price action of the NASDAQ bubble, which we have divided into 10 equal time intervals. The moves during these deciles are shown more clearly in chart 3, as is the immediate post-crash time interval. What is clear is that the bulk of the move occurs in the second half of the period, with the biggest move towards the very end; price moves accelerate as fundamentals are ignored and the subsequent reversal is rapid (grey bar).

Charts 4–9 show equivalent examples for some other bubbles and major rallies; they have a similar pattern. Rallies accelerate and have a final flourish before the correction rapidly kicks in. The equivalent process can also happen with sharp, accelerating price declines – a good example being the collapse in the oil price in late 2014, early 2015.

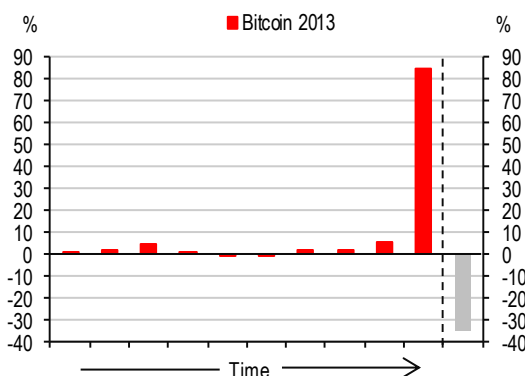


4. USD-RUB: 26/06/14 - 16/12/14



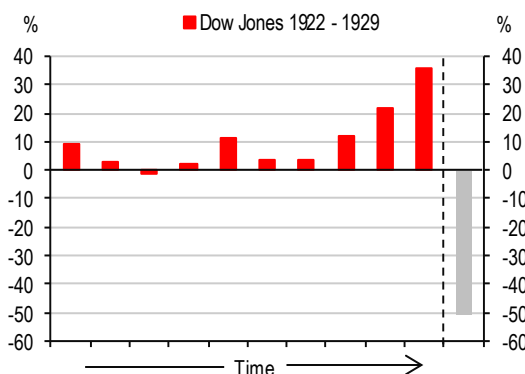
Source: Bloomberg, HSBC

5. Bitcoin: 02/01/13 - 29/11/13



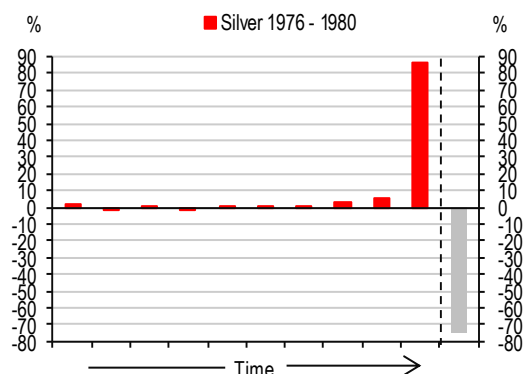
Source: Bloomberg, HSBC

6. Dow Jones: 24/08/21 - 03/09/29



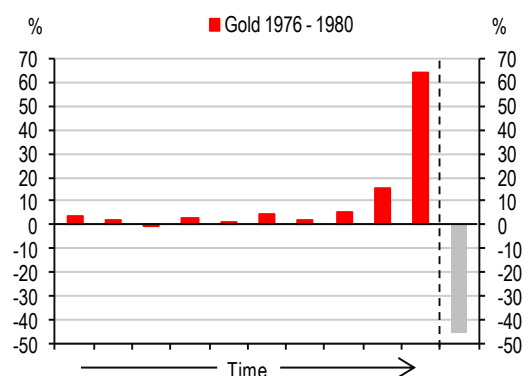
Source: Bloomberg, HSBC

7. Silver: 21/01/76 - 18/01/80



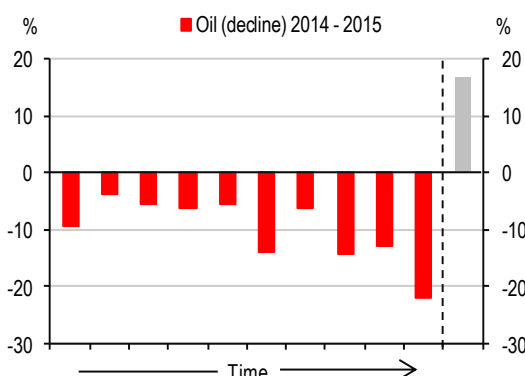
Source: Bloomberg, HSBC

8. Gold: 25/08/76 - 21/01/80



Source: Bloomberg, HSBC

9. Oil: 19/06/14 - 13/01/15



Source: Bloomberg, HSBC

The current USD rally

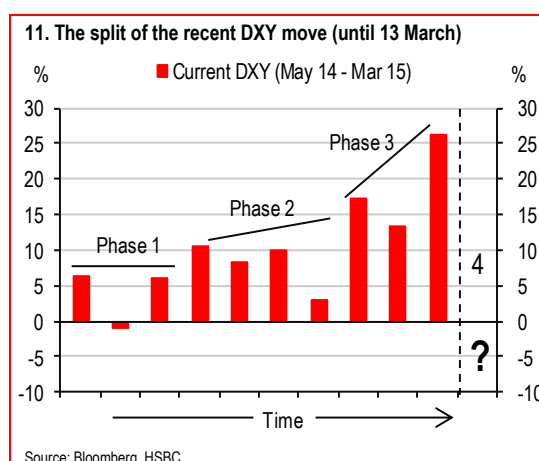
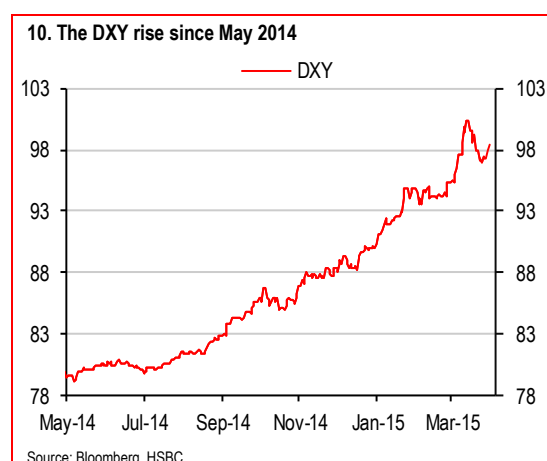
The current USD rally is one of the larger ones by historical standards. Using the DXY index, since 1970 only the two 'mega rallies' of the 1980s and late 1990s have been bigger. So far we have seen a move in excess of 25%, as depicted in charts 10 and 11. The lifecycle of a bubble as described above seems fitting.

Phase 1 – The new discovery: The currency war ignites. A weaker currency is desirable in a world of low growth and low inflation. The US recovery, with its relatively better fundamentals, sets up the USD to take the strain and appreciate.

Phase 2 – The early rise: The dollar rallies and validates the reasoning. The ECB rhetoric reaffirms the likelihood of easing while the US Fed tapers and attention shifts to the timing of the first Fed rate hike. A justifiable adjustment in exchange rates takes place.

Phase 3 – The pace picks up: Participant are buying the USD, not because the fundamentals have changed (if anything, the US data has been softer than expected of late), but instead simply because they think the rally will continue. ECB QE is known both in terms of scale and duration. A Fed rate hike in 2015 is already widely anticipated. **We believe this is where we are now.**

Phase 4 – The subsequent fall: There is a possibility of a final temporary lurch higher for the dollar, with EUR-USD challenging parity, but that would be a signal that the USD is overstretched rather than the beginning of another powerful USD surge. We continue to see EUR-USD at 1.10 by the end of 2016. The expected rate hikes are unlikely to offer USD much support, as emphasised in our recent piece: ['Currency Weekly: Don't buy the dollar when the Fed raises rates'](#), 25 March.



Conclusion

As stated in our [previous report](#), we are coming to the end of the USD bull run. We accept there might be a push towards parity, but a further fall in EUR-USD below this level seems unlikely. There has been nothing new that justifies a permanent push lower and, if anything, the US data has been disappointing of late. We expect the USD to stabilise against both developed and emerging market currencies. The party is nearly over, it's time to gather your belongings and get out whilst you can.

Quant Indicators

1. HSBC Positioning Indicators (pg 8)

The HSBC Positioning Indicators measure the degree to which the momentum community is either long or short of a currency pair. For exchange rates where position data is available from the IMM, we compare the two sources of data. Discrepancies between these two sources of data can be particularly informative about positioning and sentiment of fundamental FX traders.

2. Correlation Analysis: Multi-Asset (RORO) & G10 FX (pg 13)

(a) RORO Index – multi-asset correlations

The RORO Index is at moderate levels. Cross-asset correlations are weaker than was typical during the height of the crisis.

(b) Emerging Market RORO Indices

Regional correlations within EM regions are at moderate levels. The Asia and LatAm regional EM-common-factors remain risk-on; however, the EMEA factor is not significantly correlated to the RORO factor at this time.

(c) Equity RORO Index

The Equity RORO index measures the strength of correlations within the main “risky” asset class of equities. The Equity RORO Index is significantly lower than the all-time highs seen in late 2011, but is still high by pre-crisis levels.

(d) High-frequency G10 FX correlations

We show the strength of the correlations between all G10 exchange rates, calculated using hourly FX price data.

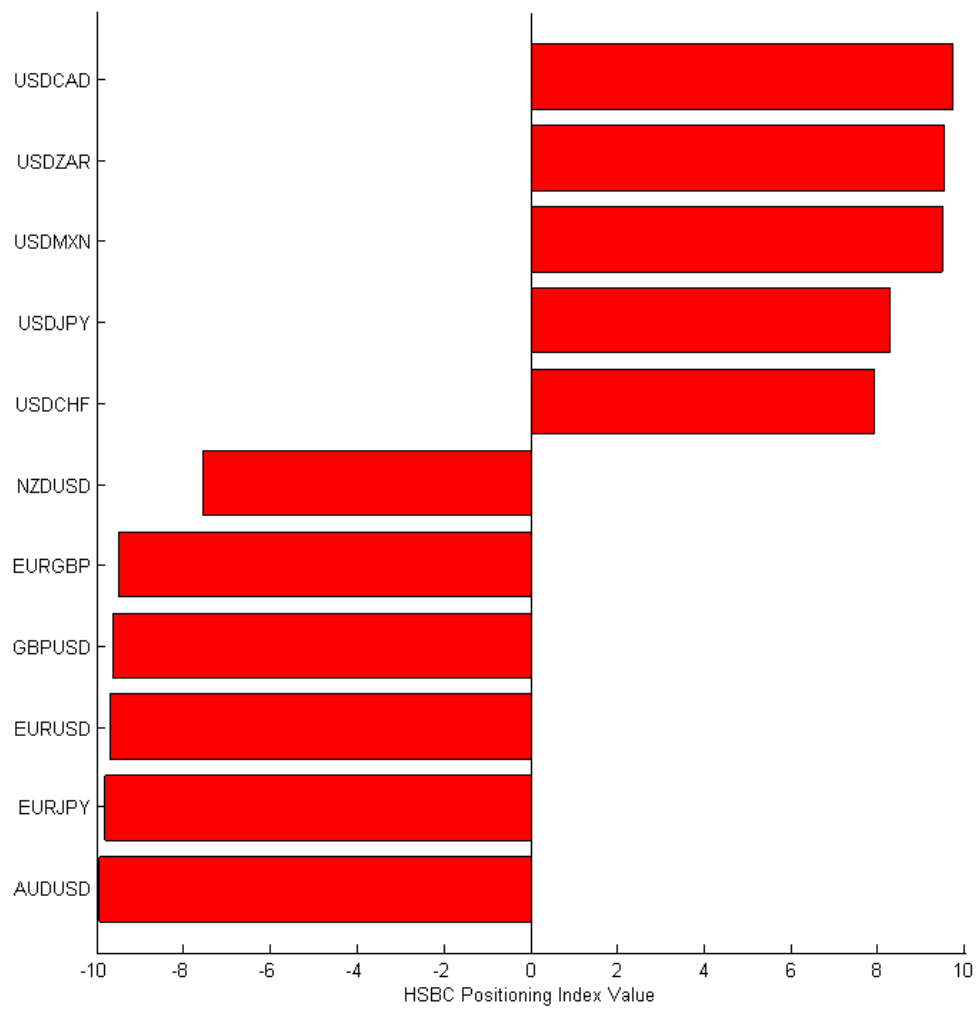
3. Risk Appetite: OPRA Index and MRAI (pg 22)

The OPRA index measures risk appetite based on the positions held in contracts with varying degrees of risk by speculative traders on US futures exchanges. The OPRA Index is **in positive territory**; this indicates that speculative traders on the US futures exchanges have shifted their exposure towards riskier assets.

The MRAI is in a long-term downtrend. This indicates that **risk premia have increased**.

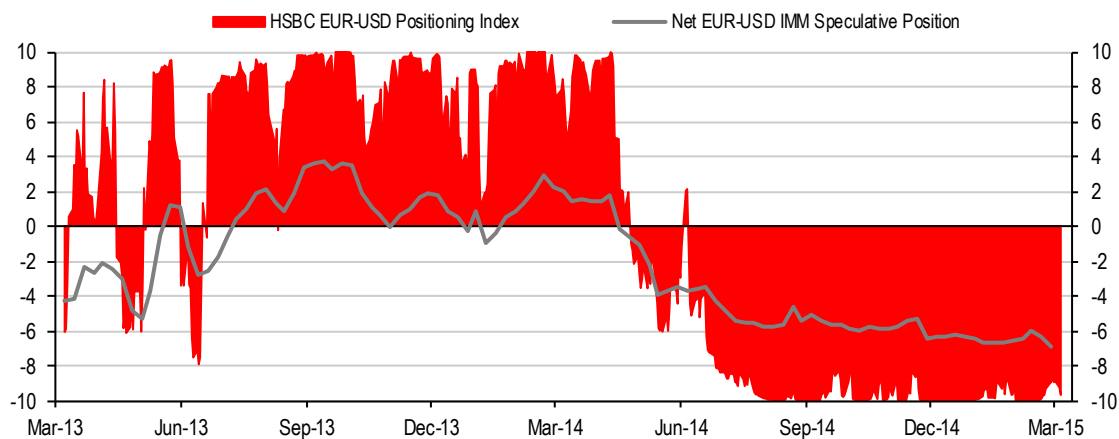
HSBC Positioning Indices

Current Value of HSBC Positioning Indices



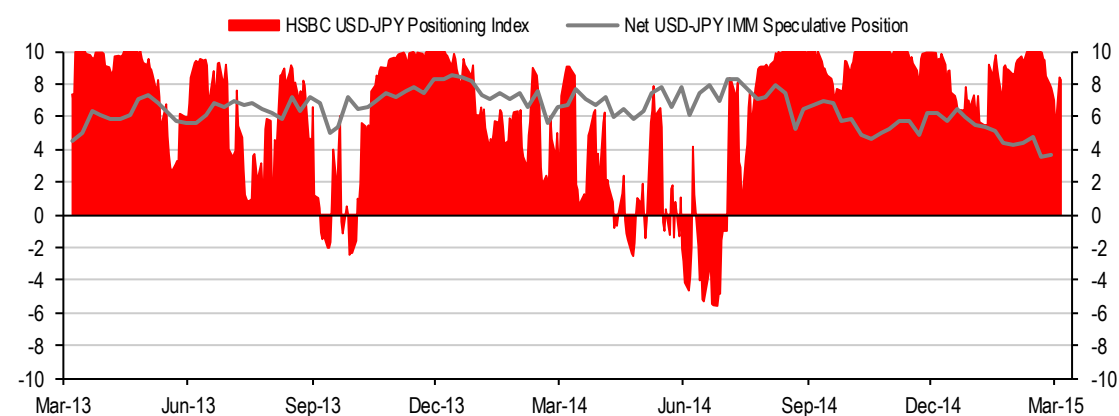
Source: HSBC, Bloomberg

HSBC EUR-USD Positioning Index



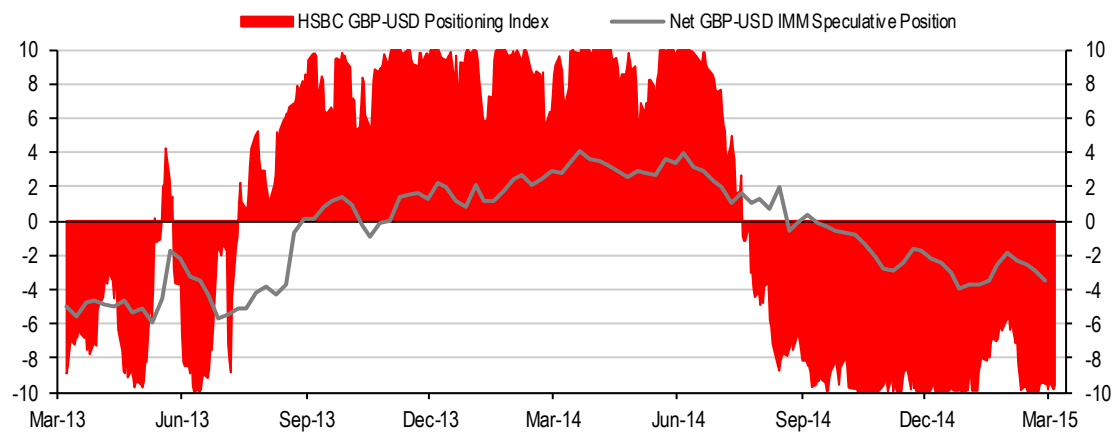
Source: HSBC, Bloomberg

HSBC USD-JPY Positioning Index



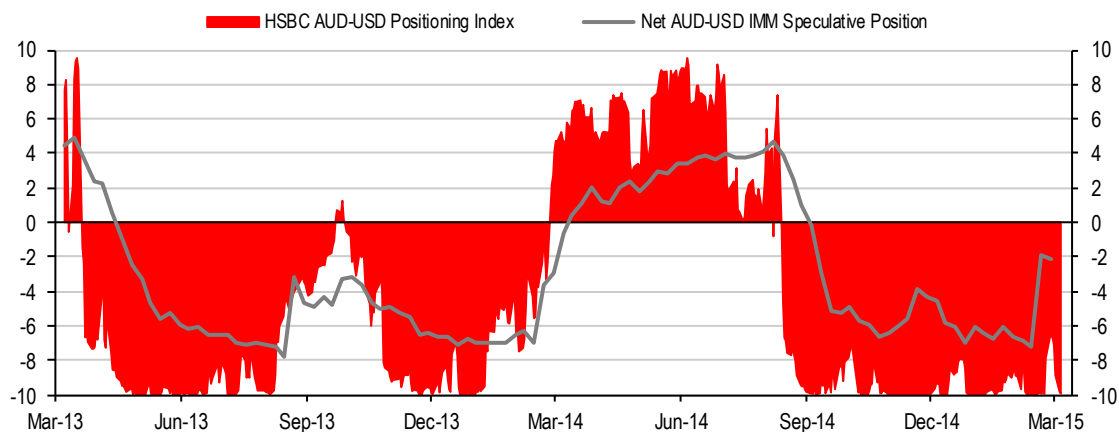
Source: HSBC, Bloomberg

HSBC GBP-USD Positioning Index



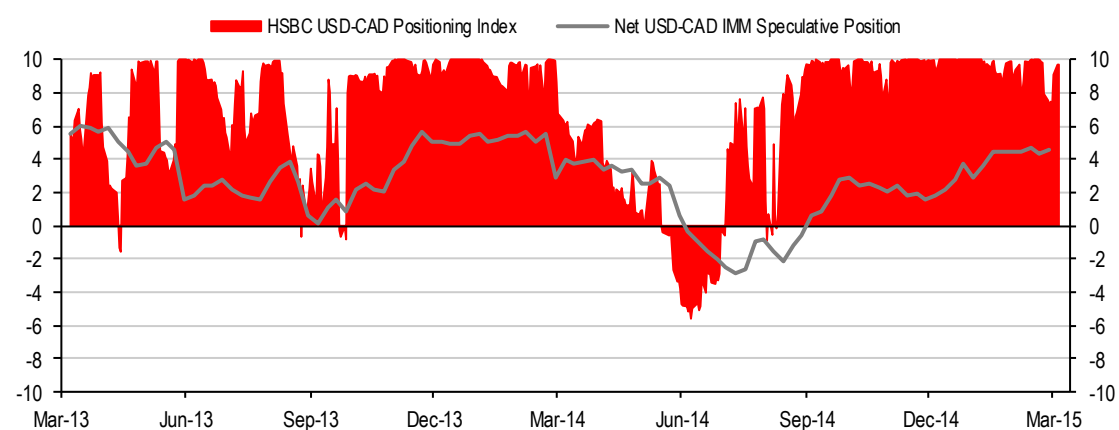
Source: HSBC, Bloomberg

HSBC AUD-USD Positioning Index



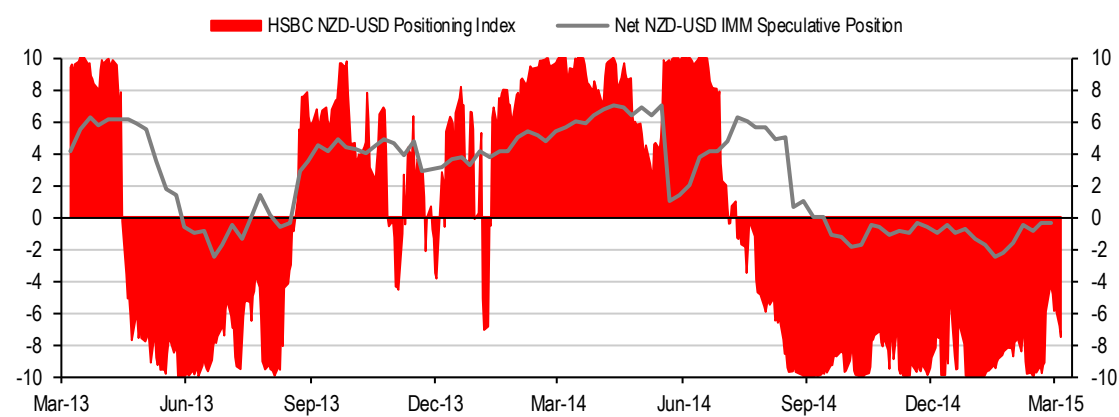
Source: HSBC, Bloomberg

HSBC USD-CAD Positioning Index



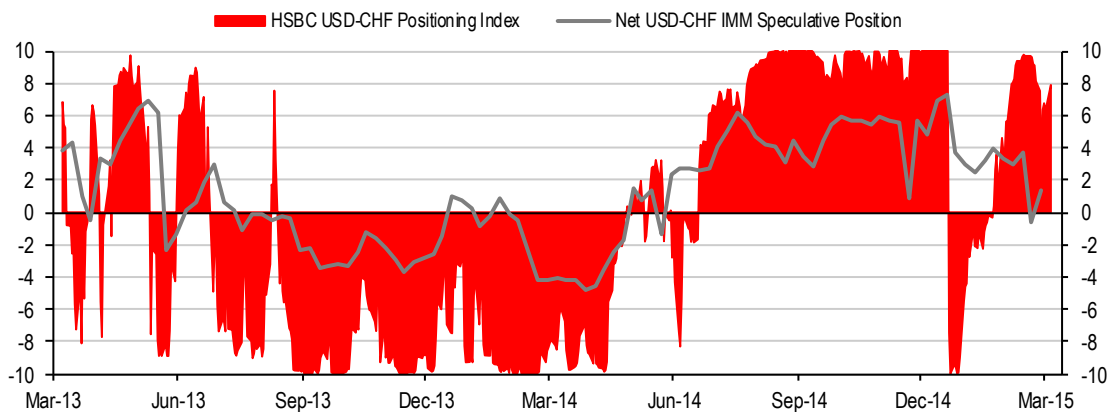
Source: HSBC, Bloomberg

HSBC NZD-USD Positioning Index



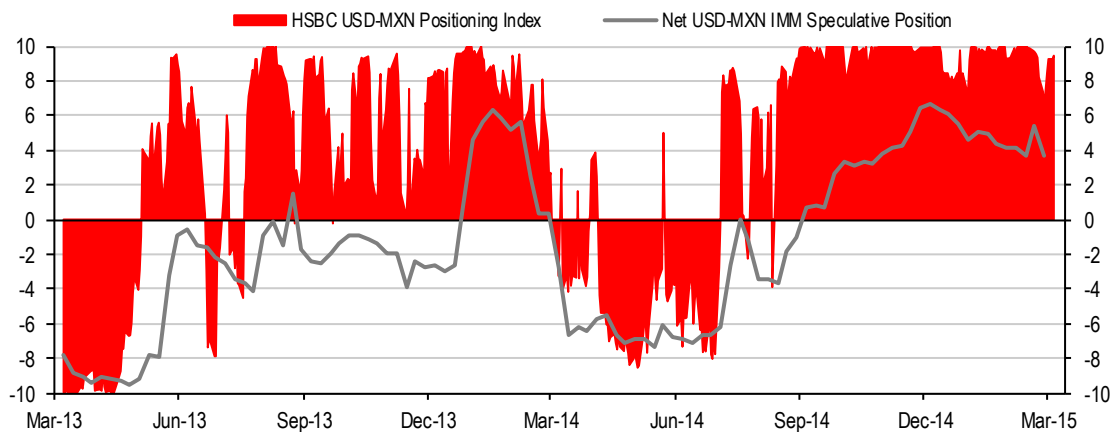
Source: HSBC, Bloomberg

HSBC USD-CHF Positioning Index



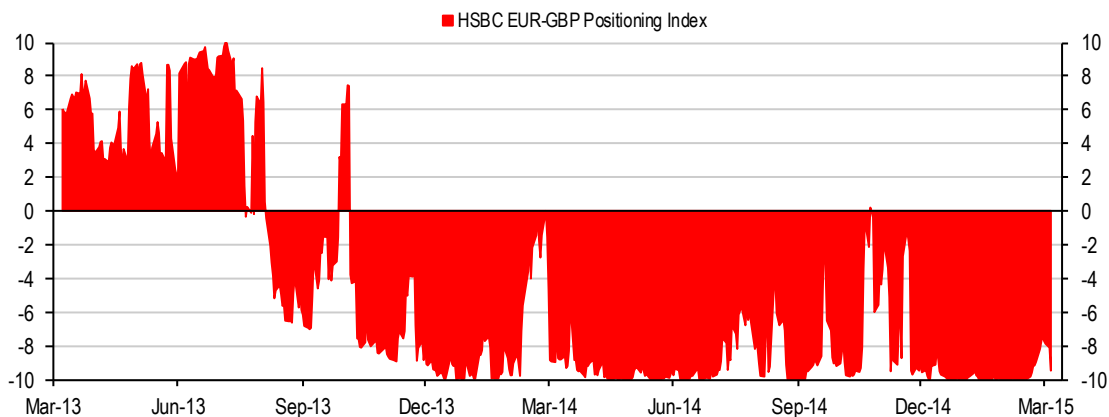
Source: HSBC, Bloomberg

HSBC USD-MXN Positioning Index



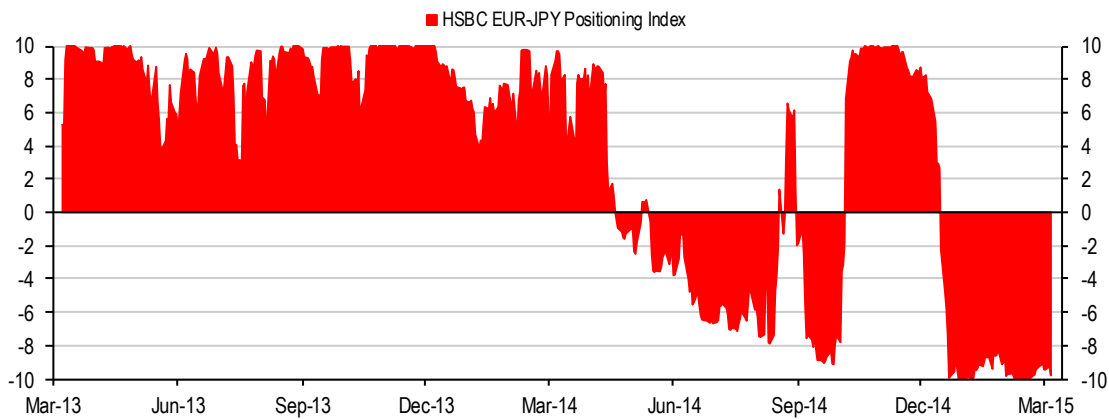
Source: HSBC, Bloomberg

HSBC EUR-GBP Positioning Index



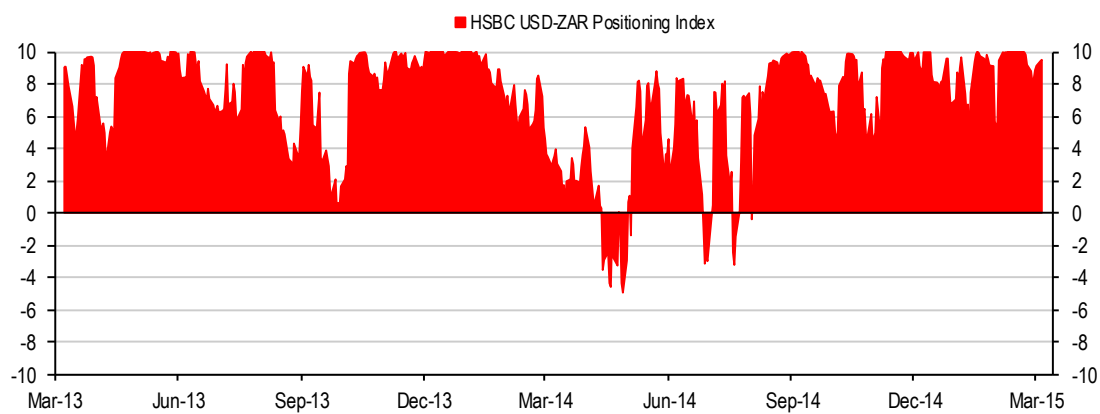
Source: HSBC, Bloomberg

HSBC EUR-JPY Positioning Index



Source: HSBC, Bloomberg

HSBC USD-ZAR Positioning Index



Source: HSBC, Bloomberg

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HSBC Risk On – Risk Off Index

Risk On – Risk Off Index



Source: HSBC, Bloomberg

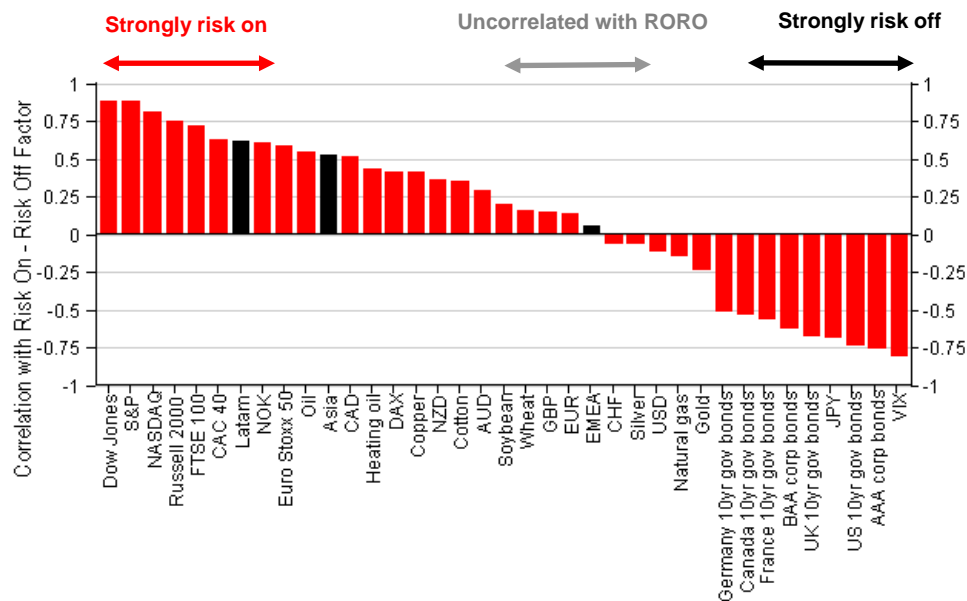
RORO Index

The RORO index is at moderate levels, having fallen sharply recently.

This indicates that the risk on – risk off phenomenon is not as dominant as during the height of the crisis.

See Appendix A1 for more details of the methodology.

Asset correlations with the risk on – risk off factor



Source: HSBC, Bloomberg

RORO Correlations

The assets that were most highly correlated with the risk on – risk off factor during the previous 20 weeks were:

Risk-on assets

- ▶ Dow Jones
- ▶ S&P 500

Risk-off assets

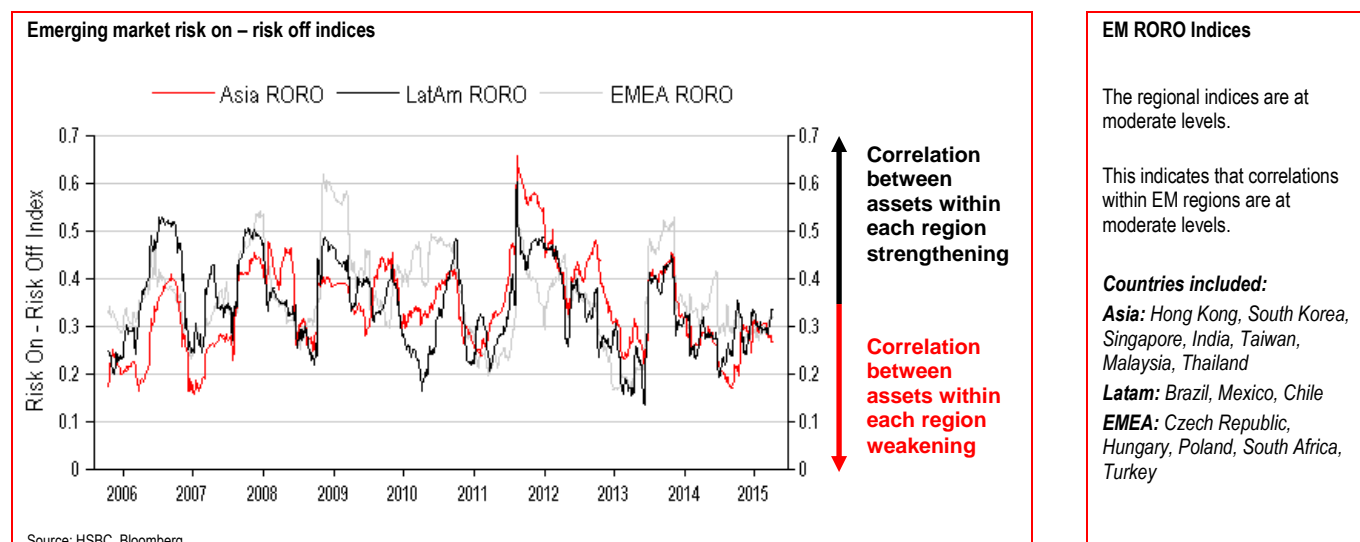
- ▶ AAA Corporate Bonds
- ▶ VIX

Uncorrelated with RORO

- ▶ CHF
- ▶ Silver

Asia and LatAm are both positively correlated with RORO; however, EMEA is not significantly correlated to the RORO factor at this time.

HSBC Emerging Market RORO Indices



Interpretation

Risk on – risk off is a truly global phenomenon that drives returns and causes high correlations across many different markets and geographic regions. However, there can still be variations in the strength of correlations between assets from different markets, as well as differences in the extent to which these correlations are driven by risk on – risk off rather than region-specific factors.

To quantify the strength of correlations in different emerging markets, we construct three EM RORO indices (shown in the chart above). A high index level indicates strong correlations between assets in that region. For example, when the Asia RORO index is high this implies that a single factor is driving returns across Asia, which leads to strong correlations between Asian assets. Similarly, high levels of the Latam and EMEA RORO indices imply that correlations are high in Latin America and EMEA, respectively.

Strong correlations between assets in different regions can be caused by local phenomena as well as global RORO dynamics. To illustrate the importance of risk on – risk off rather than local factors in driving correlations, in the bar chart on the previous page we show the extent to which the different regions are driven by the RORO factor. When a region is strongly driven by risk on – risk off, it will have a high correlation with the RORO factor and will appear to the left of the bar chart. On the other hand, if regional correlations are not primarily driven by risk on – risk off, but instead by other local factors, a region will be only weakly correlated with the RORO factor.

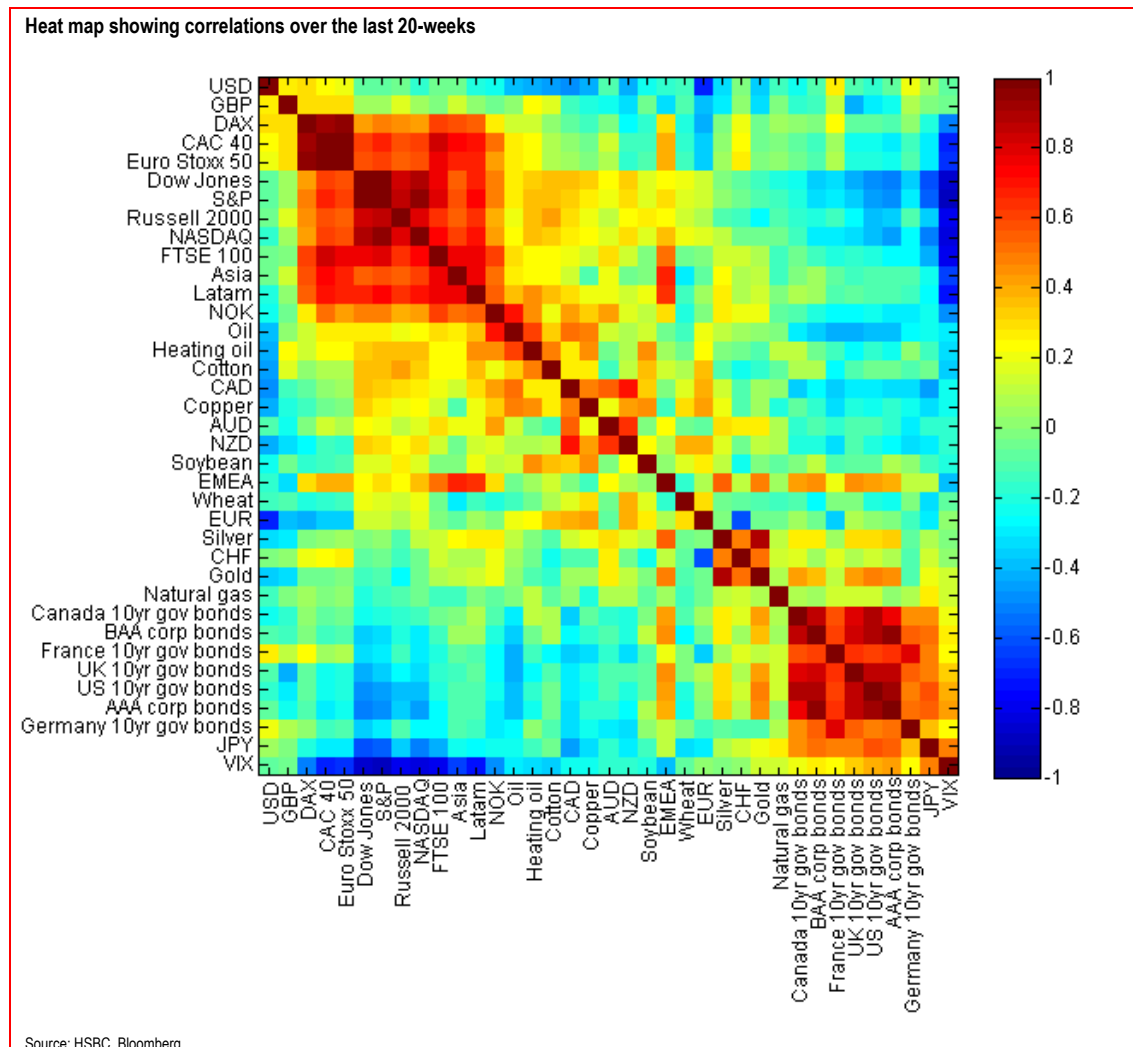
The picture today

Correlations within EM regions are at moderate levels.

Methodology

See Appendix A2 for more details of the construction methodology.

Correlation heat map



Reading the heat maps

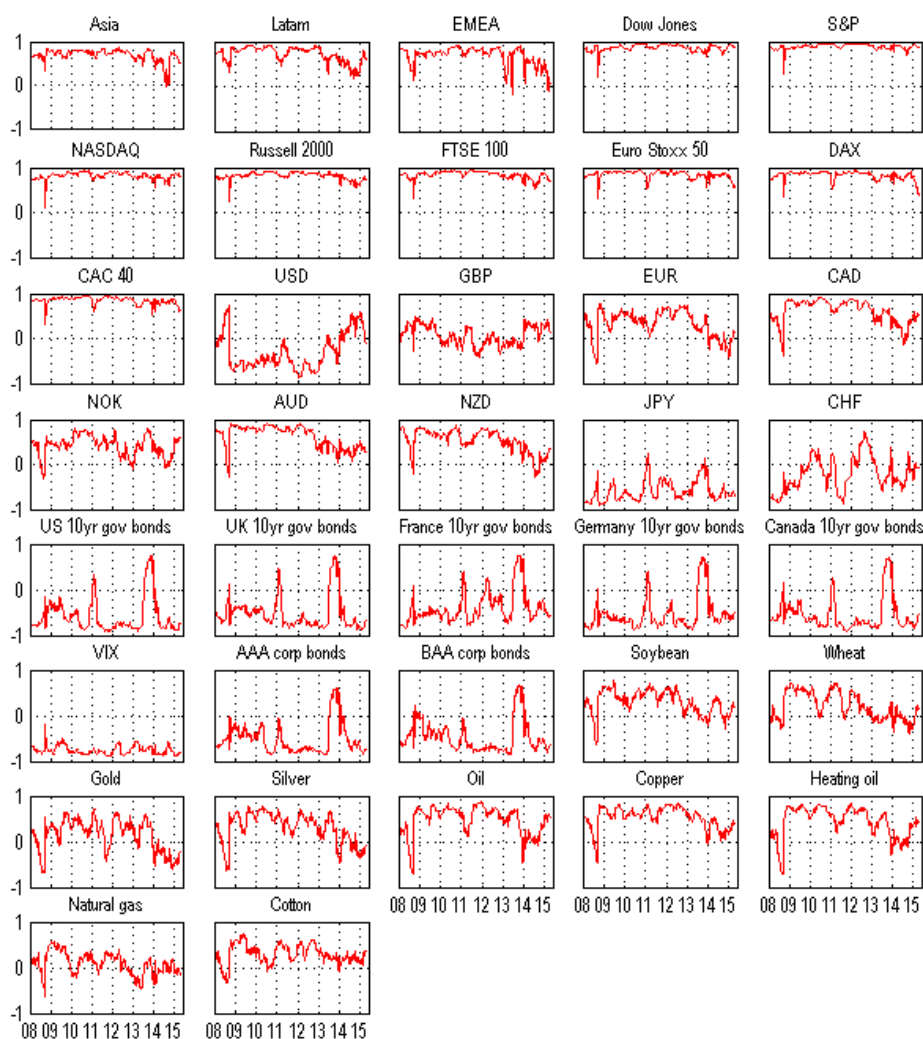
The heat map shows the correlations between different assets during the last 80 days. **Dark red** regions indicate **strong positive** correlations. **Dark blue** regions indicate **strong negative** correlations. **Yellow** and **green** regions indicate **weak correlations/uncorrelated** assets.

The picture today

Market structure is showing some signs of RORO contamination, with reds (positive correlations) and blues (negative correlations) quite noticeable in the heatmap. However, the intensity of the red and blue areas has diminished, which is consistent with the recent fall in the RORO Index.

Correlations with the risk on – risk off factor through time

Rolling correlations of individual assets with the risk on – risk off factor

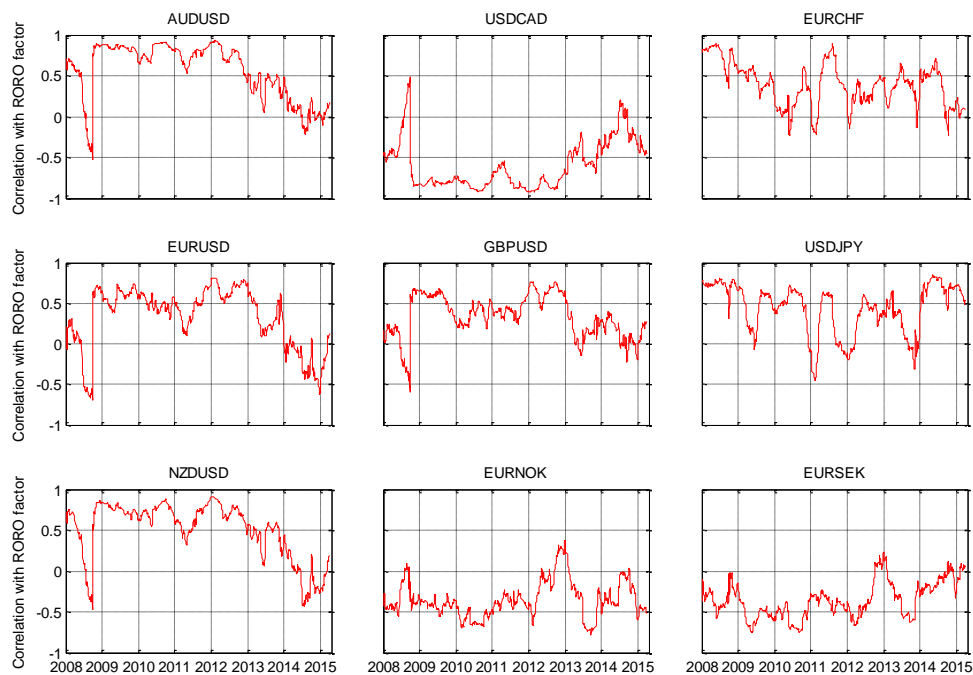


Source: HSBC, Bloomberg

The charts show the strength of the correlations between individual assets and the risk on – risk off factor through time. **These correlations quantify the extent to which the different assets are driven by risk on – risk off.** A correlation close to 1 implies that the asset is strongly risk on; a correlation close to -1 implies that the asset is strongly risk off; and a correlation near zero suggests that the asset is not primarily driven by the risk on – risk off phenomenon.

G10-FX Correlations with the RORO factor

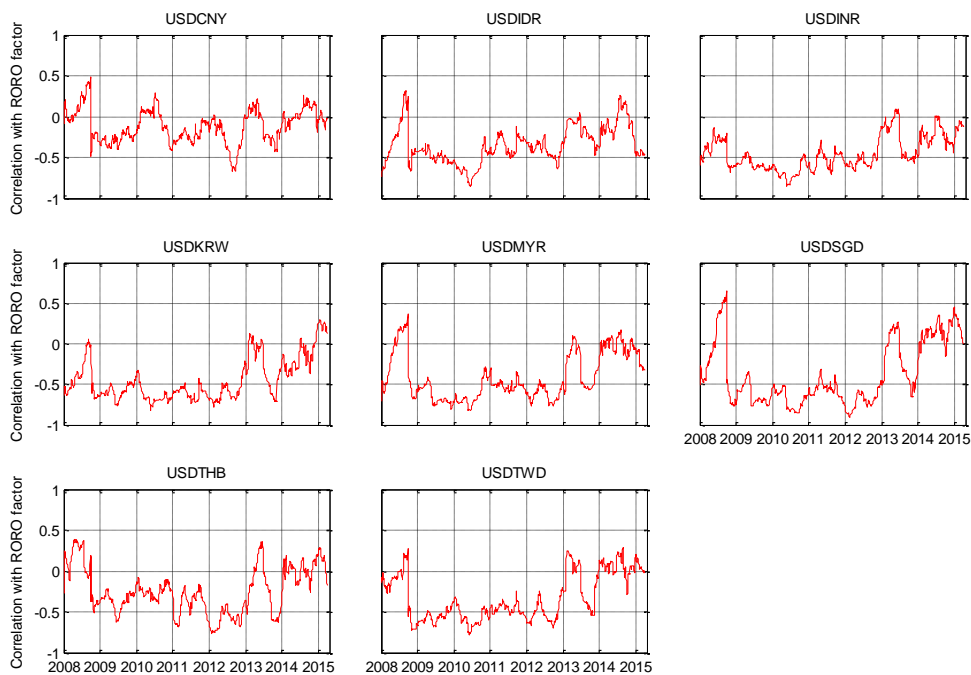
Rolling correlations of G10-FX with the risk on – risk off factor



Source: HSBC, Bloomberg

Asia-FX Correlations with the RORO factor

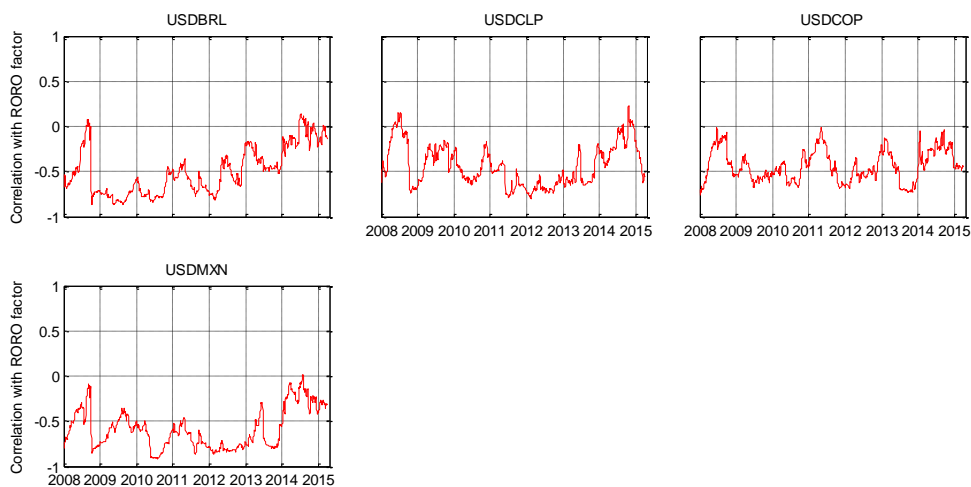
Rolling correlations of Asia-FX with the risk on – risk off factor



Source: HSBC, Bloomberg

LatAm-FX Correlations with the RORO factor

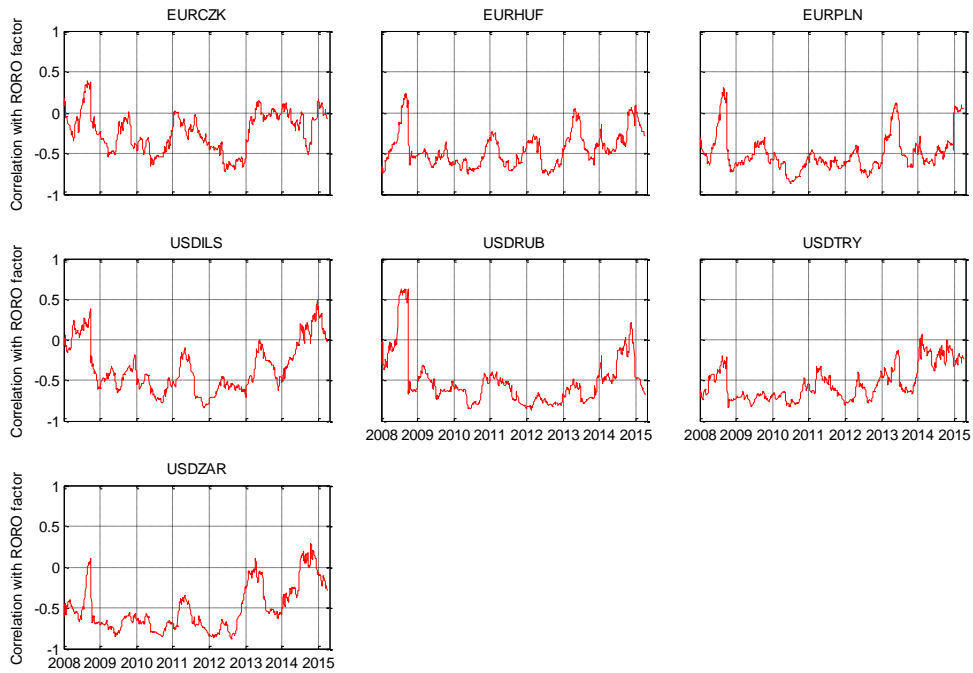
Rolling correlations of LatAm-FX with the risk on – risk off factor



Source: HSBC, Bloomberg

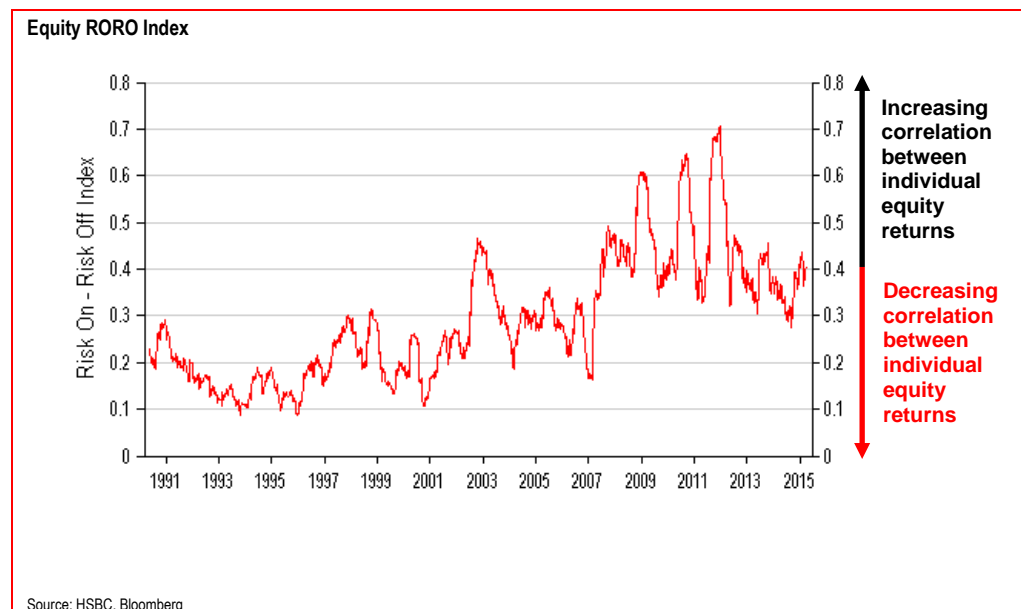
EMEA-FX Correlations with the RORO factor

Rolling correlations of EMEA-FX with the risk on – risk off factor



Source: HSBC, Bloomberg

HSBC Equity RORO Index



EM RORO Indices

The Equity RORO Index has moved sharply higher since September 2014. It remains significantly below the all-time highs seen in late 2011; however, the index is high by pre-crisis standards.

This indicates that equity moves are showing more dispersion than during late 2011, but are more similar than was typical in pre-crisis times.

See Appendix A3 for more details of the methodology.

Interpretation

Whilst risk on – risk off is inherently a cross-asset phenomenon, equities are the quintessential risk-on asset. When there is a perception in the market that correlations are high, it is important to determine whether it is simply a within-asset-class phenomenon or part of the wider global macro theme.

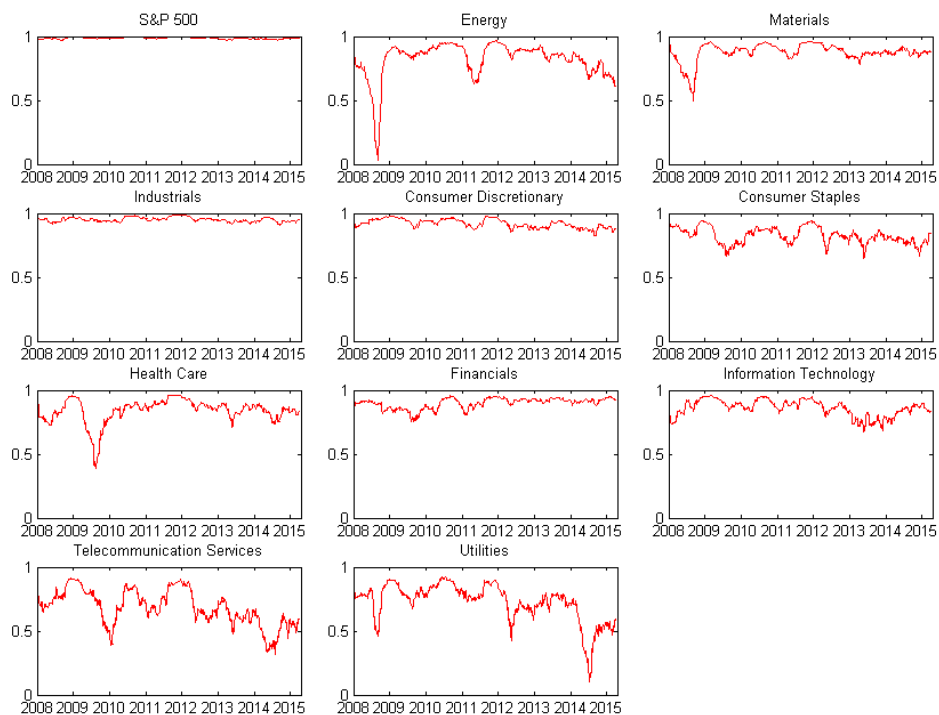
The HSBC Equity RORO Index allows us to distinguish between high correlations which are specific to this main “risky” asset class and high cross-asset correlations, as measured in the original RORO Index, which indicate broader macro stress.

The picture today

At the moment, whilst the Equity RORO Index is significantly lower than the all-time highs seen in late 2011, it is high by pre-crisis standards. This indicates that movements in individual equities are showing significantly greater dispersion than in late 2011, but are more similar than was typical in pre-crisis times.

Correlation of sectors with Equity RORO factor

Rolling correlations of individual sectors with Equity RORO factor



Source: HSBC, Bloomberg

These charts show the rolling correlations between the returns of individual equity sectors and the Equity RORO factor. Values close to +1 indicate that the sector is simply moving in response to changes in the Equity RORO factor. The closer the value is to 0, the more that sector is displaying sector-specific character.

Interpretation

Some sectors are currently showing only moderate correlations to the Equity RORO factor. This is consistent with the level of the Equity RORO index being much lower than the all-time highs seen in late 2011.

G10 Exchange Rate Correlations

In the linked document at the following url

(<http://www.research.hsbc.com/midas/Res/RDV?p=pdf&ao=20&key=vX357DLIFy&n=454623.PDF>),

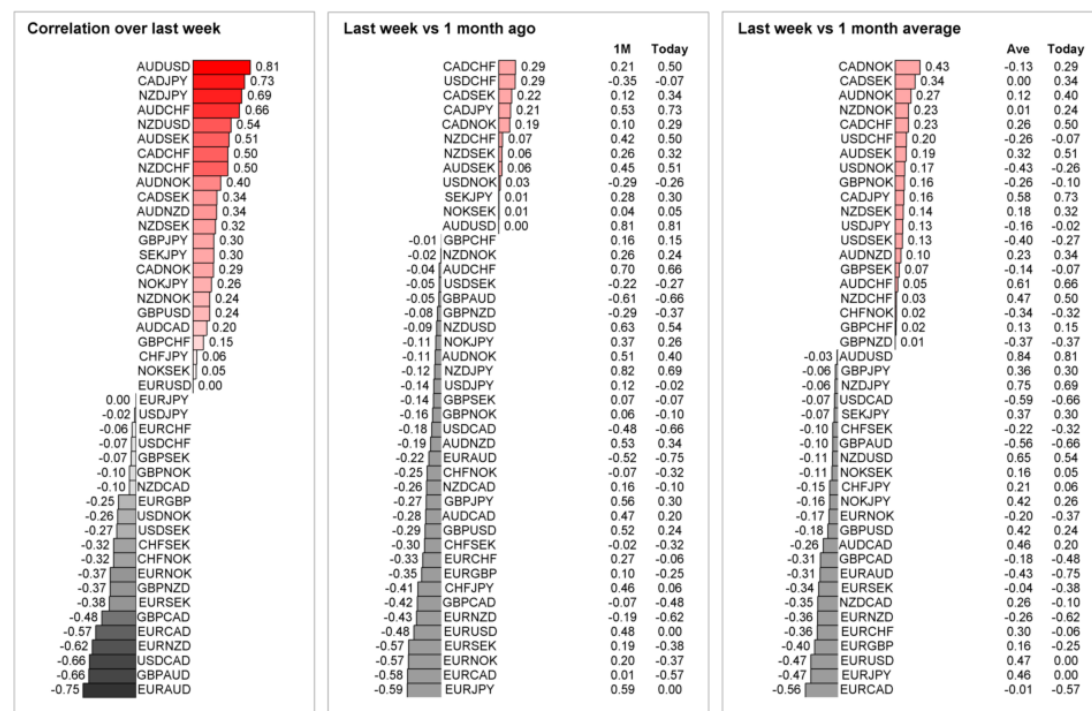
we show the strength of the correlations between all G10 exchange rates. If one has a view on how an exchange rate is going to move, this can be used to identify other trading opportunities by highlighting other currency pairs that move independently or in the same (or opposite) direction.

The chart below is an example page from this document for AUD-JPY. The three bar charts show:

- ▶ The correlation of AUD-JPY with all other G10 crosses during the previous week;
- ▶ A comparison of AUD-JPY correlations during the previous week with a 1-week period 1-month ago; and
- ▶ A comparison of last week's AUD-JPY correlations with the average correlation during the previous month.

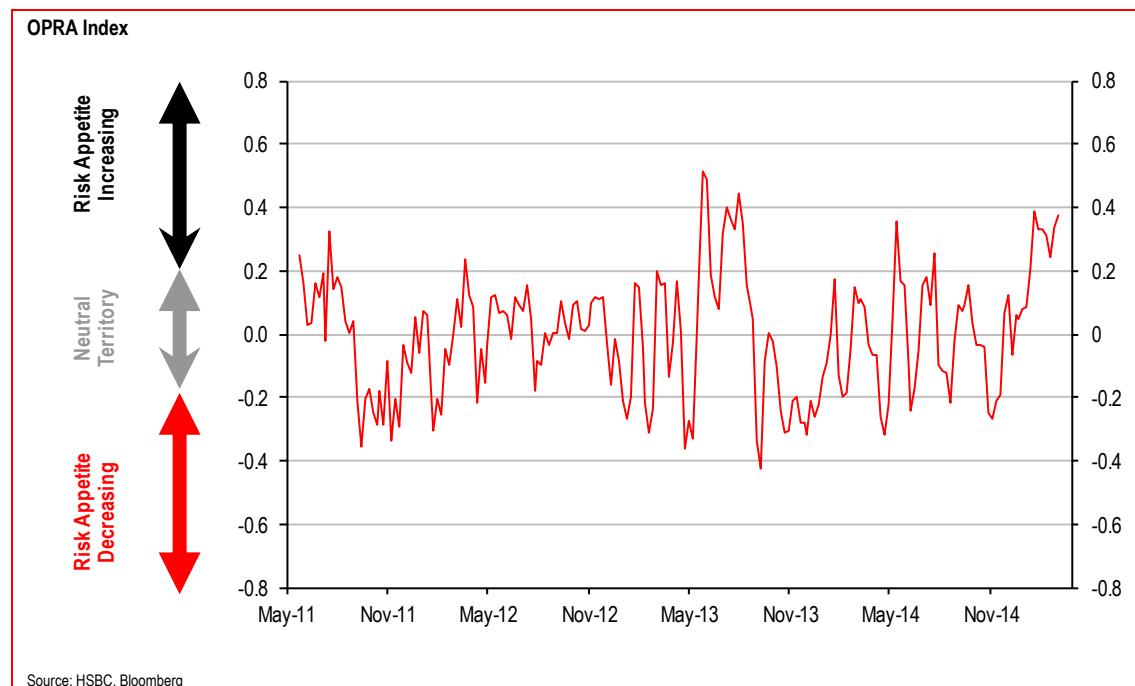
To enable us to calculate correlations over periods as short as a week, we have used hourly price data. In the linked document, we provide similar charts for all other G10 crosses and more details of the methodology that we use to construct the charts.

Example page from the linked correlation document: AUD-JPY correlations over the last week and versus the previous month



Source: HSBC

OPRA



Interpretation

When the OPRA index is close to 1 it indicates that speculators have increased their exposure to risky assets, whereas a value close to -1 indicates that speculators have shifted their exposure to less risky assets.

The picture today

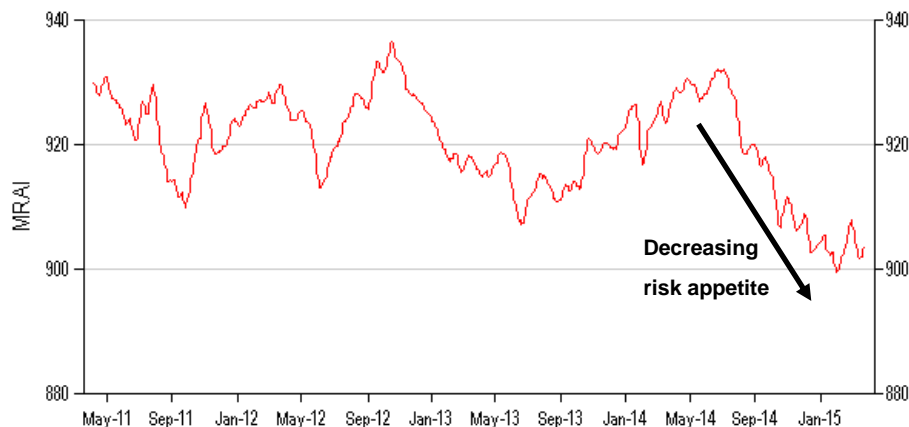
The OPRA Index is **in positive territory**. This indicates that speculative traders on the US futures exchanges have shifted their exposure towards riskier assets. This is indicative of **increasing risk appetite**.

Methodology

The OPRA index is based on the relationship between changes in the futures positions held by speculative traders in various contracts and the risk associated with holding the contracts. See Appendix B for more details of the methodology.

MRAI

MRAI: Short-term picture



Source: HSBC, Bloomberg

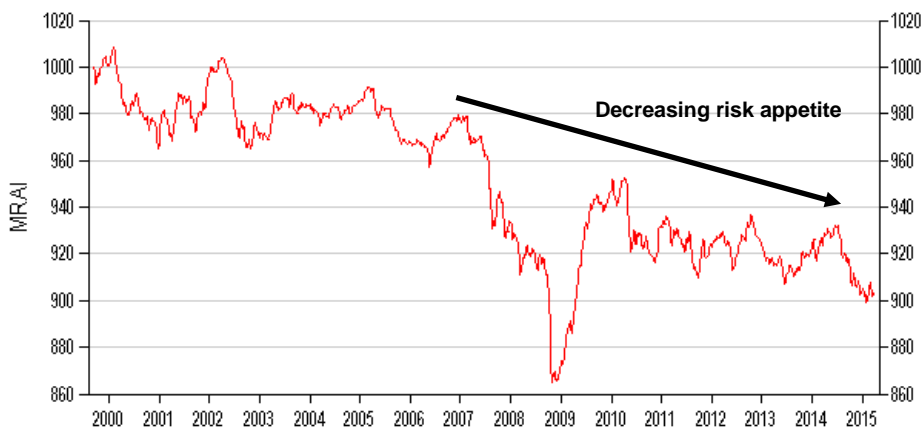
Short-term picture

The price-based risk appetite index has moved lower in the last few months.

This index is based on changes in prices and volatilities of assets that are known to be affected by risk appetite.

See Appendix C for more details of the methodology.

MRAI: Long-term picture



Source: HSBC, Bloomberg

Long-term picture

The MRAI is in a long-term downward trend.

Interpretation

A positive trend in the MRAI implies increasing risk appetite whereas a negative trend implies decreasing risk appetite.

The picture today

The MRAI is in a long-term downtrend. This indicates that **risk premia have increased**.

Appendix A1: RORO Methodology

Market-wide correlation index

HSBC Risk On – Risk Off (RORO) Index

The Risk On – Risk Off (RORO) index takes the rolling correlations between the daily returns of the 34 assets listed in the table below and combines them into a single index. We construct the index by using principal component analysis (PCA) to decompose the 34 asset return time series into 34 principal components (PCs), which are mutually uncorrelated variables that explain the observed asset returns.

The first PC represents the most important factor driving financial markets during a particular time period. In current market conditions, this factor can be considered to represent “risk on – risk off”. That is, the paradigm in which the market either believes the future is bright – “risk on” – or that it is bad – “risk off”. The proportion of the variance explained by the first PC then provides an indication of the strength with which this paradigm dominates markets. If the first PC dominates markets and explains a large proportion of the variance, this implies that market-wide correlations are strong, which is a key feature of the risk on – risk off paradigm. In this scenario, this single factor is driving synchronized changes amongst many different markets; hence correlations are high.

We define the RORO index as the variance in market returns explained by the first PC. An increase in the RORO index implies an increase in market correlations, whereas a decrease implies that market correlations have decreased. In constructing the index we focus on markets that have a large overlap in trading hours (Europe and North America and Asian currency markets). This enables us to track correlations on a daily basis without having to worry about the non-synchronicity of return time series.

We also consider correlations between the different assets and the risk on – risk off “factor”. These are the correlations between the different return time series and the first PC, and can also be considered to provide an indication of the extent to which risk on – risk off is driving different assets.

Assets included in the RORO Index

| Equities | Government bonds (10 year yields) | Corporate bonds (yields) | Currencies (trade weights indices) | Metals | Other |
|---------------|--------------------------------------|-----------------------------|---------------------------------------|--------|-------------|
| S&P | US | AAA | USD | Gold | VIX |
| Dow Jones | Canada | BAA | EUR | Silver | Oil |
| NASDAQ | UK | | CHF | Copper | Natural Gas |
| Russell 2000 | Germany | | GBP | | Heating Oil |
| FTSE 100 | France | | JPY | | Wheat |
| Euro Stoxx 50 | | | AUD | | Soybean |
| DAX | | | CAD | | Cotton |
| CAC 40 | | | NZD | | |

Source: HSBC

Appendix A2: EM RORO

Regional emerging market correlations

HSBC Emerging Market RORO Indices

We produce Emerging Market RORO Indices for Asia, Latin America, and EMEA. We construct the indices using a similar methodology to that described in Appendix A1 for the cross-asset RORO index. For each region, we perform a principal component analysis (PCA) on the returns of a range of assets from that region. We then define each regional index as the proportion of the variance in the returns of assets in that region explained by the first principal component (PC).

For the original multi-asset RORO Index the first PC represents the most important global macro factor driving returns across a wide range of different assets. When the RORO index is high, this factor is strong. The regional EM indices have an analogous interpretation. For example, when the Asia RORO index is high this implies that a single factor is driving returns across Asia, which leads to strong correlations between Asian assets. Similarly, high levels of the Latam and EMEA RORO indices imply that correlations are high in Latin America and EMEA, respectively.

For each of the regions, we use both bond and equity data for the countries listed in the table below. To enable us to compare the regional indices, we use weekly price data to eliminate any effects due to the different time zones. This also allows us to compare these indices to the cross-asset RORO. We consider the correlation between the dominant market factor in the different regions and the main risk on – risk off factor that we identify in our cross-asset analysis. This is the correlations between the first PC for each region and the first PC for the cross-asset returns. The strength of these correlations can be considered to provide an indication of the extent to which risk on – risk off is driving returns in the different regions.

Assets included in the EM RORO Indices

| Asia | Latin America | EMEA |
|-------------|---------------|----------------|
| Hong Kong | Brazil | Czech Republic |
| South Korea | Mexico | Hungary |
| Singapore | Chile | Poland |
| India | | South Africa |
| Taiwan | | Turkey |
| Malaysia | | |
| Thailand | | |

Source: HSBC

Appendix A3: Equity RORO

Equity market correlations

HSBC Equity RORO Index

The HSBC Equity RORO Index looks at all current members of the S&P 500 Index that have an appropriate data history back to 1 January 1990. We use a similar construction methodology for this index to the one described in Appendix A1 for the RORO Index.

To construct the Equity RORO Index we perform a principal component analysis (PCA) on the returns of all of the equities that we consider. We define the index as the proportion of the variance in the returns of these equities that can be explained by the first principal component (PC).

This first PC is the most important factor driving the returns at any time. For the original multi-asset RORO Index the first PC represents the most important global macro factor driving returns across a wide range of different assets. When the RORO index is high, this factor is strong.

For the Equity RORO, there is an analogous interpretation; however, in this case we are only looking at the risky asset class of equities. When the Equity RORO index is high it indicates there is a “supercharged” market beta dominating stocks – correlations are high and individual identity is reduced.

We use the two indices together to characterise the stress in the global macro environment. High correlations are generally an indication of market strain and have consequences for most asset classes. The two indices help understand the extent to which stress is confined to risky assets or is more comprehensive.

Appendix B: OPRA Methodology

Position-based risk appetite index

Open Positions Risk Appetite (OPRA) Index

We use speculative positions from the CFTC Commitments of Traders report to measure risk appetite. We track changes in exposure of the speculative community to the various contracts listed in the table below and relate these changes to the risk associated with the contracts.

We view it as a sign of high risk appetite when the speculative community has increased its exposure to the more risky assets more than for less risky assets. To measure this we calculate the rank correlation between changes in the speculative open interest and volatility. A rank correlation is used since this is less susceptible to outliers than a standard correlation.

Since this is a correlation, the index will lie between -1 and +1. A value close to +1 indicates that speculators have been increasing their positions in risky assets across the board, with the largest percentage increase in exposure being in the riskiest assets. A value close to the minimum value of -1 indicates the opposite. If speculative positions have been changing in a way unrelated to risk, then the value of this index will be close to zero.

Contracts included in OPRA Index

| Agricultural | Drinks | Metals | Currencies | Oil | Other |
|--------------|--------|----------|------------|-------------|--------|
| Corn | Cocoa | Platinum | AUD | LSCrude | Lumber |
| Oats | Coffee | Silver | CAD | Unleaded | |
| Rough Rice | OJ | Copper | CHF | Heating Oil | |
| Soybeans | | | EUR | Natural Gas | |
| Soybean Oil | | | GBP | | |
| Soybean Meal | | | JPY | | |
| Wheat | | | | | |
| Cotton | | | | | |
| Lean Hogs | | | | | |
| Live Cattle | | | | | |

Source: HSBC

Appendix C: MRAI Methodology

Price-based risk appetite index

Market Risk Appetite Index (MRAI)

The MRAI measures the aggregate level of risk appetite in the financial system using risk premia from various markets. The index is based on changes in price and volatility of several assets that are known to be strongly affected by risk appetite. A positive trend in the MRAI implies an increasing appetite for risk whereas a negative trend in the MRAI implies a decreasing appetite for risk.

We construct the index using equally weighted z-scores of changes in the level of six inputs: the VIX and VDAX volatility indices; the Global Hazard Index, which aggregates the 3-month implied volatilities for EURUSD, USDJPY, and EURJPY; BAA and AAA corporate bonds spreads; and interest rate swap spreads.

Disclosure appendix

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