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Global Equity Derivatives & Delta One Strategy
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These reports related to Cross-Asset Correlation Strategies originally published as of the date stamp on each of them, are now presented as a single report within the Investment Strategies series of publications under number 99.

Rise of Cross-Asset Correlations

Asset Class Roadmap for Equity Investors

Summary

- **Cross-Asset Correlations:** Over the past ten years, cross-asset correlations roughly doubled. Globalization of capital markets, and new risk-management and alpha-extraction techniques have driven the secular increase of cross-asset correlations. The recent cyclical increase is a result of elevated macro volatility. We believe that understanding the fundamentals and technicals of cross-asset correlation will be an increasingly important task for investors.
- **Currencies:** The increasing share of EM equities, US and Japan debt, and the declining share of US equities in Global market capitalization is an important driver of correlation between currencies and equities. Risk-on/off trading, currency carry trades, and cross-asset arbitrage are further strengthening this correlation.
- **Interest Rates:** Investors who decrease risk exposure usually sell equities to buy Treasury bonds. These risk flows cause a positive rate/equity correlation. Positive rate/equity correlation and a breakdown of the so-called "Fed Model" occurred in 1997 when three successive crises caused global de-risking and a flight to Treasuries. Risk of a correlation reversal is posed by severe stagflation or treasury/equity contagion.
- **Commodities:** Historically, diversification benefits resulted in significant investment interest for commodities. The traditionally negative correlation to equities reversed sharply in 2008, as a result of delevering and demand destruction. About 40% of current commodity/equity correlation is a spillover from FX/equity correlation. Despite diversification benefits, commodities are not immune to tail events such as the one recently exhibited by silver.
- **Credit:** With current correlation of ~80%, credit, equities, and equity volatility are the most correlated assets. Correlation of credit and equities is logical as both are priced based on the value and volatility of company assets. In practice, correlation is driven by capital structure arbitrage and hedging of credit with equity instruments.
- **Equities:** Due to the globalization of capital markets, cross-regional equity correlation rose steadily over the past 20 years. Recent high levels have diminished the benefits of cross-regional diversification. Macro volatility is a more significant driver of sector and stock correlation. Specific risk-management and alpha-extraction trends impacting correlation were discussed in our report: "Why we have a correlation bubble."
- **Alternative Assets:** Low correlation between strategies and ability to generate alpha make hedge funds an attractive asset class. Over the past ten years, hedge fund assets increased notably relative to the size of global equity markets. Disciplined risk-management techniques and alpha extraction employed by hedge funds likely contributed to the secular increase of correlations.
- **Hybrid Derivative Trades:** In this section we highlight several trade ideas that take advantage of current levels of cross-asset correlations. Equity hedges contingent on interest rates, currencies, or commodities can significantly reduce the cost of equity hedging and be tailored for specific scenarios such as US stagflation or a debt crisis.

Global Equity Derivatives & Delta One Strategy

Marko Kolanovic[AC] (Global Head)
(1-212) 272-1438
marko.kolanovic@jpmorgan.com
J.P. Morgan Securities LLC

Davide Silvestrini (EMEA)
(44-20) 7325-9064
davide.silvestrini@jpmorgan.com
J.P. Morgan Securities Ltd.

Tony SK Lee (Asia Pacific)
(852) 2800-8857
tony.sk.lee@jpmorgan.com
J.P. Morgan Securities (Asia Pacific) Limited

Michiro Naito (Japan)
(81-3) 6736-1352
michiro.naito@jpmorgan.com
JPMorgan Securities Japan Co., Ltd.

Equity Derivatives Strategy

US
Marko Kolanovic mkolanovic@jpmorgan.com
Adam Rudd adam.ch.rudd@jpmorgan.com
Amyn Bharwani amyn.x.bharwani@jpmorgan.com
Kapil Dhingra kapil.dhingra@jpmorgan.com
Min Moon min.k.moon@jpmorgan.com

EMEA
Davide Silvestrini davide.silvestrini@jpmorgan.com
Bram Kaplan bram.kaplan@jpmorgan.com
Peng Cheng peng.cheng@jpmorgan.com

Asia Ex-Japan
Tony Lee tony.sk.lee@jpmorgan.com
Clara Law clara.cs.law@jpmorgan.com
Sue Lee sue.sj.lee@jpmorgan.com

Japan
Michiro Naito michiro.naito@jpmorgan.com
Hayato Ono hayato.ono@jpmorgan.com

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See page 26 for analyst certification and important disclosures, including non-US analyst disclosures.

Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

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Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

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Drivers of Cross-Asset Correlations

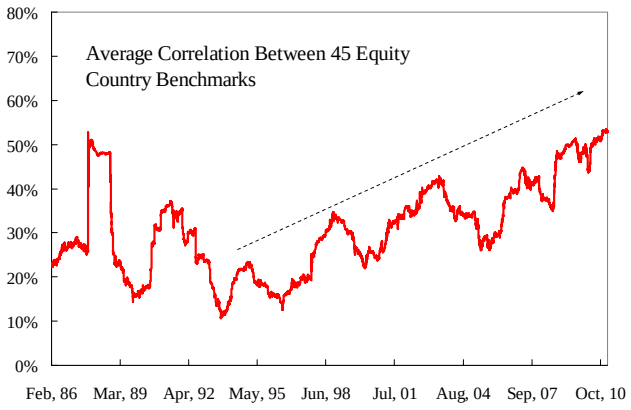
Rise of Cross-Asset Correlations

Correlation measures the degree to which prices of assets move together. Over the past decade, investors witnessed a significant increase of correlation between equities as well as an increase of correlation between other risky assets such as credit, foreign exchange, interest rates, and commodities.[1] High levels of correlation usually point to a common source of risk for asset prices. In times of high macro uncertainty, the prices of equities, risky bonds, oil, gold, and emerging market currencies are largely driven by changes in the macroeconomic outlook. In addition to a recent increase due to macro volatility, cross-asset correlation has been on a secular rise due to changes in market structure. Integration of global economies, increased efficiency and globalization of financial markets, and new risk-management and alpha-extraction techniques have all contributed to a rise in cross-asset correlation levels. In this report we discuss trends in cross-asset correlations and their impact on investors.

Figure 1 shows the average correlation between 45 developed world and emerging market country equity benchmarks contained in the MSCI All Country World Index. Over the past 20 years, the average correlation between these country benchmarks roughly doubled. This secular increase of cross-regional equity correlation is a result of the integration of global economies and capital markets. Liberalization of flows of goods between economies (free trade, outsourcing of labor), the rise of Emerging Markets (e.g., BRICS), and globalization of the financial industry (e.g., global banks and hedge funds) all contributed to the increase of cross-regional correlations. While the globalization of capital markets reduced diversification and cross-market arbitrage opportunities, the benefits of globalization are immense – the rapid growth of emerging economies has led to improved economic well-being for billions.

Similar to cross-regional equity correlation, the correlation between equities, credit, foreign exchange, interest rates, and commodities all increased over the past two decades. Figure 2 shows the average levels of cross-asset correlations for the 1990-1995 time period, and compares them to the average correlation levels over the past five years. On average, correlations between different asset classes more than doubled. Each of these cross-asset correlations will be discussed in the rest of the report.

Figure 1: Globalization – Rise of Correlation Between Equity Market Benchmarks for 45 Emerging and Developed Economies



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 2: Cross-Asset Correlation Levels Increased for Equities, Credit, Foreign Exchange, Interest Rates, and Commodities

Asset Class	Correlation Between	1990-1995*	Past 5Y	Change
Equity	DM Country Indices	31%	47%	17%
Equity	EM Country Indices	23%	45%	23%
Equity	DM and EM Indices	38%	74%	36%
Equity	Economic Sectors	57%	69%	12%
Equity	Individual Stocks	25%	41%	16%
Credit	High Yield and Equities	46%	64%	19%
Credit	High Yield and VIX	37%	60%	24%
Foreign Exch.	DM Currencies and Equities	-1%	28%	29%
Foreign Exch.	EM Currencies and Equities	6%	42%	36%
Interest Rates	10Y Rate and Equities	-38%	29%	67%
Commodity	All Commodities	5%	25%	21%
Commodity	Commodities and Equities	-5%	12%	17%
Average		19%	45%	26%

* For Credit 2002-2005. All Currencies vs. USD

Source: J.P. Morgan Equity Derivatives Strategy.

[1] For a detailed study of equity correlations and their drivers, please see our report: "Why we have a correlation bubble."

Correlation Risk/Reward

A common list of asset classes includes: equities, credit, interest rates, foreign exchange, commodities, and alternative assets. *Asset class* is generally defined as "a group of securities that exhibit similar characteristics, behave similarly in the marketplace, and are subject to the same regulations."[2] In other words, the correlation between assets plays an important role in the defining of an asset class itself. In the early 1990s, correlation between Emerging Market (EM) stocks and Developed Markets (DM) stocks was ~30% and the two sets of equities were considered separate asset classes. Over the past three years, EM/DM correlation was ~80% and the two asset classes morphed into one. Similarly, the recent correlation of High Yield credit spreads to equities of ~75% is higher than the current average correlation between S&P 500 stocks of ~45%.

Below we consider the impact of cross-asset correlation on the risk and reward of multi-asset portfolios. The volatility of a multi-asset portfolio increases with the level of cross-asset correlation and the volatility of the assets in the portfolio.[3] Hence, the higher the cross-asset correlation, the higher the portfolio volatility. If the portfolio volatility is reduced by lower cross-asset correlation, investors can free up risk capital that can be employed to generate additional returns.

Consider a portfolio of the following risky assets: emerging and developed market stocks, high yield bonds, commodities, and currencies. As shown in Figure 2, these assets are highly correlated. Over the past 15 years, the correlation between these assets increased from ~20% to ~45%, increasing by 25 correlation points. Assuming an average annualized asset volatility equal to that of equities (14.3% US equity volatility since 1871), this increase of cross-asset correlation would cause portfolio risk to increase by more than a third (35% increase in risk). Assuming that tied risk capital could have been employed to generate the average return of equities (8.9% annualized total return for US equities since 1871), the implicit cost of this cross-correlation increase is estimated at 312 basis points per annum.[4]

Figure 2 also shows a dramatic increase in equity/rates correlation. An increase of equity/rate correlation reduces the risk of a portfolio of equities and Treasury bonds. Consider a portfolio with equal weights invested in equities and US Treasury bonds. The increase of more than 60 points in rates/equity correlation over the past 15 years reduced the risk of an equity/treasury portfolio by a quarter. Assuming that the freed risk capital could have been employed to generate the average return of equities and treasuries (6.8% annualized total return since 1871), the implicit benefit of the cross-correlation increase is an estimated at 180 basis points per annum.[5]

In addition to the described impact on a multi-asset portfolio, cross-asset correlation can have a significant impact on equity-only portfolios. For instance, the most recent FX and Oil price movements have impacted the performance of equities. Equity investors can also trade cross-asset correlation directly through derivative products such as rate/equity, FX/equity, or commodity/equity hybrid options (described in the last section of this report). We believe that understanding the fundamentals and technicals of cross-asset correlation will be an increasingly important task for all portfolio managers.

Volatility, Risk Management, and Alpha as Drivers of Correlation

In times of elevated macro uncertainly, investors and risk managers look at equities, risky bonds, commodities, and currencies as sources of portfolio risk. As portfolio risk is adjusted up or down in a risk-on/off trading style, the prices of all risky assets tend to move in sync. In this rigid investment approach, any asset is viewed as having an exposure or 'beta' to the macro risk and some asset-specific 'alpha'. Given the level of macro risk and the magnitude of 'alpha' available in the asset class, a risk-on/off trading approach determines the market level of cross-asset correlations.

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[2] Investopedia website.
[3] For a more exact expression, see the Appendix.
[4] For a portfolio of Equities, High Yield Bonds, Commodities, and Currencies, the portfolio's risk increased 1.4% for each cross-asset correlation point increase. The equivalent performance opportunity cost was 12bps for each point increase in cross-asset correlations.
[5] For a portfolio of Equities and US Treasuries, the portfolio's risk decreases 0.5% for each point increase in rates/equity correlation. The equivalent performance benefit is 3bps per point increase in equity/rate correlation.

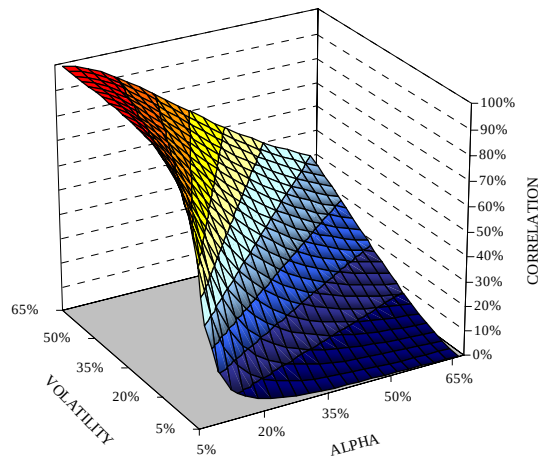
This relationship between cross-asset correlation, macro volatility, and availability of alpha in markets is summarized in Figure 3 (for a more formal explanation, see the Appendix). Essentially, a high level of macro volatility causes high cross-asset correlation. In addition, a lack of alpha also causes an increase of correlations. Interestingly, in a high-alpha environment spikes in macro volatility have a muted impact, while in a low-alpha environment macro volatility can cause a dramatic spike in cross-asset correlation. Figure 4 shows theoretical levels of cross-asset correlation (vertical axis) as a function of alpha and macro volatility. In order to have a large spike in cross-asset correlation, not only is macro volatility needed, but the level of alpha in the markets needs to be depleted.

Figure 3: Relationship Between Cross-Asset Correlation, Macro Volatility, and the Magnitude of Alpha Opportunities in the Market

More VOLATILITY	→	More Correlation
Less VOLATILITY	→	Less Correlation
Less ALPHA	→	More Correlation
More ALPHA	→	Less Correlation
Less ALPHA	→	Volatility has greater impact on Correlation

Source: J.P. Morgan Equity Derivatives Strategy.

Figure 4: Graphical Representation of the Relationship Between Cross-Asset Correlation, Macro Volatility, and Magnitude of Alpha



Source: J.P. Morgan Equity Derivatives Strategy.

In the rest of this report, we explain the fundamentals of cross-asset correlation between currencies, rates, commodities, credit, equities, and alternative assets. **We also link the increase of cross-asset correlation to the current high macro volatility and to developments in risk-management and alpha-extraction techniques.**

US Treasuries and Risk Management

Disciplined risk management and portfolio diversification can contribute to an increase of cross-asset correlations. For instance, when investors increase their equity risk exposure by purchasing US, Developed World, and Emerging Markets equities in proportion to market capitalization, this leads to a net selling of USD and buying of foreign currencies. In addition, when the additional risk capital is obtained by reduction of holdings of government bonds (in proportion to current government bond market capitalization), it causes selling of US Treasuries. This type of risk-on/off flows is causing the current negative correlation between USD and global equities, and the positive correlation between equities and treasury yields (see the Currencies and Interest Rates sections). Over the past few years, many investors started increasing commodity allocation due to their low historical correlation to other risky assets and resistance to inflation. 'Risk-on' flows into commodities, along with USD/Equity correlation (note that commodities are priced in USD), recently gave rise to a strong positive correlation between equities and commodities.

Risk hedging with liquid derivative products can also have an impact on correlations. However, derivatives are not the cause of correlation but just facilitate the previously described risk-management techniques. For instance, hedging of equity exposure is typically implemented via index futures on liquid, capitalization-weighted indices such as the S&P 500. Trading of these instruments can mechanically increase correlation between large-cap stocks. Similarly, hedging credit portfolios with VIX or S&P 500 products can result in increased credit-equity correlation.

Alpha Extraction

A decrease of asset-specific alpha increases the level of cross-asset correlations. An example of alpha capture that causes correlation increase is statistical arbitrage. In a simple pair strategy, an arbitrageur is trading two correlated assets – buying the underperforming asset and selling the outperforming one. The trade increases the correlation between the pair and captures (diminishes) the alpha. This type of arbitrage can be implemented between pairs of stocks, sectors, and regional markets, between indices and their constituents, and more generally between different assets such as currencies, rates, and equities.

Similar to statistical arbitrage, alpha is extracted by various relative-value trading strategies. Capital structure arbitrage is a relative-value approach of trading equity versus credit. It can be employed on an individual security as well as an index level (e.g., trading CDX against S&P 500). Capital structure arbitrage can cause an increase of credit/equity correlations. Currency carry trades involve selling low-yielding currencies (e.g., USD and JPY) and buying high-yielding currencies, or more generally risky assets denominated in these currencies. This 'generalized' currency carry trade can cause an increase of FX/equity correlation, and even an increase in commodity/equity correlation.

An increase in the amount of assets invested in alpha-extraction strategies may have a secular impact on cross-asset correlations. Hedge funds assets, currently at ~$2T, experienced significant growth over the past ten years. While not all hedge funds can consistently generate alpha, the increase of hedge fund assets likely had a net effect of alpha reduction and thus increase of correlation.

The described market changes that contributed to a secular increase of cross-asset correlations also brought some benefits. For example, cross-regional capital flows provide capital to emerging economies, electronic trading can improve liquidity for all market participants, and credit/equity arbitrage equally distributes risk and reward between bondholders and shareholders. Cross-asset correlations will likely decrease alongside macro volatility. However, the described market developments should persist and reset correlation levels to a new, higher, norm.

Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

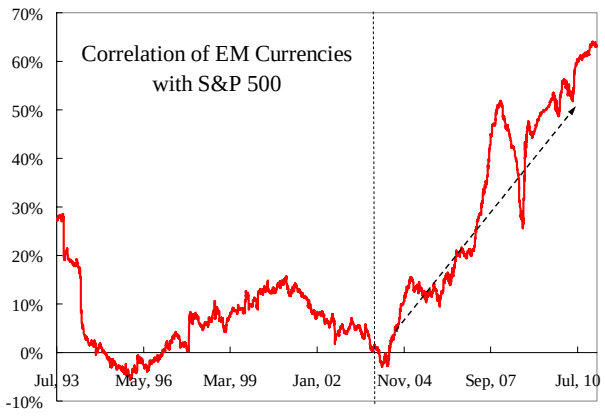
Currencies

Risk On/Off and Global Currency Flows

It is well known that an increased risk appetite of investors results in an inflow of capital into Emerging Market stocks. In order to purchase these stocks, funds need to be converted into local EM currencies. Given the liquidity of EM stocks and currencies, these inflows typically cause both assets (EM stocks and currencies) to appreciate at the same time, giving rise to positive correlation between equities and EM currencies. Increased interest for EM equities and the risk-on/off trading style caused a remarkable increase of EM Currency/Equity correlation over the past seven years (Figure 5). In fact, the current average correlation between the S&P 500 and EM Currencies is higher than the average correlation between large-cap US stocks even at the peak of the financial crisis in 2008.

Similar risk flows drive the correlation between equities and currencies of major developed economies such as USD, EUR, and JPY. Of particular interest for equity investors is the strong negative correlation between equities and USD. Developments in global equity markets over the past ten years can help us understand this relationship. Figure 6 shows the market capitalization of US, Developed World ex US, and Emerging Equity Markets since 1998. The figure shows the relative rise of EM, and decline of US market capitalization. Ten years ago, US equity markets represented ~60% of global equity market capitalization, with emerging markets only 6%. In the decade from 2001 to 2011 the US equity market halved to ~35% of global market capitalization, Developed Markets ex US increased to 41%, and Emerging Markets expanded to 24% of global equity capitalization. [6] The relevance of capitalization changes to currency/equity correlation is that, while ten years ago the 'risk-on' trade into global equities (in proportion to global market capitalization) involved net buying of USD, since 2004 (and in particular over the past three years) the global 'risk-on' trade involves net selling of USD in order to purchase EM and Developed World ex US equities.

Figure 5: Correlation of EM Currencies (vs. USD) and S&P 500



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 6: Global Equity Market Capitalization Since 1998

Year	Market Capitalization ($Bn) US	DM ex US	EM	US %	DMxUS %	EM %
1998	7,800	5,000	200	60%	38%	1%
1999	9,900	6,300	200	60%	38%	1%
2000	12,300	7,800	400	60%	38%	2%
2001	11,800	7,500	1,200	57%	37%	6%
2002	10,500	6,100	1,000	60%	35%	6%
2003	8,100	6,100	1,000	53%	40%	7%
2004	10,300	8,600	1,700	50%	42%	8%
2005	11,300	10,500	2,200	47%	44%	9%
2006	11,300	11,900	3,300	43%	45%	12%
2007	12,800	14,700	4,700	40%	46%	15%
2008	12,900	16,900	7,800	34%	45%	21%
2009	7,900	9,500	3,600	38%	45%	17%
2010	9,900	12,300	6,500	34%	43%	23%
2011	11,400	13,400	8,000	35%	41%	24%

Source: J.P. Morgan Equity Derivatives Strategy.

[6] The period includes 9/11/2011, wars in Iraq and Afghanistan, emergence of BRICs, and strengthening of European Monetary Union.

Equally important is to look at the capitalization of global government debt markets shown in Figure 7. Currently, US and Japanese government bonds represent 62% of the market. US Treasuries and Japan government bonds are the largest, most liquid, and broadly held 'riskless' assets. US Treasuries alone represent almost 30% of all government bonds, and almost 60% of all AAA-rated bonds. In other words, US Government debt is most broadly used as a liquid store of 'risk-free' assets. A 'risk-on' trade involves shifting allocation from 'riskless' into 'risky' assets, and will therefore involve net selling of US (or Japan) debt and selling the USD (or JPY) to buy risky assets such as equities – two-thirds of which are denominated in non-US currencies.[7] The 'risk-on/off' impact to asset allocation between government bonds and more risky assets will also cause correlation between interest rates and equities discussed in the next section.

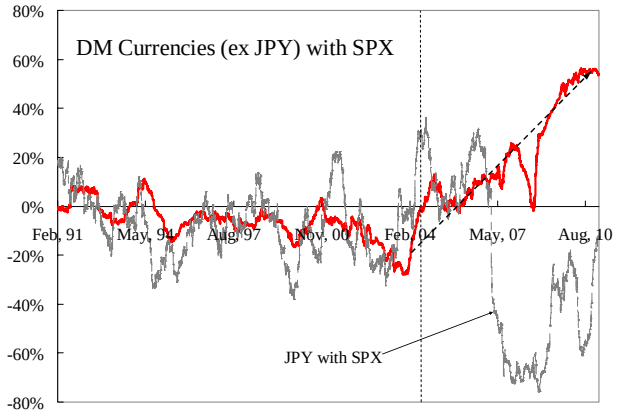
Figure 8 shows the correlation of DM currencies (excluding JPY) and equities over the past 20 years. We note that correlation started significantly increasing in 2004, which is roughly the time US equity market capitalization dropped below half of the global market capitalization. As the US capitalization dropped to roughly a third, correlation between DM currencies (excluding JPY) and equities further increased. The same chart shows correlation of JPY/USD and equities. Given the role of Japan's government bond market (the largest liquid 'risk-free' asset pool), correlation of JPY/USD to equities is negative, in clear contrast to the rest of DM currencies.

Figure 7: Global Government Debt Market Capitalization

Country	Debt ($Bn)	% of Total	S&P Rat.	% of GDP
Japan	10,779	34%	AA-u	226
USA	9,077	28%	AAAu	59
Italy	2,299	7%	A+u	118
France	1,869	6%	AAAu	84
Germany	1,761	5%	AAAu	79
UK	1,726	5%	AAAu	77
Spain	939	3%	AA	63
Canada	633	2%	AAA	34
Greece	479	1%	BB-	144
Belgium	451	1%	AA+u	99
Netherlands	449	1%	AAAu	65
Austria	276	1%	AAA	70
Portugal	206	1%	BBB-	83
Australia	203	1%	AAAu	22
Next 10	1,025	3%	--	--

Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Figure 8: Correlation of DM Currencies (vs. USD) with S&P 500 (Solid); Correlation of JPY (vs. USD) with S&P 500 (Dashed)



Source: J.P. Morgan Equity Derivatives Strategy.

We have shown how secular changes in global equity and bond market capitalization as well as risk-management techniques (namely asset allocation between risky and riskless assets) impact the correlation between currencies and equities. Next we address the role of alpha-extraction techniques such as currency carry trades and cross-asset statistical arbitrage.

Currency carry trades involve borrowing in low-yielding currencies, and selling the currency to invest in higher-yielding currencies or other higher-yielding assets such as equities. Historically, low-yielding currencies were the JPY, and more recently the USD. Higher-yielding currencies were typically riskier EM currencies or commodity-driven developed world currencies. In both cases the currency carry trade is a 'risk-on' trade that involves selling USD or JPY while buying currencies (or assets) positively correlated with equity or commodity risk. Through this mechanism, the currency carry trade strengthens the USD/equity correlation, as well as correlation between equities, currencies, and commodities.

Cross-asset statistical arbitrage involves simultaneous trading of currencies, equities, and commodities. A computer model establishes and forecasts covariance between these assets, then algorithmically trades based on discrepancies between the expected relative moves of assets and observed moves. This type of statistical trading can provide liquidity and sap the market impact from trades in each asset class. However, the result is an increase of cross-asset correlation. We can find

[7] Or alternatively buying riskier corporate or non-US government debt from countries such as Italy, Spain, and Greece.

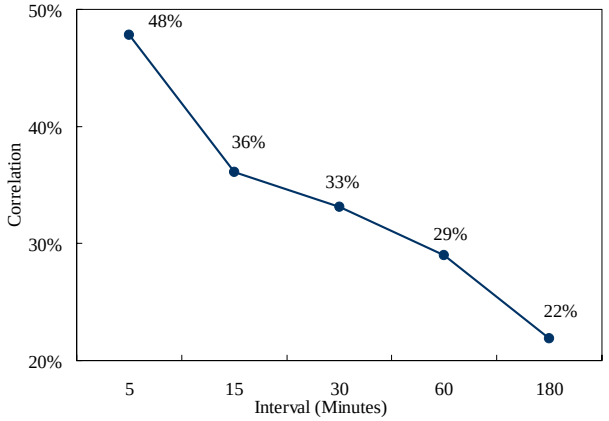
potential evidence of high-frequency statistical cross-asset trading activity in the behavior of currency/equity correlation calculated over different time horizons. Asset allocation flows typically occur over long-term time horizons. For instance, a portfolio manager may decide to review the allocation to risky assets vs. riskless bonds on a weekly basis, but will not adjust risk exposure minute-by-minute.

Figure 9 below shows EUR/USD correlation to equities calculated based on 5-, 15-, 30-, 60-, and 180-minute returns over the past six months. We note that EUR/USD to equity correlation is highest for the shortest time interval (5 minutes) and decreases for longer time periods. This suggests that some form of cross-asset trading, most likely of a statistical nature, does take place at high frequency.

High correlation between currencies and equities has a variety of implications for equity investors. The negative correlation between USD and equities increases the volatility of foreign assets (e.g., ADRs) to US investors. Similarly, for foreign investors this makes US equities less volatile as equity and USD risks partially offset each other.

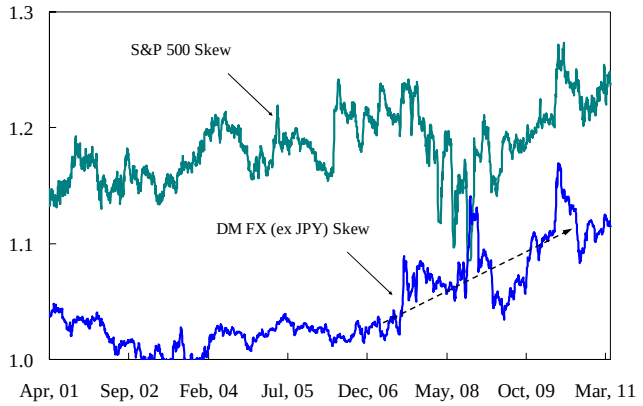
Another interesting application of currency/equity correlation is the possibility of cross-asset hedging. If FX options are cheaper than equity index options, investors could hedge equity exposure with FX options. In this approach the investor relies on the stability of correlation between currencies and equity, and seeks FX options that are 'cheaper' than S&P 500 options. Figure 10 below shows the six-month downside skew for the S&P 500 and the average skew for FX options of DM currencies against USD.[8] Skew is expressed as a ratio of out-of-the-money (OTM) put implied volatility to at-the-money (ATM) implied volatility. We note that S&P 500 skew is trading persistently higher than FX skew. The reason for this is the supply/demand imbalance for equity index put options (more buyers than sellers of downside protection). Meanwhile, FX skew was fairly low prior to 2004, but given the steady increase of currency/equity correlation (Figure 8), FX skew has been rising as well. Despite this increase, FX skew for certain currency pairs may still be cheaper than S&P 500 skew, making FX puts an attractive alternative hedge for equities.[9]

Figure 9: EUR/USD Correlation to S&P 500, Calculated from 5-, 15-, 30-, 60-, and 180-Minute Returns



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 10: S&P 500 and DM Currencies vs. USD Downside Skew



Source: J.P. Morgan Equity Derivatives Strategy.

[8] Skew measures the difference between the price of OTM downside puts to at-the-money puts. High levels of skew imply a high probability of a large downside move, which increases the price of downside put options.
[9] For specific examples of currency/equity hedging, see J.P. Morgan publications: "Tail-Risk Hedging with FX Options" and "VIX, Equities, and Dollar Carry Trade."

Interest Rates

End of Fed Model and Use of US Treasuries as Global 'Risk-Free' Asset

In the previous section, we explained the role of US and Japan government debt as a liquid, 'riskless' storage of assets. When investors increase risk exposure, they typically sell some government debt, and invest the proceeds in DM and EM equities, risky debt, or commodities. Reducing risk exposure involves selling risky assets and buying treasuries (flight to quality). This 'risk-on/off' asset allocation approach has caused a positive correlation between equities and interest rates over the past ten years. Positive correlation between rates and equities adds significant diversification benefits to a portfolio of risky assets and treasury bonds – as risky assets decline in value, treasury bonds appreciate and vice versa (e.g., see 'Correlation Risk/Reward' section).

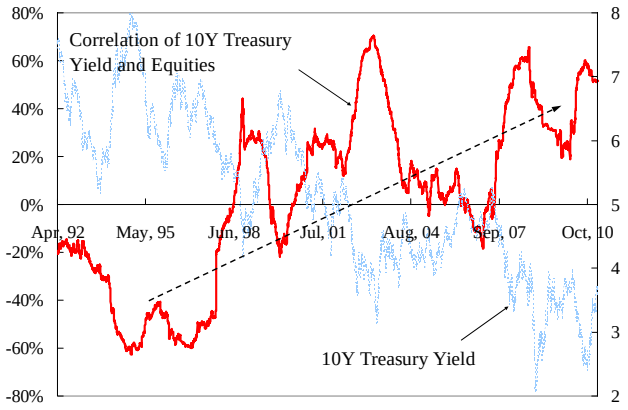
Another reason for use of Treasuries as a 'risk-free' asset and a positive equity/rate correlation is an active monetary policy. If the economy is overheating and risky assets rally, the central bank may increase rates to cool down the economy. Conversely, if risky assets are selling off, the Fed may cut rates to support growth and avoid recession (Greenspan/Bernanke Put). Given the positive nominal yield of treasury bonds and negative correlation to equities, treasuries are considered to be a superior 'riskless' asset to cash deposits. The widespread usage of US Treasuries as 'riskless' storage has caused an increase of equity/rate correlations and decrease of treasury yields over the past 15 years, as shown in Figure 11.

Historically, the correlation between equities and rates was not always positive. Moreover, there are theoretical reasons why this correlation should in fact be negative. The so-called "Fed Model" states that treasury yields should be roughly equal to equity earnings yield (E/P or simply the inverse of the P/E ratio).[10] The so-called "Fed Model" therefore implies direct negative correlation between treasury yields and equities – the higher the stock price, the lower the equity yield and hence the lower the treasury yield. The rationale behind the "Fed Model" is that investors compare the yield generated by holding treasuries to equity earnings yield, and invest their cash deposits into the one that looks more attractive (until treasury yield and earnings yield become equal). Market data over the past ten years have proved this reasoning to be flawed. Figure 12 shows a 30-year history of rate/equity correlation. We note that prior to 1997, rate/equity correlation was indeed negative, as predicted by the so-called "Fed Model." This changed virtually in one day, when the Asian crisis caused risk contagion across global markets on 10/27/1997.

[10] Ed Yardeni, "Fed's stock market model finds overvaluation," Topic Study #38, US Equity Research, Deutsche Morgan Grenfell, 1999.

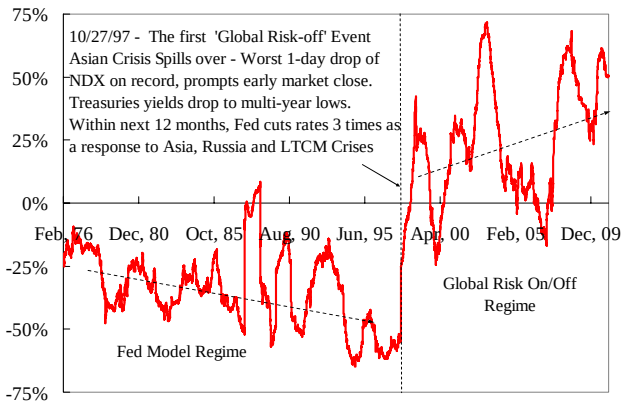
Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

Figure 11: Correlation of 10Y Treasury Yield and S&P 500



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 12: Regime Change of Equity/Rate Correlation Occurred in 1997/1998



Source: J.P. Morgan Equity Derivatives Strategy.

Investors across the globe sold risky assets and piled into Treasury bonds, driving yields lower. The first global "Risk-off" event resulted in the worst one-day returns for the Nasdaq and Dow Jones, and caused Treasury yields to drop to two-year lows. Over the next 12 months and as a response to the crisis, the Fed postponed one rate increase, and subsequently cut rates three times thereby reinforcing the positive correlation between equities and yields. Similar equity selloffs and Treasury rallies occurred twice more in the next year during the LTCM and Russia debt crises. Risk-off events have become truly global affecting all asset classes (EM and DM Equities in the Asia crisis, Emerging Market Debt in the Russia crisis, Equity Volatility, Interest Rate Swap Spreads, and M&A Spreads in the LTCM crisis). These events established treasury bonds as the 'riskless' asset of choice and reversed the levels of equity/rates correlation for years to come.

Despite our view that equity/rate correlations will stay positive, there are certain scenarios that could cause a weakening or reversal of this relationship. While the return of an outdated "Fed Model" investment approach does not pose a risk for correlation, the occurrence of Stagflation or even full-fledged US bond/equity contagion could reverse the equity/rate correlation. In the case of Stagflation, treasury yields are expected to increase as a result of increased inflation expectations. A low or negative growth outlook and increased inflation expectations could cause an equity selloff. In this way, the occurrence of Stagflation could cause equity/rate correlations to drop or even turn negative.

The most dramatic reversal of equity/rate correlations could happen in the event of full-fledged US bond/equity contagion. This could occur as a result of a US fiscal crisis, prompting foreign investors to abandon US Treasuries as the 'risk-free' asset of choice. A sharp increase in rates would be followed by a broad selloff of all dollar assets. This type of tail event could result in equity/rate correlation dropping towards -100%. In addition, this event would likely trigger a dramatic reversal of equity/currency and equity/commodity correlations, likely weakening cross-regional equity correlations (e.g., US equities underperforming).

Investors wary of a potential US fiscal crisis and the tail-risk scenario described above could use an equity/rate correlation view in order to inexpensively hedge their equity exposure. An example trade would be to buy an out-of-the-money put option on the S&P 500 index, with a payoff that is contingent on treasury yields rising above a certain level. Given the current positive correlation between rates and equities, the cost of this type of hybrid would be significantly cheaper (as compared to the simple S&P 500 put option). For more details on this trade, see the last section of this report (Hybrid Derivative Trades).

Commodities

Silver Bullet for Asset Allocation

Prior to the financial crisis in 2008, commodities were essentially uncorrelated to equities and bonds, and were relatively weakly correlated among themselves. These attractive features were highlighted in numerous studies in the mid-2000s. For instance, a 2006 Ibbotson Associates study concluded that including commodities would have improved performance by 133bps, and suggested that an optimal asset allocation should include a significant proportion of commodities.[11] In addition to diversification benefits, commodities are considered to be a store of value and a hedge for inflation. These findings were largely based on historical analyses and did not take into account the potential price and correlation impact of widespread commodity allocations.

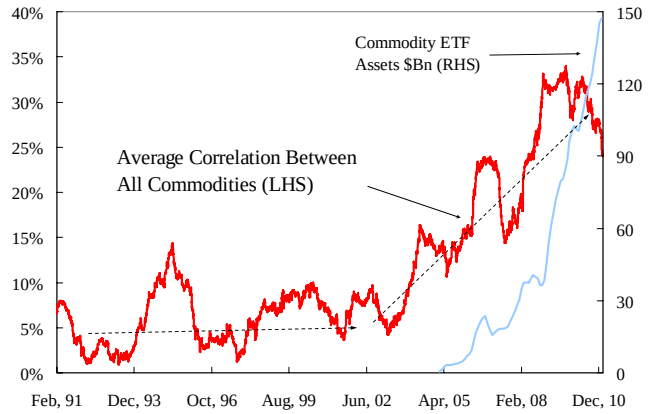
These attractive historical properties of commodities caught investors' attention and significant funds started flowing into the asset class. The demand for commodities from China and other emerging economies, the benign monetary policies of central banks, and increased geopolitical tensions caused large price increases, further fueling interest in the asset class. For instance, assets invested in Commodity ETFs roughly doubled every year since their launch in 2005 and currently stand at ~$150bn. In addition to individual commodities, broad commodity indices such as GS, DJ UBS, and TR/J CRB attracted significant investment assets. Figure 13 shows the growth of commodity ETF assets, as well as the steady increase in correlation between various commodities over the past ten years. Correlation between individual commodities was weak in the 1990s, but started increasing steadily in the 2000s. This is likely the result of increased investment allocation to commodities and commodity indices.

Correlation between commodities and equities was on average negative in the 1990s and early 2000s. However, following the collapse of Lehman Brothers, commodity/equity correlation turned positive (Figure 14). There are several reasons that caused this quick reversal. Firstly, commodities sold off alongside equities and other risky assets in the big 'risk-off' event of 2008/2009. As investors de-levered and de-risked, any speculative premium built into commodities was erased. Alongside de-risking, the recession that followed the crisis reduced demand for commodities, causing a positive correlation between equities and commodities (e.g., a drop in GDP expectations translates into reduced demand for oil and lower equity valuations at the same time). Another significant driver of positive commodity/equity correlation is the negative correlation of USD to equities described in the Currencies section of this report (see Figures 5 and 8). As commodities are priced in USD, currency/equity correlation spills over to commodity/equity correlation. For instance, a 1% increase in equities will, on average, coincide with a 20bps drop in USD. As commodities are priced in USD, this will mechanically lead to a 20bps increase in commodity prices on account of USD/equity correlation. Currently, about 40% of the positive commodity/equity correlation can be attributed to the (negative) correlation of USD to equities. The increase of commodity/equity correlation since 2008 and the commodity/equity correlation adjusted for USD pricing of commodities is shown in Figure 14.

[11] "Strategic Asset Allocation and Commodities," Ibbotson Associates, 2006.

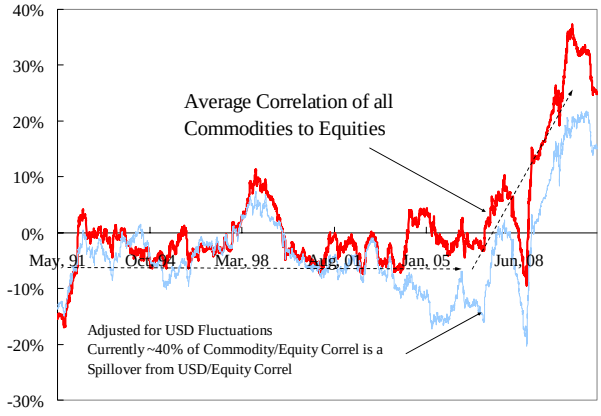
Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

Figure 13: Correlation Between Various Commodities and Growth of Commodity ETFs



Source: J.P. Morgan Equity Derivatives Strategy.

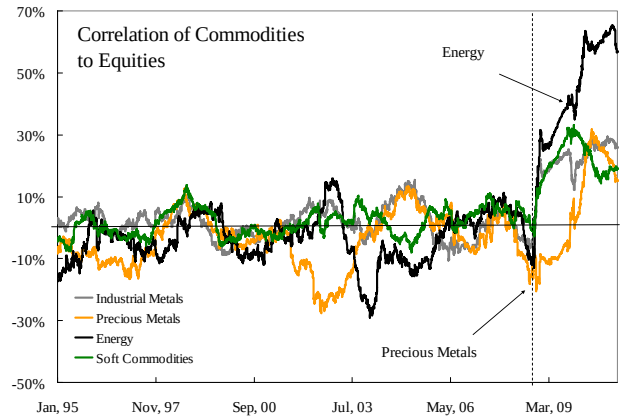
Figure 14: Commodity/Equity Correlation and the Spillover of Equity/FX Correlation



Source: J.P. Morgan Equity Derivatives Strategy.

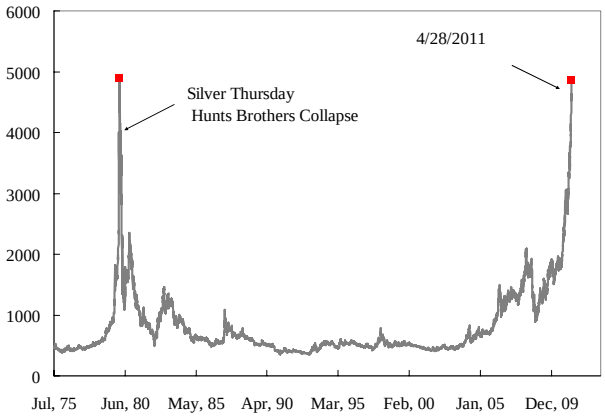
Figure 15 provides more details on the shift in commodity/equity correlation that occurred in 2008. The biggest reversion was experienced by Oil/Equity correlation which spiked from roughly -10% to current levels of over 60%. Industrial metals and soft commodities experienced similar correlation shifts. Gold/Equity correlations initially dropped as investors sold equities and rushed into the perceived relative security of gold. However, correlation quickly turned positive fueled by speculative demand and strong negative correlation of USD to equities.

Figure 15: Commodity/Equity Correlation for Energy, Precious Metals, Industrial Metals, and Soft Commodities



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 16: Some Commodities Are Prone to the Creation of Bubbles



Source: J.P. Morgan Equity Derivatives Strategy.

The increase of commodity/equity correlation since 2008 diminished some of the diversification value to a cross-asset portfolio. At least part of the correlation increase can likely be attributed to the investment demand for commodities. As investors increase or decrease exposure to all risky assets (including commodities and equities), commodities/equity correlation increases.

More precarious than the reduced diversification benefit is the risk of creation and bursting of speculative bubbles. The burst of an asset bubble can reduce returns and erase diversification benefits achieved over time. Figure 16 shows the price of Silver over the past 35 years. There are two prominent features of the chart. The first one is the speculative bubble engineered by the Hunt Brothers and its burst on “Silver Thursday” in March 1980, and the second one is the price of silver at the time of writing of this report.

Aside from market risk, there are intriguing social and macroeconomic aspects of commodity investing. Some of these issues were publicly discussed following a decision by California State Teachers' Retirement System against a large investment into commodities. In the run-up of silver prices during the Hunt Brothers' scheme, Tiffany published a full-page add in *The New York Times* stating: "We think it is unconscionable for anyone to hoard several billion, yes billion, dollars worth of silver and thus drive the price up so high that others must pay artificially high prices for articles made of silver." Replacing "Silver" with "Food" or "Gas" reveals the socioeconomic risk of potential commodity bubbles.

In addition to asset allocation, commodity/equity correlation plays an important role in valuations and volatility estimates for Materials and Energy sector stocks.[12] As discussed in the Rates section, investors trade hybrid options based on equity and commodity prices. Two examples of such hybrid option trades are explained in the 'Hybrid Derivatives Trades' section.

[12] For further discussion of Oil/Equity correlation, and its impact on Energy Sector Volatility, please see our paper "Energy Sector Volatility – Fundamentals of Volatility and Relative Value Ideas" from 2008.

Credit

Capital Structure Arbitraged

Correlation between credit spreads and equities has been steadily increasing over the past ten years. Figure 17 shows the correlation of changes in 5-year High Yield credit spreads and S&P 500 returns, as well as the correlation between changes in HY credit spreads and changes in VIX levels. With correlation of ~80%, credit, equities, and equity volatility are currently the most closely correlated assets.

There are many theoretical reasons behind the strong credit/equity correlation. Structural models of credit provide prices for both bonds and the stock of a company based on the value and volatility of the company's assets. If the value of the assets drops below the level of debt, the equity price is zero. For higher levels of assets, equity is priced as a call option on assets struck at the debt level. J.P. Morgan Equity Derivatives Research maintains a simple structural model that can indentify divergences between credit, equity volatility, and equity levels for individual stocks.[13]

Aside from the theoretical relationship, a high correlation between credit and equities is realized through relative-value trading. Capital structure arbitrage trades and cross-asset hedging tend to closely align these three assets. An example of a capital structure arbitrage trade is a relative-value trade between CDS and equity put options.[14] Perhaps more important drivers of credit and equity correlation are cross-asset hedges which are usually implemented at an index level. Due to the liquidity and transparency of the equity options market, many investors hedge their credit exposure via equity index options and volatility products (e.g., put spreads and put-spread collars on equity indices, VIX futures, calls/call spreads and index variance).

In addition to liquidity and transparency, an advantage of using equity instruments for credit hedging is hedge diversification. Investors diversify their hedges to avoid potentially crowded positions in credit hedges (such as outright shorting, or buying puts on CDX price index). If a hedge is 'crowded', investors that rush to monetize the payoff may impact the price of the hedging instrument and thus reduce the effectiveness of the hedge. For this reason it may be prudent to have hedges diversified across liquid instruments and thus minimize the impact of hedge unwinds. Another advantage of using equity hedges for credit is the potential pricing advantage. Due to high levels of equity skew, pricing of equity put-spreads and put-spread collars in some instances may be more attractive than outright purchases of CDX options or shorting CDX.

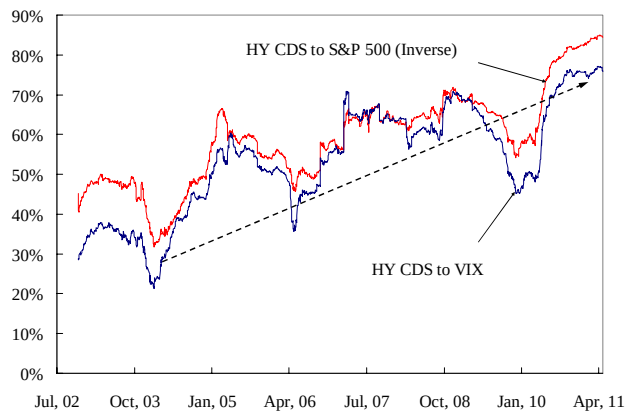
An obvious risk of credit/equity hedges (and more generally cross-asset hedges) is the tracking error between the two assets. The size of this tracking error is typically comparable to or greater than potential savings in the option pricing.

However, the tracking risk can also provide great opportunities for investors hedging credit with equity (or vice versa). The reason is that credit and equity prices can exhibit significant divergence in the short term. Investors who can correctly identify a divergence can buy protection on the 'expensive' asset to hedge the one that appears 'lagging'. Figure 18 shows the cumulative divergence of HY Credit spreads over equities and volatility (S&P 500 and VIX) based on a simple multiple regression model. This simple approach can help investors identify hedging relative-value opportunities. For instance, the figure shows a widening of credit relative to equities in the aftermath of GM's downgrade in the spring of 2005. Another episode of credit/equity divergence occurred when the VIX declined to multi-year lows at the end of 2005.

[13] "A Framework for Credit-Equity Investing," 2007.
[14] "Credit and Equity Volatility – Relative Value Opportunities," 2006.

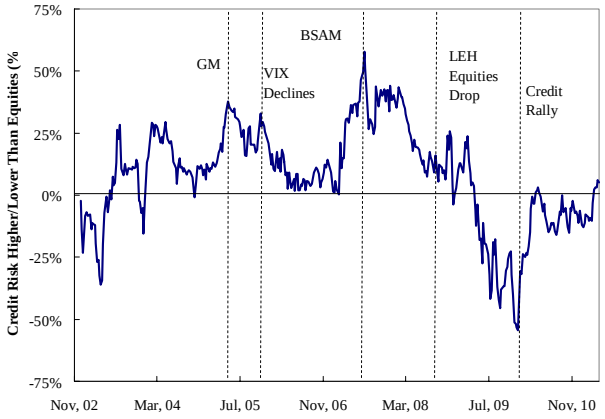
Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

Figure 17: Correlation of 5Y HY Credit Spreads to S&P 500 and VIX



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 18: Credit/Equity Divergences over the Past Ten Years



Source: J.P. Morgan Equity Derivatives Strategy.

Perhaps the biggest divergence and hence credit/equity hedging opportunity occurred in the summer of 2007, following the collapse of BSAM credit hedge funds. During this episode, equity markets failed to react to the deterioration in credit markets leading into the 2008 financial crisis. In all of these cases, holding equity hedges would have been more profitable than holding credit hedges, as credit either widened ahead of equities or equity volatility was lower than credit spreads. However, equity hedges are not always more attractive. At the end of 2009, credit spreads tightened more than what would have been expected based on the regression against equities and the VIX (buying credit protection may have been more effective leading into the market correction that happened in May 2010). Despite the recent widening of credit spreads relative to equity volatility, currently we do not see a large discrepancy between the two assets.

Equities

Why We Have a Correlation Bubble

As with other asset classes, correlation between various equity markets and sectors has been trending higher over the past 20 years.[15] The equity correlations most interesting to investors are the correlation between different regional markets (e.g., the correlation between developed world indices), the correlation between various industry sectors, and the correlation between individual stocks.

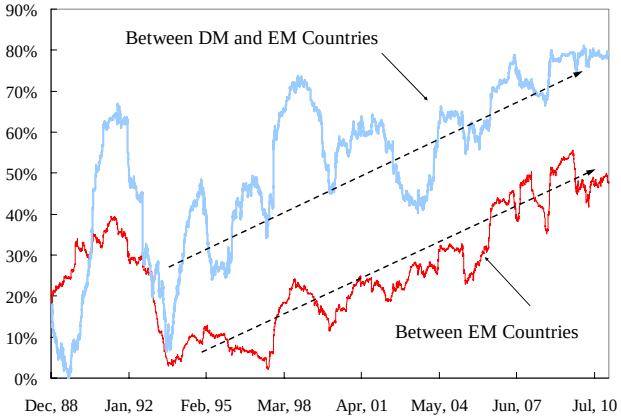
Figure 19 shows the correlation between developed and emerging markets and the correlation between different emerging market country benchmarks (in addition, Figure 1 shows the regional correlation between all country benchmarks). We note that the increase of cross-regional equity correlation is largely a secular trend (and only to a smaller extent driven by macro volatility). As explained in the first section of the report, this trend has been caused by the globalization of economies and financial markets. We believe this globalization, and hence the high cross-regional correlation trend, is not reversible. While region-specific events such as the recent earthquake in Japan may soften cross-regional correlations, markets are not likely to revert to the levels observed in the mid-1990s, when the average correlation between EM benchmarks was close to zero and EM/DM correlation was only ~25%. This trend of rising cross-regional correlation significantly diminished the once important diversification benefit of investing across emerging and developed markets. It appears that in the case of cross-regional investing, 'the only free lunch in finance' (a common reference to diversification) has been eaten.

The correlations between industry sectors are currently at their highest levels. Figure 20 shows a trend of increasing sector correlations over the past ten years, in particular the increase due to market volatility in 2008. Aside from market volatility, sector-specific market trends can have a large impact on cross-sector equity correlation. The most prominent is the large drop in sector correlation during the creation and burst of the internet bubble in 2001 as Technology stocks first rallied and then crashed relative to 'old economy' sectors.[16]

Figure 20 also shows average correlation between S&P 500 stocks. The recent increase of equity correlation has largely been driven by the increased macro volatility since 2007. However, other structural reasons contributed to increased levels of equity correlation. The widespread use of index products (e.g., futures) and high-frequency trading strategies, such as statistical arbitrage and index arbitrage, are likely contributing to increased levels of correlation.[17] While the levels of correlation should decrease with reduced macro volatility (correlation has already significantly decreased over the past six months), the new normal for equity correlation will likely be higher due to the aforementioned structural developments. The historical average level of correlation was 28%, and our estimate for the future long-term average is ~35% (significantly lower than correlation during the peak of market crisis, but higher than the historical average). In addition to increased long-term average levels, correlation will probably be more prone to spikes due to the alpha depletion discussed in the first section.

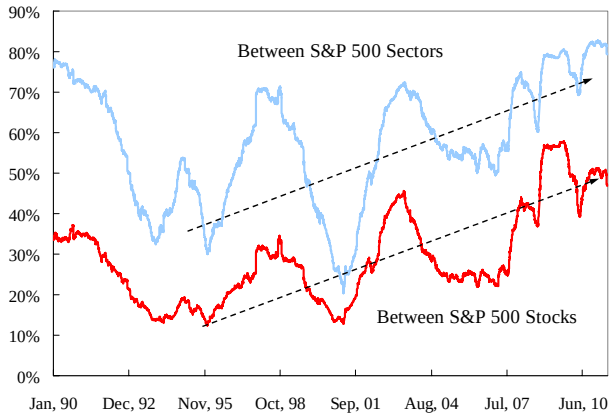
[15] For a detailed discussion of equity correlations see our report "Why we have a correlation bubble," 2010.
[16] For a more detailed discussion of sector correlations and their impact on market volatility, see our report "New Framework for Trading Correlation," 2010.
[17] This was discussed in detail in our report "Why we have a correlation bubble."

Figure 19: Secular Increase of Cross-Regional Equity Correlation



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 20: Sector and Stock Equity Correlation



Source: J.P. Morgan Equity Derivatives Strategy.

Equity correlations are an important input to manage the risk of a multi-asset portfolio or an equity-only long-short portfolio. More directly, equity correlations are used to price various derivatives instruments as described below.

Correlation between markets in different regions is used to price options on baskets of global indices. These 'World Basket' options are used by both retail and institutional investors. An example is a put option on the best-performing index out of the S&P 500, EuroStoxx 50, and Nikkei. The buyer of a 'Best-of' put is buying correlation, i.e., counting that if the markets go down, correlation between these indices will increase, causing them all to fall by a similar amount. 'Best-of' options can significantly reduce the cost of hedging as they cost less than the cheapest put option on one index. Another popular instrument is outperformance options. An example is an option on the outperformance of Emerging Markets (e.g., MSCI EM index) over DM (e.g., S&P 500). Pricing of this option depends on the projected correlation between EM and DM, and the instrument can provide a relatively secure and levered exposure to strong EM performance (see Hybrid Derivative Trades section).

Both sector and average stock equity correlations can be traded through relative-value trading of index, sector (e.g., ETF), and stock options. Selling equity correlation entails selling index options and buying options on the individual index constituents (stocks) in a specific ratio. Sophisticated investors should be aware of the price of correlation (implied correlation) they are paying when buying index options (e.g., buying index puts). Due to excessive demand and a lack of supply of index options, equity correlation typically trades above its fair value. In many cases, investors may be better off buying options on individual stocks or sectors than index options. When the price of equity correlation is much higher than levels realized by stock prices, arbitrage investors step in and sell index correlation.[18]

[18] For more details see "Why we have Correlation Bubble," "Tail Risk Relative Value," and "New Framework for Correlation Trading."

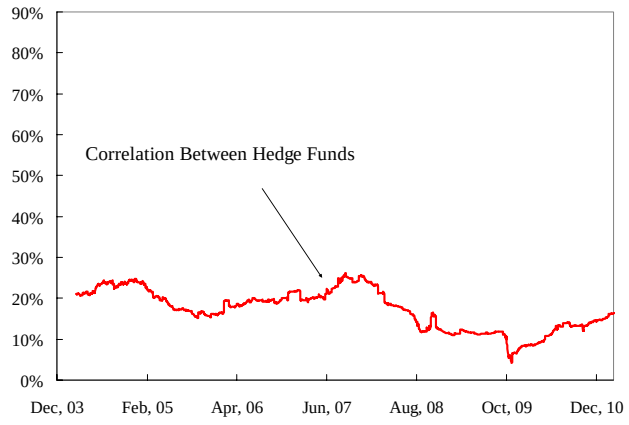
Alternative Assets

Hedge Funds and Correlation

Throughout this report we showed examples of increasing cross-asset correlation levels. One may ask if there is an asset class that did not experience a secular increase of correlation during recent years. An asset that could consistently generate positive alpha (outperformance) and not have a significant exposure to market risk (beta) would be uncorrelated to market risk. Many hedge funds seek to generate pure alpha through an absolute return mandate and should therefore be less correlated to other risky assets. Hedge funds are usually classified as 'Alternative Assets', alongside private equity and venture capital. There are various types of hedge funds including Merger Arbitrage, Global Macro, Distressed, Equity Market Neutral, Convertible Arbitrage, and others. These hedge fund strategies show relatively low correlation between one another. Figure 21 shows the average correlation between Hedge Fund Research Indices over the past eight years.[19] Correlation between various hedge fund strategies has been low, and is not showing a secular increasing trend as we see with equities, commodities, and currencies.

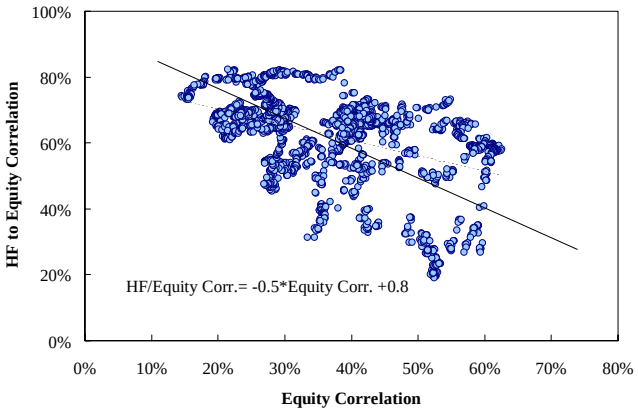
Correlation between the average performance of hedge funds (as measured by the HFRXGL Index) and the S&P 500 has been in a 20-80% range. This shows that, on average, hedge funds do have a significant exposure to equity markets. An attractive feature of hedge fund/equity correlation is that it tends to decline with an increase of market risk. In other words, on average, hedge funds show the ability to scale down market exposure in periods of high macro volatility. This is shown in Figure 22 which plots hedge fund/equity correlation vs. levels of equity correlation.

Figure 21: Correlation Between Hedge Fund Indices



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 22: Hedge Fund/Equity Correlation Declines in Times of High Macro Volatility



Source: J.P. Morgan Equity Derivatives Strategy.

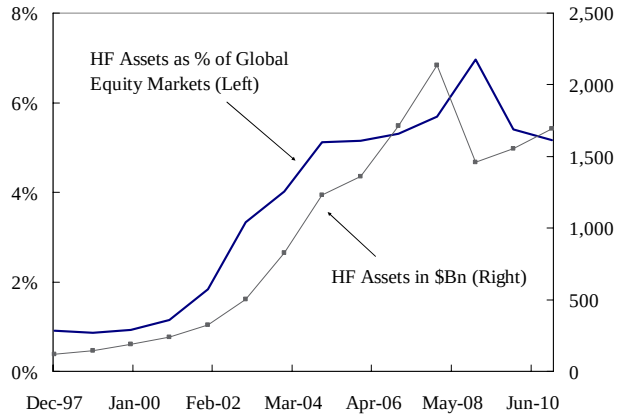
The low correlation between hedge fund strategies and lower correlations to other risky assets in periods of stress make hedge funds an attractive asset class. Over the past ten years, hedge fund assets increased significantly, both in absolute terms as well as in terms of percentage of global equity market capitalization. This is shown in Figure 23.

Hedge fund managers usually have a disciplined approach to risk management and neutralize risk exposures with the use of index-based and leveraged products such as futures and options. These risk-management techniques, alongside higher-than-average turnover, can contribute to increased levels of correlation.[20] Additionally, hedge funds seek to extract alpha through relative-value (hedged) trading. In the first section of this report, we showed that diminished levels of alpha increase the

[19] 12M average pair-wise correlation between the following Hedge Fund Research indices: HFRXMA, HFRXDS, HFRXEH, HFRXCA, HFRXRVA, HFRXGL, HFRXM, HRXEMN, HFRXCOM, HFRXCRED, and HFRXTEM.
[20] See "Why we have correlation bubble," 2010.

level of correlation and make markets more susceptible to correlation spikes. It is a possibility that the growth of hedge fund assets (shown in Figure 23) contributed to the secular increase of correlations over the past ten years (e.g., global macro and emerging market strategies may have contributed to an increase of cross-regional correlations, capital structure arbitrage strategies to credit/equity correlation, statistical arbitrage strategies to equity correlation, etc.).

Figure 23: Growth of Hedge Fund Assets Over the Past 15 Years



Source: J.P. Morgan Equity Derivatives Strategy, BarclayHedge LTD – Alternative Investments database.

In this report we have discussed structural changes in the market that have led to an increase of correlation levels. While the increase of correlations over the past three years is largely driven by macro volatility, secular market changes are causing a rising trend in cross-asset correlations. These changes include the integration of global economies and capital markets, and innovations in the financial industry. Advancement of risk-management techniques, such as hedging and dynamic asset allocation, use of US Treasuries as 'risk-free' storage, as well as more intensive extraction of alpha, have likely contributed to a secular increase in cross-asset correlations. Compared to 20 years ago, markets are currently more correlated and there is more pronounced "Alpha/Beta" separation. General market risk or 'beta' is managed more efficiently and at significantly lower cost (e.g., liquid derivative instruments and electronic trading), while large pools of assets are seeking 'alpha' via relative-value and arbitrage trading necessary for the proper functioning of capital markets.

Hybrid Derivative Trades

Implementing Cross-Asset Views

There are a number of trading strategies that can take advantage of cross-asset views. A common approach is to look for a closely correlated pair of assets and proxy hedge one with the other. This was briefly discussed in the Credit and Currencies sections. The main premise of proxy hedging is that the correlation between the two assets will remain stable. Cross-asset hedging makes the most sense when the price of one asset appears to be out of line relative to the other (e.g., equity volatility too low relative to credit spreads), or when the cost of protection in one asset class is significantly cheaper than in the other (e.g., FX volatility cheaper than equity index volatility). Investors can also focus on various tail-risk scenarios and look at the cost of tail protection across a range of assets. The expected benefits of cross-asset hedging (either coming from the cheapness of protection, or expected reversion of price divergence) are then compared to the tracking risk.

In this section we present several trades to implement cross-asset views directly through over-the-counter "Hybrid" derivatives. Hybrid derivatives have a payoff that is conditional on the price of more than one asset class. An advantage of using hybrid derivatives is that investors can significantly cheapen the cost of a hedge by buying protection against a particular cross-asset scenario. An example is buying a put option on the S&P 500 with a payoff conditional on the gold price rising above a certain level. If an investor believes that a market crash will coincide with a run of investors into the relative security of gold, buying this hybrid option could be significantly cheaper than buying a plain put on the S&P 500. In some cases, hybrid derivatives can have an added cost benefit if there is a natural supply of cross-asset risk (e.g., from retail structured product issuance or insurance industry demand). Below we list several cross-asset hybrid trades based on cross-asset relationships discussed in this report.

Rate/Equity

S&P 500 5-Year 90% Put Option contingent on 10-Year Swap Rate above 6% at maturity. The cost of this rate/equity hybrid option is ~3.5%. **This represents a discount of ~75%** compared to the cost of a vanilla S&P 500 5Y 90% put costing ~14.7%.

As discussed in Interest Rates section, rates are currently exhibiting positive correlation to equities (Figures 11 and 12). This means that if the S&P 500 drops, rates are likely to drop as well. The reason for this correlation relates to risk flows out of (into) equities and into (out of) US treasury bonds. Given the current positive correlation, the probability that the market will drop and rates go up is relatively small. For this reason the cost of this hybrid option is significantly lower than a plain S&P 500 put. However, there are two scenarios in which rate/equity correlation could sharply reverse. The first one is severe stagflation in which rates would go up and the market decline, and the second one is a tail event resulting in a sharp selloff of bonds and stocks (see Interest Rates section). Investors hedging against these two scenarios can significantly cheapen the cost of the hedge by purchasing this hybrid option.

Moreover, there are structural forces that are cheapening the price of this hybrid. Insurance companies that sell variable-annuity products with embedded guarantees are most vulnerable to falling equities (reducing the value of the assets used to provide guaranteed returns) and lower long-term interest rates (lowering the discount rate and therefore increasing the present value associated with future liabilities). These companies typically buy structured and hybrid investments that are long equity/rate correlation in order to hedge against the most unfavorable scenario of equities and interest rates falling simultaneously. Dealers that sell these structures are therefore left short equity/rate correlation and frequently seek to trade products with other clients that permit them to buy equity/rate correlation in order to reduce their own exposure. S&P 500 puts contingent on higher interest rates is an example of such a product. Investors that are willing to make their equity protection contingent on an increase in long-term interest rates can significantly reduce the cost of this protection by exploiting dealers' desire to buy this equity/rate correlation.

Commodity/Equity

S&P 500 1-Year 95% Put Option contingent on Crude Oil above 105%. This option costs ~3.3% compared to plain S&P 500 1-year 95% put at ~6.6%. **This represents a ~50% lower premium.**

As discussed in the Commodities section, the current correlation between equities and oil is strongly positive (Figure 15). This positive correlation is caused by the link between expected economic activity and demand for oil, investment inflows/outflows into commodities as a portfolio risk asset, and a negative relationship between equities and USD – the currency in which oil is priced. Investors who believe that this high correlation between crude oil and equities could reverse may reduce the cost of their equity protection by making it contingent on a rising oil price.

A potential reversal of correlation could be triggered by a supply shock such as escalation of MENA crisis (e.g., a blockade of oil shipments through the Persian Gulf). In such a scenario oil prices may sharply increase and equities sell off. Another scenario in which oil/equity correlation may reverse is a potential US fiscal crisis – a sharp selloff of USD could mechanically push commodity prices higher.

S&P 500 1-Year 95% Put Option contingent on Spot Gold above 105%. The cost of this option is ~2.9% compared to vanilla put at ~6.6%. This **reduces the premium by ~55%** compared to the cost of a vanilla S&P 500 1-year 95% put.

The current correlation between gold and equities is mildly positive (Figure 15). This is caused by the investment demand for gold and a negative relationship between equities and USD – the currency in which gold is priced. The positive correlation between equities and gold is significantly cheapening the price of this option (which is contingent on gold and equities moving in the opposite direction).

Despite the fact that gold and equities are now positively correlated, in the times of escalating macro volatility (e.g., see Figure 15, September 2008), gold prices are known to exhibit negative correlation with equities. This is driven by the use of gold as a relatively secure 'store of value'. In addition, an inflationary shock could prop up the prices of gold while negatively impacting equities. Investors who believe that gold/equity correlation may reverse either due to macro volatility shocks or US inflation may consider cheapening the cost of their equity protection by making it contingent on a rising gold price.

Currency/Equity

S&P 500 September 2011 ATM Put Option contingent on the Euro rising 3.5% against the USD at maturity. The cost of this option is 1.15% compared to a vanilla S&P 500 put that costs 4.8%. **This represents a ~75% lower premium.**

The S&P 500 recently exhibited a strong positive correlation to the Euro/USD (Figure 8). Therefore, a decline of the S&P 500 is expected to coincide with a decline in the Euro. However, if dollar assets show weakness as a result a potential large selloff in treasury bonds (e.g., triggered by the end of QE2), the Euro may strengthen despite a market selloff. Investors who believe that a potential decline of equities may be accompanied by a selloff of USD assets can significantly reduce the cost of their equity protection by making it contingent on the EUR rising. In this trade, an investor is selling currently record-high levels of equity/FX correlation and counting on a correlation reversal.

S&P 500 December 2011 95% Put Option contingent on the Canadian Dollar strengthening 3.5% against the USD. The cost of this option is 0.55% vs. a vanilla put cost of ~4.6%. **This represents a ~85% lower premium.**

The current correlation between CAD and equities is an astounding 80%. As with other DM currencies (Figure 8), as equities rise, the USD weakens causing appreciation of the CAD. In addition, the CAD is highly correlated to gold, and the positive correlation of equities and gold further increases the correlation of the CAD to equities. For these reasons the S&P 500 put option contingent on CAD rising is ~85% cheaper than the vanilla S&P 500 put.

However, there are several scenarios that could cause this correlation to reverse. If an equity selloff is caused by a selloff in US assets triggered by end of QE2, the occurrence of stagflation in the US, or a dollar crisis, the CAD could strengthen relative to the USD. In addition, in case of escalation of macro risk, gold/equity correlation would be expected to reverse

(Figure 15, September 2008) further supporting the CAD. Investors who believe that either equity/USD correlation or equity/gold correlation may reverse (causing the USD to weaken relative to the CAD in a negative equity environment) could significantly benefit from selling S&P 500/CAD correlation at record levels.

Cross-Regional

Outperformance of MSCI EM over S&P 500 1-Year Call Option. The cost of this option is ~6.4%. If the option is made contingent on the S&P 500 being above its current level at expiry, the cost is further reduced to ~3.9%. **This represents ~35% and ~60% premium reductions, respectively,** relative to a vanilla 1-year MSCI EM ATM call option (currently at ~9.6%).

An EM/DM outperformance option provides a relatively secure and levered exposure to strong EM performance, as the loss is limited to premium invested and the cost is lower than an outright option on EM. The correlation between EM and DM equities is currently at record levels (Figure 19). High levels of EM/DM correlation are cheapening the price of this option, as investors who purchase the option are effectively selling EM/DM correlation.

Investors who think that Emerging Markets may outperform US equities (e.g., due to risk of US fiscal crisis), causing a reversal of EM/DM equity correlation, would find an outperformance option attractive. For investors with a bullish outlook on equities, the additional contingency on the S&P 500 being above the current price represents an attractive feature. MSCI EM has a beta of ~1.25 to S&P 500, and the positive payoff of EM/DM outperformance is expected to coincide with the S&P 500 rising in absolute terms.

3-Month 95% Strike Best-of Put on a basket of S&P 500, FTSE 100, and ASX 200. The cost of this option is 1.2%. **This represents a 31% discount** compared to the cheapest vanilla put on any of the indices (premium of 1.75%).

One way to cheapen the cost of protection is buying best-of puts on a basket of indices. A best-of put has the same payoff as a standard 'vanilla' put, but the underlying instrument is the best-performing index within the selected basket. By conditioning the payoff on the best performer out of a basket of three indices, investors can cheapen the cost of protection significantly. The price of the best-of put is driven by the correlation between the constituents, the number of constituents, and their implied volatilities. A best-of put is typically cheaper when correlation is low. Moreover, best-of puts benefit from an increase in correlation and volatility, which both typically occur during a market selloff. Thus, if equities sell off sharply, investors are likely to have purchased these options at a lower correlation and volatility level than what is subsequently realized. All major global indices sold off together during the Q4 2008 credit crisis and the May 2010 Euro area sovereign debt crisis, suggesting the best-of put structure would have been effective in protecting a global portfolio during these sharp sell-offs.[21]

[21] See European Equity Derivatives Weekly Outlook – Revisiting tail risk hedging, 1-Mar-2011.

Marko Kolanovic
(1-212) 272-1438
MKolanovic@jpmorgan.com

Appendix: Simple Correlation Model

Volatility of a multi-asset portfolio is proportional to the average correlation between asset classes (cross-asset correlation) and the weighted-average volatility of asset classes in the portfolio.

$$\sigma^2_{Portfolio} = \sum_{i,j} w_i w_j \rho_{ij} \sigma_i \sigma_j = \sum_i w_i^2 \sigma_i^2 + \rho \sum_{i \neq j} w_i w_j \sigma_i \sigma_j$$

$$\sigma^2_{Portfolio} \approx \rho \sum_{i,j} w_i w_j \sigma_i \sigma_j = \rho \sum_i w_i \sigma_i \sum_j w_j \sigma_j = \rho \langle \sigma \rangle^2$$

In a simplified risk-on/off world, one can model each asset as having an exposure or 'beta' to the performance of macro risk and some asset-specific 'alpha'. Cross-asset correlation is then a function of macro volatility σ_r, exposure of assets to macro volatility (beta), and asset-specific risk (i.e., magnitude of individual asset's alpha). For two assets (labeled with indices *x* and *y*), correlation is calculated from their returns as:

$$r_x = \beta_x r + \alpha_x \qquad r_y = \beta_y r + \alpha_y$$

$$\rho_{xy} = \frac{\sum_i r_x r_y}{\sigma_x \sigma_y} = \frac{\beta_x \beta_y \sigma_r^2}{\sqrt{(\beta_x^2 \sigma_r^2 + \alpha_{\sigma x}^2)(\beta_y^2 \sigma_r^2 + \alpha_{\sigma y}^2)}}$$

For assets with a similar exposure to macro risk (beta) and similar magnitude of asset-specific 'alpha', cross-asset correlation further simplifies to the following expression:

$$\rho_{xy} \approx \frac{1}{1 + \frac{\alpha_\sigma^2}{\beta^2 \sigma_r^2}}.$$

Risks of Common Option Strategies

Risks to Strategies: Not all option strategies are suitable for investors; certain strategies may expose investors to significant potential losses. We have summarized the risks of selected derivative strategies. For additional risk information, please call your sales representative for a copy of "Characteristics and Risks of Standardized Options." We advise investors to consult their tax advisors and legal counsel about the tax implications of these strategies. Please also refer to option risk disclosure documents.

Put Sale. Investors who sell put options will own the underlying stock if the stock price falls below the strike price of the put option. Investors, therefore, will be exposed to any decline in the stock price below the strike potentially to zero, and they will not participate in any stock appreciation if the option expires unexercised.

Call Sale. Investors who sell uncovered call options have exposure on the upside that is theoretically unlimited.

Call Overwrite or Buywrite. Investors who sell call options against a long position in the underlying stock give up any appreciation in the stock price above the strike price of the call option, and they remain exposed to the downside of the underlying stock in the return for the receipt of the option premium.

Booster. In a sell-off, the maximum realised downside potential of a double-up booster is the net premium paid. In a rally, option losses are potentially unlimited as the investor is net short a call. When overlaid onto a long stock position, upside losses are capped (as for a covered call), but downside losses are not.

Collar. Locks in the amount that can be realized at maturity to a range defined by the put and call strike. If the collar is not costless, investors risk losing 100% of the premium paid. Since investors are selling a call option, they give up any stock appreciation above the strike price of the call option.

Call Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the stock is below the strike price of the call option.

Put Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the stock is above the strike price of the put option.

Straddle or Strangle. The seller of a straddle or strangle is exposed to stock increases above the call strike and stock price declines below the put strike. Since exposure on the upside is theoretically unlimited, investors who also own the stock would have limited losses should the stock rally. Covered writers are exposed to declines in the long stock position as well as any additional shares put to them should the stock decline below the strike price of the put option. Having sold a covered call option, the investor gives up all appreciation in the stock above the strike price of the call option.

Put Spread. The buyer of a put spread risks losing 100% of the premium paid. The buyer of higher ratio put spread has unlimited downside below the lower strike (down to zero), dependent on the number of lower struck puts sold. The maximum gain is limited to the spread between the two put strikes, when the underlying is at the lower strike. Investors who own the underlying stock will have downside protection between the higher strike put and the lower strike put. However, should the stock price fall below the strike price of the lower strike put, investors regain exposure to the underlying stock, and this exposure is multiplied by the number of puts sold.

Call Spread. The buyer risks losing 100% of the premium paid. The gain is limited to the spread between the two strike prices. The seller of a call spread risks losing an amount equal to the spread between the two call strikes less the net premium received. By selling a covered call spread, the investor remains exposed to the downside of the stock and gives up the spread between the two call strikes should the stock rally.

Butterfly Spread. A butterfly spread consists of two spreads established simultaneously. One a bull spread and the other a bear spread. The resulting position is neutral, that is, the investor will profit if the underlying is stable. Butterfly spreads are established at a net debit. The maximum profit will occur at the middle strike price, the maximum loss is the net debit.

Pricing Is Illustrative Only: Prices quoted in the above trade ideas are our estimate of current market levels, and are not indicative trading levels.

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J.P.Morgan

North America Equity Derivatives & Quantitative Strategy
10 April 2013

Update on Cross-Asset Correlations

Despite Regional Decoupling, Macro Uncertainty Remains High

- The average level of correlations across asset classes has more than doubled from ~20% in 2000-2005 to ~50% over the past five years. While a large part of the correlation increase was due to macro volatility post-Lehman, correlations have been on a secular rise due to changes in market structure. **In 2013, we are seeing weakening of several cross-asset correlations. In this report we analyze these recent trends and provide our outlook.**

- **As macro volatility declined and risky assets rallied in 2013, levels of cross-asset correlation moderated.** In particular, specific macro events caused a large decline in cross-regional correlations: yen weakening, and the related decoupling of Japanese equities, as well as the outperformance of Developed (US, Japan) relative to EM equities (e.g., Korea). **Yen weakening can explain more than half of the drop in cross-regional correlations this year**. Currency developments in Japan had a bigger impact on cross-regional correlations than the Fukushima nuclear disaster.

- Despite the recent decline, on average, cross-asset correlations remain elevated relative to pre-Lehman levels. **There is still a substantial gap between the elevated correlations and low levels of volatility. Particularly high are macro correlations such as rate-equity, oil-equity, and Euro-equity correlations.** This suggests that **despite the decline in regional correlations, we likely remain in a macro-driven market regime prone to volatility and correlation spikes.**

- In the rest of the report, we provide an updated analysis of correlations for Equities, Currencies, Interest Rates, Commodities, and Credit, originally published in our primer on Cross-Asset Correlations.

US Equity Derivatives Strategy

Marko Kolanovic [AC]
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Bram Kaplan, CFA
(1-212) 272-1215
bram.kaplan@jpmorgan.com

J.P. Morgan Securities LLC

Global Equity Derivatives & Quantitative Strategy

Marko Kolanovic (Global)
(1-212) 272-1438
mkolanovic@jpmorgan.com

J.P.Morgan Securities LLC

Davide Silvestrini (EMEA)
(44-20) 7134-4082
davide.silvestrini@jpmorgan.com

J.P.Morgan Securities plc

Tony Lee (Asia Pacific)
(852) 2800-8857
tony.sk.lee@jpmorgan.com

J.P.Morgan Securities (Asia Pacific) Limited

See page 17 for analyst certification and important disclosures.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

J.P.Morgan

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Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Rise of Cross-Asset Correlations

High levels of correlation usually point to a common source of risk for asset prices. In times of high macro uncertainty, the prices of equities, risky bonds, oil, gold, and emerging market currencies are largely driven by changes in the macroeconomic outlook. Over the past decade, investors witnessed a significant increase of correlation between equities as well as other risky assets such as credit, foreign exchange, interest rates, and commodities.

The average level of correlations across asset classes has more than doubled from ~20% in 1990 to ~50% over the past five years (Figure 1). While a large part of the correlation increase was due to macro volatility in the wake of the global financial crisis, cross-asset correlation has been on a secular rise due to changes in market structure. Integration of global economies and financial markets, and new risk management and alpha extraction techniques have all contributed to a rise in cross-asset correlation levels.

Figure 2 shows the average correlation between 45 developed world and emerging market country equity benchmarks contained in the MSCI All Country World Index. **After a dramatic rise from ~20% in the 1990s to its peak of 60% in 2012, cross-regional correlation has declined significantly in 2013.**

In addition to cross-regional correlations, we are seeing the weakening of several cross-asset correlation measures in 2013. **In this report, we analyze these developments and provide our outlook for cross-asset correlations.**

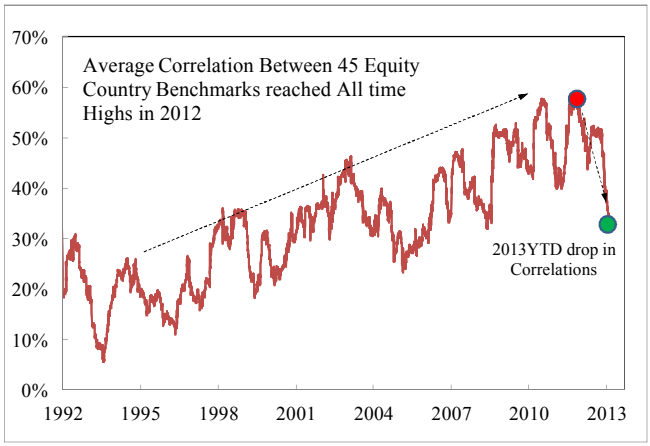
Figure 1: Over the Past 5 Years Cross-Asset Correlation Levels Increased for Equities, Credit, Foreign Exchange, Interest Rates, and Commodities

Asset Class	Correlation Between	1990-1995*	Past 5Y	Change
Equity	DM Country Indices	31%	48%	17%
Equity	EM Country Indices	23%	46%	23%
Equity	DM and EM Indices	38%	75%	37%
Equity	Economic Sectors	57%	77%	19%
Equity	Individual Stocks	25%	46%	22%
Credit	High Yield and Equities	46%	64%	19%
Credit	High Yield and VIX	37%	60%	24%
Foreign Exch.	DM Currencies and Equities	-1%	40%	41%
Foreign Exch.	EM Currencies and Equities	6%	51%	44%
Interest Rates	10Y Rate and Equities	-38%	54%	91%
Commodity	All Commodities	5%	25%	21%
Commodity	Commodities and Equities	-5%	20%	25%
Average		19%	51%	32%

* For Credit 2002-2005. All Currencies vs. USD

Source: J.P. Morgan Equity Derivatives Strategy.

Figure 2: Cross-Regional Correlation – After 20 Years Rally, This Correlation Declined in 2013



Source: J.P. Morgan Equity Derivatives Strategy.

In order to forecast cross-asset correlation, one needs to analyze the outlook for its drivers, which can be **Cyclical, Structural, or even Seasonal in nature.** Cross-asset correlation is proportional to levels of macro volatility and shows cyclical behavior. A simple model of asset returns based on the performance of risky assets shows that cross-asset correlation should be directly proportional to levels of macro volatility. Structurally, cross-asset correlations rise due to investment trends such as increased use of index products. Extraction of alpha from the market via various arbitrage strategies such as statistical arbitrage, index arbitrage, capital structure etc. also tend to increase levels of correlation. Finally, correlation tends to show seasonality. For example, in equities correlation shows strong seasonality with earnings and option expiry cycles, and levels of cross-asset correlation tend to decline in December and January (for more details on drivers of correlation see the Appendix).

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

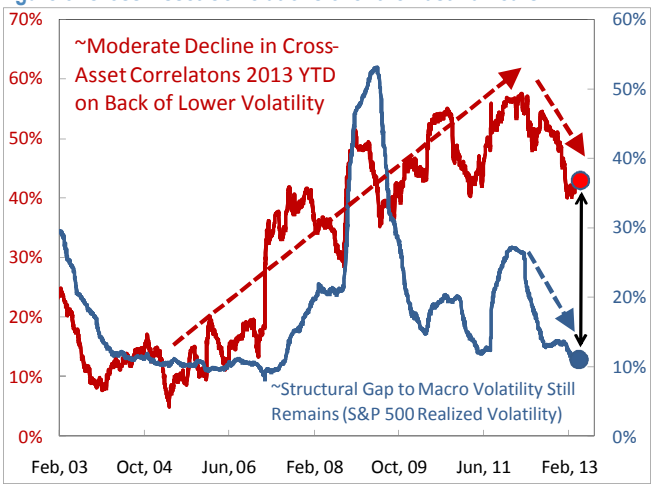
Recent Drop in Correlations

As macro volatility declined following the ECB/Fed actions in mid 2012 (as measured by, e.g., VIX), levels of cross-asset correlation started moderating. The strong rally of risky assets and seasonality also helped push correlations lower in early 2013.

In addition to the decline in macro volatility, specific macro events caused a large decline in cross-regional correlations: yen weakening, and the related decoupling of Japanese equities, as well as the outperformance of Developed (US, Japan) relative to EM equities (e.g., Korea). This contributed significantly to the recent decline of cross-asset correlation. Figure 4 below shows 2013 YTD changes in correlations relative to 2012. As we can see, the largest declines are in relation to Japan, US, and EM Equity performance, while some other correlation measures increased.

However, cross-asset correlations remain high, with a substantial gap above current levels of volatility (~25 points above the volatility implied level, Figure 3). Particularly high are indicators of the macro environment such as rate-equity, oil-equity, and Euro-equity correlations. This suggests that despite the decline of correlations, we may still be in a macro regime characterized by uncertain growth, dependence of asset prices on central bank liquidity, and continued overhang of the European debt crisis.

Figure 3: Cross-Asset Correlations over the Past 10 Years



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 4: Change in Cross-Asset Correlations YTD

Correlation	Current	2012 AVG	Change
HY Credit vs. VIX	51%	45%	6%
Gold vs. S&P 500	23%	20%	3%
10Y Rate vs. S&P 500	60%	59%	1%
HY Credit vs. S&P 500	67%	66%	1%
EUR vs. S&P 500	49%	50%	-1%
Oil vs. S&P 500	49%	55%	-6%
Avg. Cross Asset Correlation	**37%**	**50%**	**-12%**
Individual Stocks	24%	38%	-14%
Equity Industry Sectors	53%	72%	-19%
JPY vs. S&P 500*	-41%	-22%	-19%
DM Country Eq. Benchmarks**	28%	47%	-20%
EM Country Eq. Benchmarks**	19%	41%	-21%
Soft Comodities vs. Equity	-21%	14%	-35%
KRW vs. S&P 500*	-2%	39%	-41%
DM vs. EM Eq. Benchmarks	27%	73%	-47%
AUD vs. S&P 500*	10%	65%	-55%
CAD vs. S&P 500*	17%	73%	-56%
GBP vs. S&P 500*	-23%	51%	-74%

Japan/Korea Related
Equity - Earnings Related
Stable correlations
Commodity vs. Equity
GBP, AUD, CAD Related

* All currencies against USD
** In Local Currency

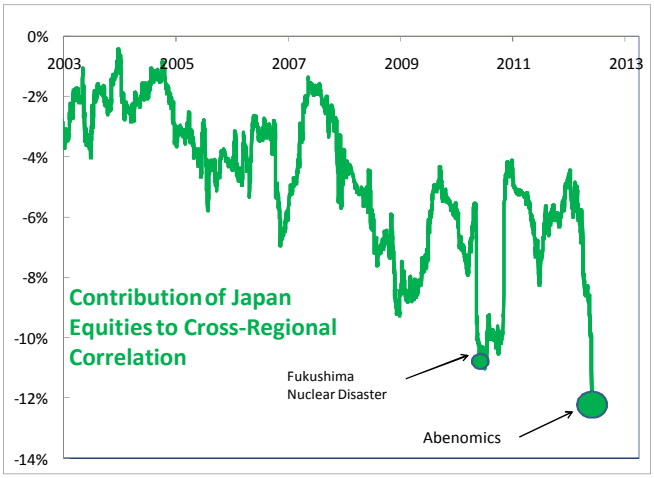
Source: J.P. Morgan Equity Derivatives Strategy.

The outperformance of Japanese stocks, on the back of the favorable currency move, caused a decline in correlation between developed market country indices (DM country correlation dropped by ~40%). Given the weak growth outlook for several EM markets and in particular weakness of Korean stocks (JPY/KRW, crisis with North Korea), the correlation between EM country indices dropped by half (from ~40% to ~20%). In addition, correlation of Emerging Market to Developed Market equity benchmarks dropped from ~70% to ~30%.

The move in the yen and Japan Equities significantly reduced cross-regional correlations. This correlation recently dropped by ~18 points. Out of that decline, we can attribute ~9 points to developments in Japan and ~5 points to the decline in the VIX. Figure 5 shows the negative contribution of Japan equities to the correlation of regional equity benchmarks in MSCI World Index (difference between correlation measured with and without Japan). Note that the effect of the weak yen on the correlation of global equities is larger than the impact of the earthquake/tsunami/Fukushima nuclear disaster in 2011. The drop in correlation introduced by Japan is a macro event, and not a result of improving micro fundamentals. In fact, the correlation of stocks in Japan is currently very high, indicating a risk on/off market within the country.

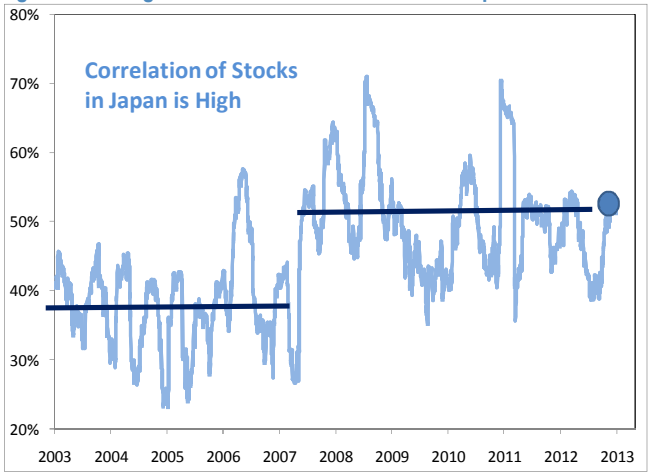
Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Figure 5: Contribution of Japan to Average Correlation Between Global Benchmarks in the MSCI World Index



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 6: Average Correlation Between Stocks in Japan

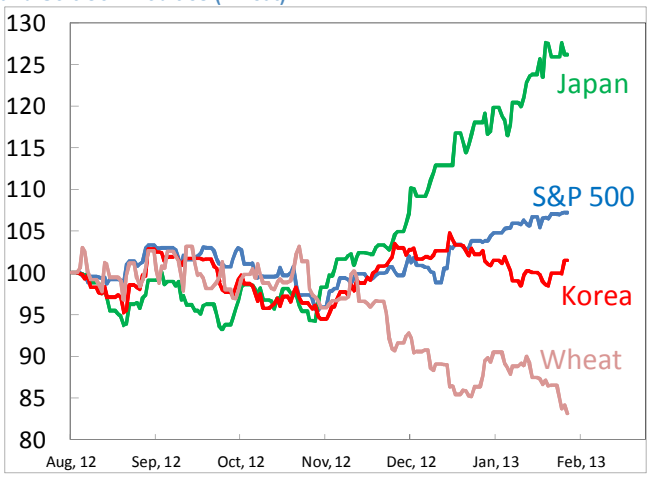


Source: J.P. Morgan Equity Derivatives Strategy.

In 2013 the S&P 500 has outperformed various credit, rate, FX, and volatility assets by an average of 2 standard deviations. A significant outperformance of the S&P 500 relative to the GBP, CAD, and AUD weakened global currency/equity correlations. GBP, AUD, and CAD are historically "risk on" currencies. However, due to the increasingly dovish policies of their respective central banks, and weaker country-specific fundamentals, these currencies have significantly underperformed the S&P 500 this year.

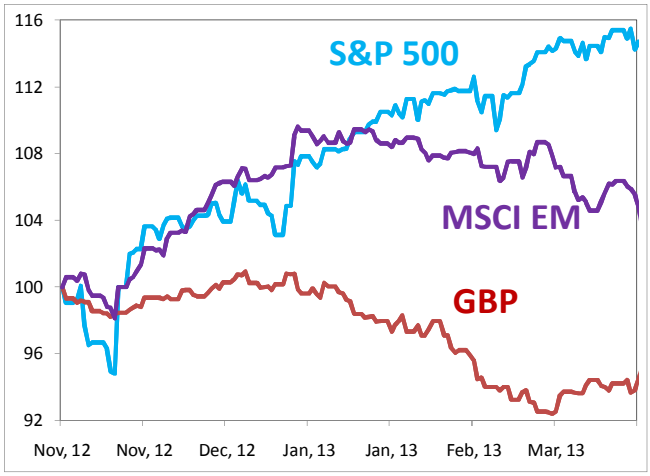
In addition, soft commodities, which were historically positively related to equities, declined due to stronger production that reversed part of the price gains caused by last summer's severe drought. The correlation of soft commodities to equities recently declined from 14% to -21%. Performance of these assets is shown in Figure 7 and Figure 8.

Figure 7: Performance of Japan, US, and Korea Equity Benchmarks, and Soft Commodities (Wheat)



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 8: Performance of S&P 500 , MSCI Emerging Markets and GBP



Source: J.P. Morgan Equity Derivatives Strategy.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Several Key Correlations Still High

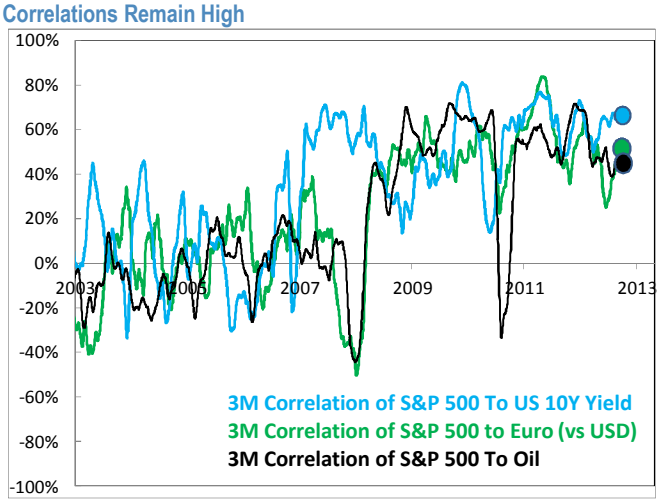
Despite the average decline, several important correlation measures remained high this year. In particular, rate-equity, oil-equity, and Euro-equity correlation are at the high end of their trading ranges (Figure 9).

High rate-equity correlation is a good indicator of a risk on/off macro environment. This correlation measures the extent to which investors make top-down decisions (e.g., stocks vs. bonds) as opposed views on individual sectors or securities. High oil-equity correlations also indicate macro uncertainty as the price of oil and equities fluctuate based on the changing outlook for global growth. Finally, high Euro-equity correlation still points to an overhang from the European debt crisis and potential for spillover effects from Europe to US and Asia assets.

Figure 10 shows the current level of various cross-asset correlations (trailing 6 and 3 months) expressed as a percentile relative to the past 10 years. Cross-asset correlation in the five years after Lehman's collapse (average ~50%) was twice the average level in the five years prior to Lehman's collapse (~25%). The table can give us a sense of which correlations have reverted to the pre-Lehman regime.

We note that only Cross-regional equity (EM/DM, EM indices) and EM-FX correlations (related to Japan/US/Korea performance) are clearly in a pre-Lehman regime. Most other measures are still consistent with the post-Lehman (risk on/off) environment.

Figure 9: Interest Rate-Equity, Oil-Equity, and Euro-Equity Correlations Remain High



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 10: Current Levels of Correlations in Historical Perspective

6M Correlation	10Y %-tile
Rates - Equity	82%
Gold - Equity	82%
Oil - Equity	76%
Equity Sector	68%
EUR Equity	68%
ALL X-ASSET	**66%**
DM FX Equity	64%
Metals Equity	58%
Commodities	49%
Stocks	47%
EM FX	37%
EM Stocks	35%
DM Stocks	16%
DM EM	13%

3M Correlation	10Y %-tile
EUR Equity	83%
Oil - Equity	75%
Rates - Equity	74%
Gold - Equity	64%
DM FX SPX	60%
EM FX SPX	58%
ALL X-ASSET	**54%**
Metals Equity	47%
Sectors	46%
Commodities	42%
EM FX	36%
EM Stocks	19%
DM Stocks	2%
DM EM	1%

Source: J.P. Morgan Equity Derivatives Strategy.

In the rest of the report, we provide an update of correlation analysis for Equities, Currencies, Interest Rates, Commodities, and Credit, originally published in our primer on Cross-Asset Correlations.

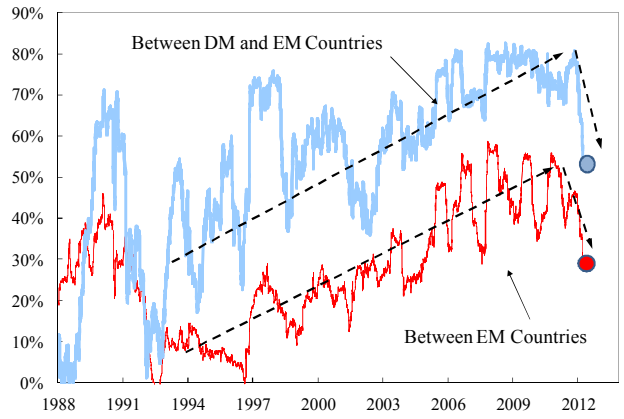
Equities

As with other asset classes, correlation between various equity markets and sectors has been trending higher over the past 20 years.[1] Of interest to investors are the correlation between different regional markets (e.g., Europe vs. US), the correlation between various industry sectors, and the correlation between individual stocks.

The increase of cross-regional equity correlation was largely a secular trend. This trend has been caused by the globalization of economies and financial markets. Region-specific events such as the Japan earthquake in 2011 and the current weakening of the JPY can significantly reduce cross-regional correlations, but they are not likely to permanently revert to the low levels observed in the mid 1990s.

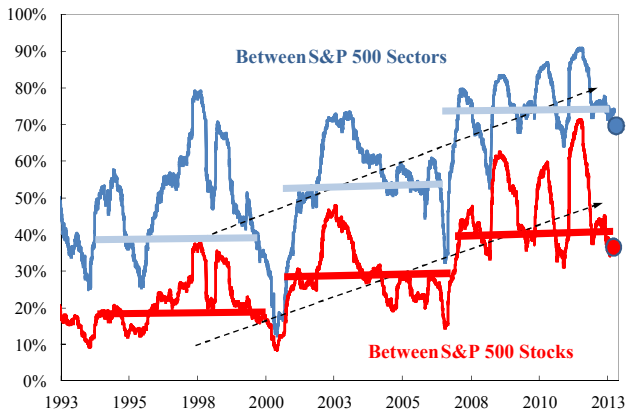
The decrease of equity and sector correlation in 2013 has largely been driven by the decline in macro volatility. However, structural and cyclical drivers are likely to keep correlations elevated. The widespread use of index products and HFT strategies are likely contributing to the secular increase. While the levels of correlation decreased with reduced macro volatility, the new normal for equity correlation will likely be higher compared to pre-Lehman. The historical average level of S&P 500 stock correlation was 20% in the 90s, 30% in the early/mid 2000s, and 40% post-Lehman. We estimate the future long-term average correlation will be in a 30-40% range.

Figure 11: Cross-Regional Equity Correlation



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 12: Sector and Stock Equity Correlation



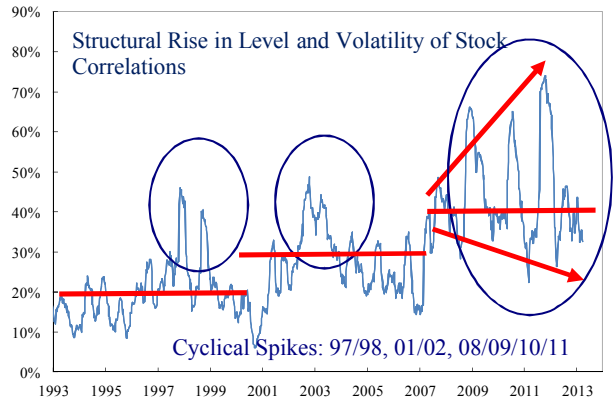
Source: J.P. Morgan Equity Derivatives Strategy.

In addition to the average level trending higher, equity correlations have been more volatile in the post-Lehman environment (Figure 13). This is understandable as prolonged periods of high correlation create distortions that are bound to revert in periods of correlation breakdowns. This is how several "correlation bubbles" were created and burst over the past five years.

Large swings in correlation tend to be related to macro scares but also to seasonal effects (end of year rebalances, earnings, quarterly expiry cycle, etc.). Similar to Japan's role in depressing cross-regional correlations, individual events can have a significant de-correlating impact on the average correlations of stocks. For instance, the underperformance of AAPL relative to other stocks in early 2013 reduced short-term equity correlations by ~15 points (Figure 14).

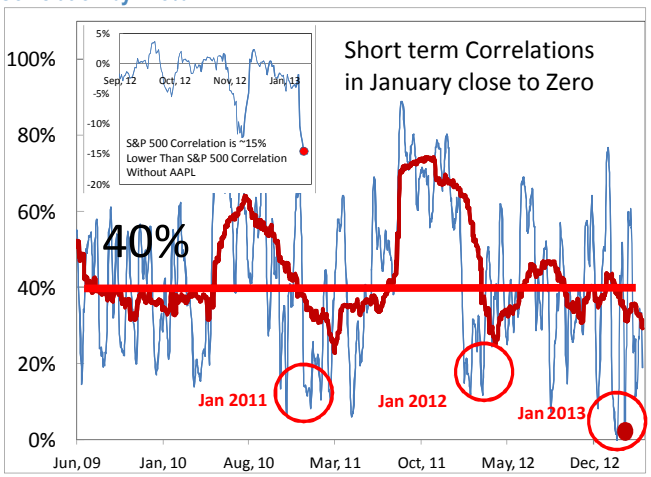
[1] For a detailed discussion of equity correlations see our report "Why we have a correlation bubble," 2010.

Figure 13: Equity Correlation Has Been More Volatile



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 14: Decoupling of AAPL Performance Reduced Short-Term Correlation by ~15%



Source: J.P. Morgan Equity Derivatives Strategy.

Currencies

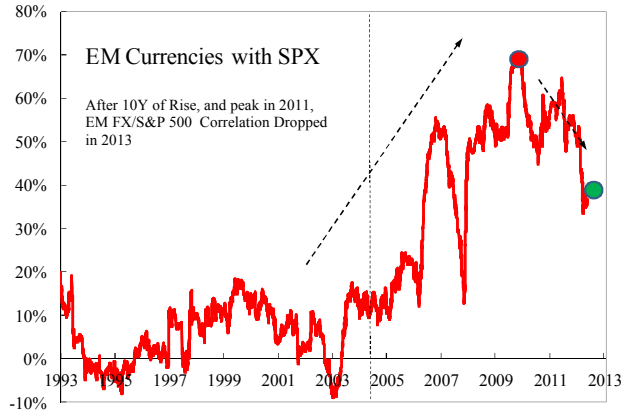
Increased risk appetite of investors usually results in an inflow of capital into EM stocks. In order to purchase these stocks, funds need to be converted into local EM currencies. These inflows typically cause both assets (EM stocks and currencies) to appreciate at the same time, giving rise to positive correlation between equities and EM currencies.

Similar risk flows drive the correlation between equities and DM currencies. Figure 16 shows the market capitalization of US, Developed World ex US, and Emerging Equity Markets since 1998. The figure shows the relative rise of EM, and decline of US market capitalization. From 1999 to 2011, the capitalization of EM grew from 1% to 24%.

The relevance of capitalization changes to currency/equity correlation is that while 10 years ago the "risk-on" trade into global equities (in proportion to global market capitalization) involved net buying of USD, since 2004 (and in particular over the past three years) the global "risk-on" trade involves net selling of USD in order to purchase EM and Developed World ex US equities.

In 2013 the EM FX/Equity Correlation weakened, caused by large outflows from EM (e.g., Korea) and inflows into US and Japan equities. In addition, the ratio of EM to DM market capitalization decreased by 25% since its peak in 2011, which likely helped weaken EM FX/Equity correlation over the past two years.

Figure 15: Correlation of EM Currencies (vs. USD) and S&P 500



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 16: Global Equity Markets Capitalization Since 1998

Year	Market Capitalization ($Bn) US	DM ex US	EM	US %	DMxUS %	EM %
1998	7,800	5,000	200	60%	38%	1%
1999	9,900	6,300	200	60%	38%	1%
2000	12,300	7,800	400	60%	38%	2%
2001	11,800	7,500	1,200	57%	37%	6%
2002	10,500	6,100	1,000	60%	35%	6%
2003	8,100	6,100	1,000	53%	40%	7%
2004	10,300	8,600	1,700	50%	42%	8%
2005	11,300	10,500	2,200	47%	44%	9%
2006	11,300	11,900	3,300	43%	45%	12%
2007	12,800	14,700	4,700	40%	46%	15%
2008	12,900	16,900	7,800	34%	45%	21%
2009	7,900	9,500	3,600	38%	45%	17%
2010	9,900	12,300	6,500	34%	43%	23%
2011	11,400	13,400	8,000	35%	41%	24%
2012	11,700	12,200	6,600	38%	40%	22%
2013	14,400	14,500	7,700	39%	40%	21%

Source: J.P. Morgan Equity Derivatives Strategy.

Equally important is to look at the capitalization of global government debt markets shown in Figure 17. US Treasuries alone represent almost 35% of all government bonds (US and Japan Debt total ~65%). In other words, US Government debt is most broadly used as a liquid store of relatively "risk-free" assets. A "risk-on" trade involves net selling of US (or Japan) debt and selling the USD (or JPY) to buy risky assets such as equities—two-thirds of which are denominated in currencies other than USD. This causes a positive correlation of currencies (ex USD, JPY) with Equities (Figure 18).

Currency carry trades involve borrowing in low-yielding currencies (USD, JPY) and selling the currency to invest in higher-yielding currencies (EM or Commodity Currencies) or other higher-yielding assets such as equities. In both cases the currency carry trade is a "risk-on" trade that involves selling USD or JPY while buying currencies (or assets) positively correlated with equity or commodity risk. Cross-asset statistical arbitrage involves simultaneous trading of currencies, equities, and commodities and can result is an increase in cross-asset correlation.

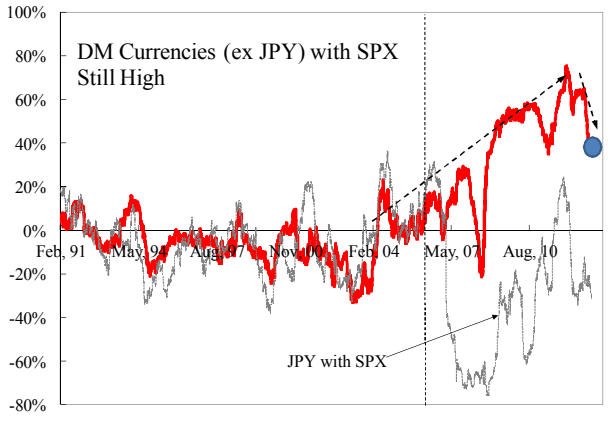
Note that in the last six months the JPY weakened ~20%, reducing the global share of Japanese debt by 5% (in USD terms). Despite this, US and Japan debt constitute two-thirds of global debt outstanding, helping DM FX/Equity and rate-equity correlations remain high.

Figure 17: Global Government Debt Market Capitalization

Country	Debt ($Bn)	% of Total	S&P Rat.	% of GDP
Japan	10,779	34%	AA-u	226
USA	9,077	28%	AAAu	59
Italy	2,299	7%	A+u	118
France	1,869	6%	AAAu	84
Germany	1,761	5%	AAAu	79
UK	1,726	5%	AAAu	77
Spain	939	3%	AA	63
Canada	633	2%	AAA	34
Greece	479	1%	BB-	144
Belgium	451	1%	AA+u	99
Netherlands	449	1%	AAAu	65
Austria	276	1%	AAA	70
Portugal	206	1%	BBB-	83
Australia	203	1%	AAAu	22
Next 10	1,025	3%	--	--

Source: J.P. Morgan Equity Derivatives Strategy. Bloomberg.

Figure 18: Correlation of DM Currencies (vs. USD) with S&P 500 (Solid); Correlation of JPY (vs. USD) with S&P 500 (Dashed)



Source: J.P. Morgan Equity Derivatives Strategy.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

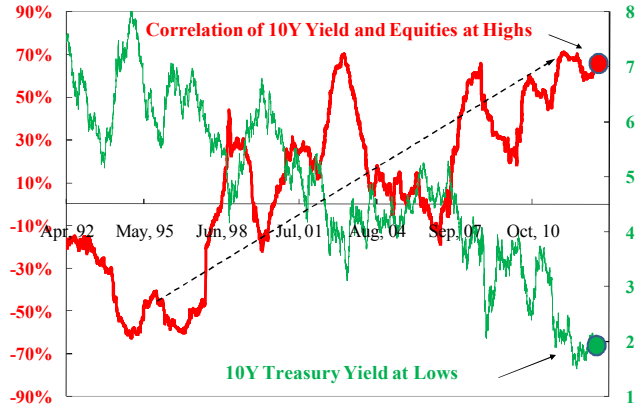
Interest Rates

When investors increase risk exposure, they typically sell some government debt and invest the proceeds in equities, risky debt, or commodities. Reducing risk exposure involves selling risky assets and buying treasuries (flight to quality). This "risk-on/off" asset allocation approach has caused a positive correlation between equities and interest rates over the past 10 years.

Another reason for a positive equity/rate correlation is expected monetary policy (weak equities suggest the CB may cut rates or perform QE). The widespread usage of US Treasuries and JGBs as virtually "riskless" storage has caused an increase of equity/rate correlations and decrease of treasury yields over the past 15 years, as shown in Figure 19.

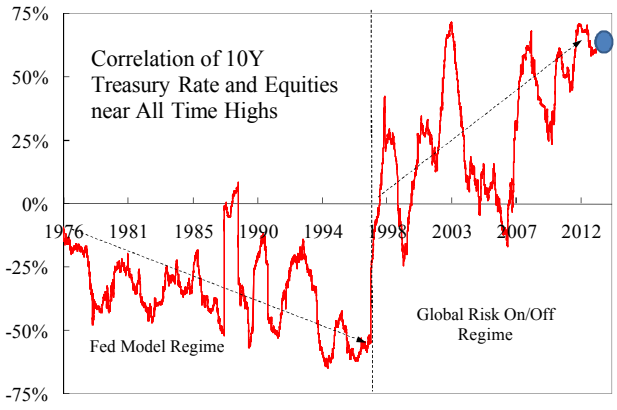
Historically, the correlation between equities and rates was not always positive. Moreover, there are theoretical reasons why this correlation should in fact be negative. The so-called "Fed Model" states that treasury yields should be roughly equal to equity earnings yield (E/P or simply the inverse of the P/E ratio). We note that prior to 1997, rate/equity correlation was indeed negative, as predicted by the so-called "Fed Model." This changed virtually in one day, when the Asian crisis caused risk contagion across global markets on 10/27/1997.

Figure 19: Correlation of 10Y Treasury Yield and S&P 500



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 20: Regime Change of Equity-Rate Correlation Occurred in 1997/1998



Source: J.P. Morgan Equity Derivatives Strategy.

2013 YTD equity-rate correlations are near record highs. This indicates that despite a pullback in regional correlations, we are likely still in a macro driven, risk on/risk off environment.

Japan's most recent Qualitative and Quantitative Easting (QQE) weakened cross-regional correlations as Nikkei performance diverged from other equity benchmarks. Note that this is not a fundamental adjustment but another macro adjustment to the change in central banks' policies (incrementally divergent between Japan, US, and other regions).

Despite our view that equity/rate correlations will stay positive, there are certain scenarios that could cause a weakening or reversal of this relationship. In the case of stagflation, treasury yields are expected to increase as a result of increased inflation expectations. A low or negative growth outlook and increased inflation expectations could cause an equity selloff. In this way, the occurrence of stagflation could cause equity/rate correlations to drop or even turn negative.

The most dramatic reversal of equity/rate correlations could happen in the event of full-fledged US or Japan bond/equity contagion. This could occur as a result of a fiscal crisis or loss of confidence in central bank actions. This could prompt foreign investors to abandon US Treasuries or JGBs as the perceived "risk-free" asset of choice.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Commodities

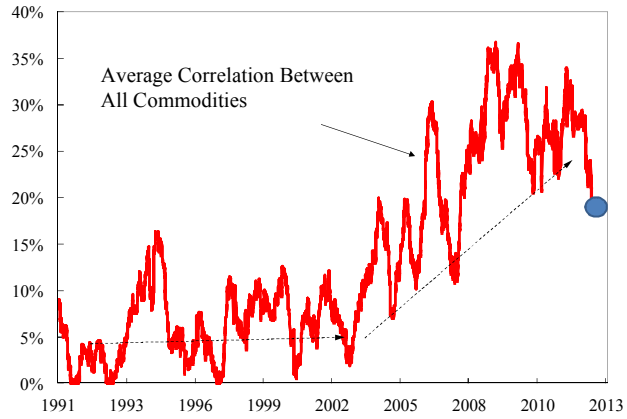
Prior to 2008 commodities were uncorrelated to equities and were relatively weakly correlated among themselves. The demand for commodities from China and other EM economies and the benign monetary policies of central banks caused large price increases. Low correlation and strong performance caught investors' attention, and significant funds started flowing into the commodities.

In 2013 the correlation of commodities declined and is currently about half way between pre-Lehman and post-Lehman averages (Figure 21).

The correlation between commodities and equities was on average negative in the 1990s and early 2000s. However, following the collapse of Lehman Brothers, commodity/equity correlation turned sharply positive. Commodities sold off alongside equities and other risky assets in the big "risk-off" event. Alongside the de-levering of investors, the recession reduced consumption demand for commodities, causing a positive correlation between equities and commodities.

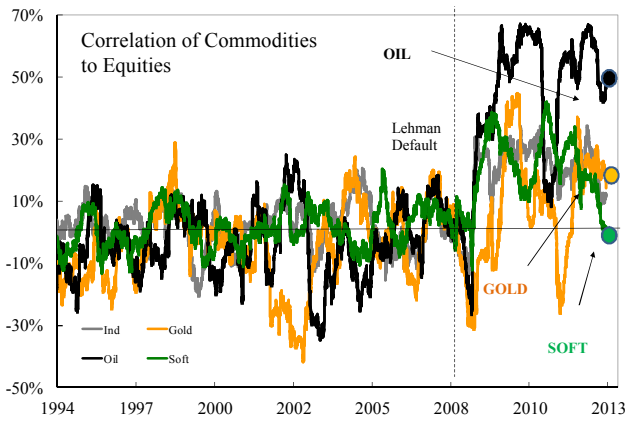
Currently oil and gold are still strongly related to equities, while soft commodities decoupled as discussed earlier.

Figure 21: Correlation Between Commodities



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 22: Commodity – Equity Correlation



Source: J.P. Morgan Equity Derivatives Strategy.

A significant driver of the positive commodity/equity correlation is the negative correlation of the USD to equities. Currently, about 40% of the positive commodity/equity correlation can be attributed to the correlation of the USD to equities.

The increase of commodity/equity correlation since 2008 diminished some of the diversification value to a cross-asset portfolio. At least part of the correlation increase can likely be attributed to the investment demand for commodities. As investors increase or decrease exposure to all risky assets (including commodities and equities), commodity/equity correlation increases. In addition to reduced diversification benefits, there is the risk of creation and breaking of speculative bubbles. The burst of an asset bubble can reduce returns and erase diversification benefits achieved over time. While commodity correlation and tail risks remain, reduced prices and correlation levels in 2013 make commodities incrementally more attractive for portfolio diversification.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

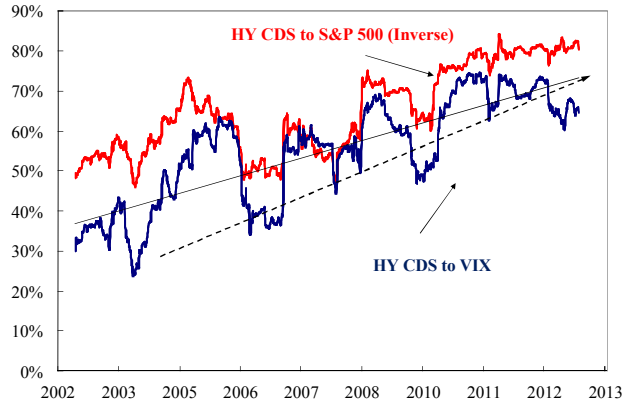
Credit

Correlation between credit spreads and equities has been steadily increasing. With correlation of ~80%, credit and equities are currently the most closely correlated assets.

There are many theoretical reasons behind the strong credit/equity correlation. Structural models of credit provide prices for both bonds and the stock of a company based on the value and volatility of the company's assets.

Aside from the theoretical relationship, a high correlation between credit and equities is realized through relative-value trading. Capital structure arbitrage trades and cross-asset hedging tend to closely align these assets.

Figure 23: Correlation of 5Y HY Credit Spreads to S&P 500 and VIX



Source: J.P. Morgan Equity Derivatives Strategy.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Appendix I: Drivers of Cross-Asset Correlation

Cyclical Drivers

In times of elevated macro uncertainly, investors and risk managers look at equities, risky bonds, commodities, and currencies as a source of portfolio risk. As portfolio risk is adjusted up or down in a risk-on/off trading style, the prices of all risky assets tend to move in sync. In this rigid investment approach, any asset is viewed as having an exposure or "beta" to the macro risk and some asset-specific "alpha." Given the level of macro risk and the magnitude of "alpha" available in the asset class, a risk-on/off trading approach determines the market level of cross-asset correlations.

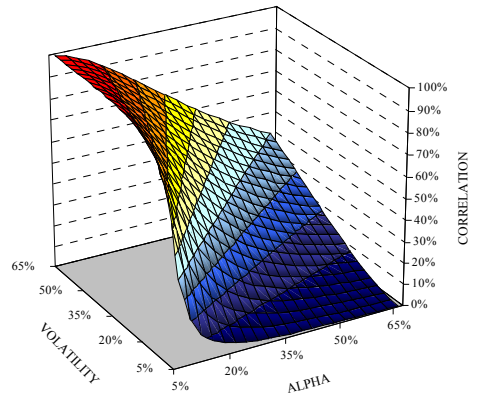
This relationship between cross-asset correlation, macro volatility, and availability of alpha in markets is summarized in Figure 24 (for a more formal explanation, see Appendix II). Essentially, a high level of macro volatility causes a high cross-asset correlation. In addition, a lack of alpha also causes an increase of correlations. Interestingly, in a high-alpha environment spikes in macro volatility have a muted impact, while in a low-alpha environment macro volatility can cause a dramatic spike in cross-asset correlation. Figure 25 shows theoretical levels of cross-asset correlation (vertical axis) as a function of alpha and macro volatility. In order to have a large spike in cross-asset correlation, not only do we need to have macro volatility, but the level of alpha in the markets needs to be depleted.

Figure 24: Relationship between Cross-Asset Correlation, Macro Volatility, and the Magnitude of Alpha Opportunities in the Market

More VOLATILITY	→	More Correlation
Less VOLATILITY	→	Less Correlation
Less ALPHA	→	More Correlation
More ALPHA	→	Less Correlation
Less ALPHA	→	Volatility has greater impact on Correlation

Source: J.P. Morgan Equity Derivatives Strategy.

Figure 25: Graphical Representation of the Relationship Between Cross-Asset Correlation, Macro Volatility, and Magnitude of Alpha



Source: J.P. Morgan Equity Derivatives Strategy.

Structural Drivers

Risk hedging with liquid derivative products can also have an impact on correlations. For instance, hedging of equity exposure is typically implemented via index futures on liquid capitalization-weighted indices such as the S&P 500. Trading of these instruments can mechanically increase correlation between large-cap stocks. Similarly, hedging credit portfolios with VIX or S&P 500 products can result in increased credit-equity correlation.

A decrease of asset-specific alpha increases the level of cross-asset correlations. An example of alpha capture that causes correlation increase is statistical arbitrage. In a simple pair strategy, an arbitrageur is trading two correlated assets—buying the underperforming asset and selling the outperforming one. The trade increases the correlation between the pair and captures (diminishes) the alpha. This type of arbitrage can be implemented between pairs of stocks, sectors, regional markets, between indices and their constituents, and more generally between different assets such as currencies, rates, and equities.

Similar to statistical arbitrage, alpha is extracted by various relative value trading strategies. Capital structure arbitrage is a relative-value approach of trading equity versus credit. It can be employed on an individual security as well as an index level (e.g., trading CDX against S&P 500). Capital structure arbitrage can cause an increase in credit-equity correlations.

Currency carry trades involve selling low yielding currencies (e.g., USD and JPY) and buying high yielding currencies, or more generally risky assets denominated in these currencies. This "generalized" currency carry trade can cause an increase in FX-equity correlation and even an increase in commodity/equity correlation.

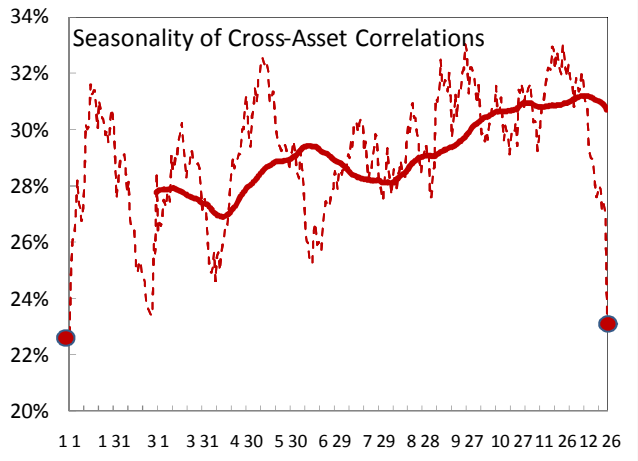
An increase in the amount of assets invested in alpha extraction strategies may have a secular impact on cross-asset correlations. Hedge funds assets, currently at ~$2T, have experienced significant growth over the past 10 years. While not all hedge funds can consistently generate alpha, the increase of hedge fund assets likely had a net effect of alpha reduction and thus an increase of correlation.

Seasonal Drivers

Cross-asset correlations also show seasonality. Correlations tend to drop to lows in December and gradually increase throughout a calendar year. This seasonal effect can explain variation of up to 5 correlation points (Figure 26).

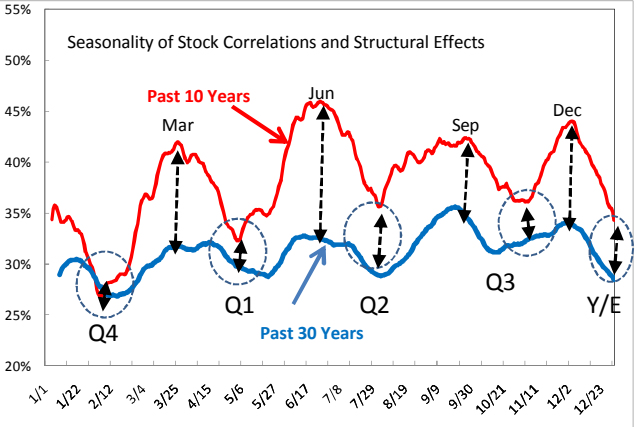
In some asset classes, seasonality has been even more pronounced. For instance, equity correlation shows strong seasonality in quarterly earnings months (Jan, Apr, Jul, Oct) and quarterly derivatives expiry months (Mar, Jun, Sep, Dec). With increased use of index products (futures, ETFs, index options), this effect is becoming more pronounced and can explain variation of up to 15 correlation points (Figure 27).

Figure 26: Seasonality of Cross-Asset Correlation



Source: J.P. Morgan Equity Derivatives Strategy.

Figure 27: Seasonality of Equity Correlation in the US



Source: J.P. Morgan Equity Derivatives Strategy.

Appendix II: Simple Correlation Model

Volatility of a multi-asset portfolio is proportional to the average correlation between asset-classes (cross-asset correlation) and the weighted average volatility of asset classes in the portfolio.

$$\sigma^2_{Portfolio} = \sum_{i,j} w_i w_j \rho_{ij} \sigma_i \sigma_j = \sum_i w_i^2 \sigma_i^2 + \rho \sum_{i \neq j} w_i w_j \sigma_i \sigma_j$$

$$\sigma^2_{Portfolio} \approx \rho \sum_{i,j} w_i w_j \sigma_i \sigma_j = \rho \sum_i w_i \sigma_i \sum_j w_j \sigma_j = \rho \langle \sigma \rangle^2$$

In a simplified risk on/off world, one can model each asset as having an exposure or "beta" to the performance of macro risk and some asset-specific "alpha." Cross-asset correlation is then a function of macro volatility σ_r, exposure of assets to macro volatility (beta), and asset-specific risk (i.e., magnitude of individual asset's alpha). For two assets (labeled with indices *x* and *y*), correlation is calculated from their returns as:

$$r_x = \beta_x r + \alpha_x \qquad r_y = \beta_y r + \alpha_y$$

$$\rho_{xy} = \frac{\sum_i r_x r_y}{\sigma_x \sigma_y} = \frac{\beta_x \beta_y \sigma_r^2}{\sqrt{(\beta_x^2 \sigma_r^2 + \alpha_{\sigma x}^2)(\beta_y^2 \sigma_r^2 + \alpha_{\sigma y}^2)}}$$

For assets with a similar exposure to macro risk (beta) and similar magnitude of asset-specific "alpha," cross-asset correlation further simplifies to the following expression:

$$\rho_{xy} \approx \frac{1}{1 + \frac{\alpha_\sigma^2}{\beta^2 \sigma_r^2}}.$$

Risks of Common Option Strategies

Risks to Strategies: Not all option strategies are suitable for investors; certain strategies may expose investors to significant potential losses. We have summarized the risks of selected derivative strategies. For additional risk information, please call your sales representative for a copy of "Characteristics and Risks of Standardized Options." We advise investors to consult their tax advisors and legal counsel about the tax implications of these strategies. Please also refer to option risk disclosure documents.

Put Sale. Investors who sell put options will own the underlying asset if the asset's price falls below the strike price of the put option. Investors, therefore, will be exposed to any decline in the underlying asset's price below the strike potentially to zero, and they will not participate in any price appreciation in the underlying asset if the option expires unexercised.

Call Sale. Investors who sell uncovered call options have exposure on the upside that is theoretically unlimited.

Call Overwrite or Buywrite. Investors who sell call options against a long position in the underlying asset give up any appreciation in the underlying asset's price above the strike price of the call option, and they remain exposed to the downside of the underlying asset in the return for the receipt of the option premium.

Booster. In a sell-off, the maximum realized downside potential of a double-up booster is the net premium paid. In a rally, option losses are potentially unlimited as the investor is net short a call. When overlaid onto a long position in the underlying asset, upside losses are capped (as for a covered call), but downside losses are not.

Collar. Locks in the amount that can be realized at maturity to a range defined by the put and call strike. If the collar is not costless, investors risk losing 100% of the premium paid. Since investors are selling a call option, they give up any price appreciation in the underlying asset above the strike price of the call option.

Call Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying asset's price is below the strike price of the call option.

Put Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying asset's price is above the strike price of the put option.

Straddle or Strangle. The seller of a straddle or strangle is exposed to increases in the underlying asset's price above the call strike and declines in the underlying asset's price below the put strike. Since exposure on the upside is theoretically unlimited, investors who also own the underlying asset would have limited losses should the underlying asset rally. Covered writers are exposed to declines in the underlying asset position as well as any additional exposure should the underlying asset decline below the strike price of the put option. Having sold a covered call option, the investor gives up all appreciation in the underlying asset above the strike price of the call option.

Put Spread. The buyer of a put spread risks losing 100% of the premium paid. The buyer of higher-ratio put spread has unlimited downside below the lower strike (down to zero), dependent on the number of lower-struck puts sold. The maximum gain is limited to the spread between the two put strikes, when the underlying is at the lower strike. Investors who own the underlying asset will have downside protection between the higher-strike put and the lower-strike put. However, should the underlying asset's price fall below the strike price of the lower-strike put, investors regain exposure to the underlying asset, and this exposure is multiplied by the number of puts sold.

Call Spread. The buyer risks losing 100% of the premium paid. The gain is limited to the spread between the two strike prices. The seller of a call spread risks losing an amount equal to the spread between the two call strikes less the net premium received. By selling a covered call spread, the investor remains exposed to the downside of the underlying asset and gives up the spread between the two call strikes should the underlying asset rally.

Butterfly Spread. A butterfly spread consists of two spreads established simultaneously – one a bull spread and the other a bear spread. The resulting position is neutral, that is, the investor will profit if the underlying is stable. Butterfly spreads are established at a net debit. The maximum profit will occur at the middle strike price; the maximum loss is the net debit.

Pricing Is Illustrative Only: Prices quoted in the above trade ideas are our estimate of current market levels, and are not indicative trading levels.

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J.P.Morgan

Global Quantitative and Derivatives Strategy
17 June 2013

Market and Volatility Commentary

Fed Tapering: Potential Implications for Volatility, Correlations and Market Risk

- Recent bouts of positive correlation between equities, bonds and commodities suggest that the Fed's stimulus inflated prices of financial assets, and removal of the stimulus could create a tail event in which prices of most of assets could go down. To reduce this risk, investors could diversify 'safe haven' assets away from treasuries and into other assets that are at lower risk in case of tapering. For instance, investors could increase allocations to equity index put options.

- Year-to-date, US ETFs experienced large inflows, the bulk of which went into US and Japan stocks, short-term bonds and specific equity styles that are appealing to bond investors: high dividend yielding stocks, low volatility strategies, and value stocks. Significant outflows occurred from Gold, Emerging Market equities and long term bonds. We note that EM Equity ETF inflows from Q4 2012 completely reversed last month due to fears of Fed tapering. We have not seen significant outflows from US and Japan equities, which could pose risk for these assets should tapering fears intensify.

- To assess potential equity downside risk from Fed tapering, we looked at the relative performance of US stocks, bonds and credit spreads since the start of QE3. In early 2013, according to a simple statistical model, stocks outperformed HY spreads by about ~6%. Additionally, most of ~14% YTD price return of S&P 500 came from increased multiples, rather than from stronger corporate revenues.

- Last month, NYSE debt in margin accounts reached all time highs. Historically, peaks in margin debt were usually followed by a sharp market correction. However, this on its own does not imply that high margin debt leads to a market correction. To test for a causal relationship, we looked at the changes in net margin debt as well as normalized margin debt against subsequent S&P 500 performance. We find that these measures indeed peaked prior to the tech bubble burst, in H2 2007 and H1 2008, and in H1 2011 – in all cases ahead of significant market corrections. While these are only three data points and hence do not amount to a reliable statistical sample, we think that the quick increase of net margin debt, and high ratio of margin debt to the S&P 500 do point to an increased probability of a market correction.

Equity Derivatives Strategy

Marko Kolanovic [AC]
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Bram Kaplan, CFA
(1-212) 272-1215
bram.kaplan@jpmorgan.com

Arjun Mehra (AJ)
(1-212) 622-8030
arjun.mehra@jpmorgan.com

J.P. Morgan Securities LLC

Global Quantitative and Derivatives Strategy

Marko Kolanovic (Global)
(1-212) 272-1438
mkolanovic@jpmorgan.com

J.P.Morgan Securities LLC

Davide Silvestrini (EMEA)
(44-20) 7134-4082
davide.silvestrini@jpmorgan.com

J.P.Morgan Securities plc

Tony Lee (Asia Pacific)
(852) 2800-8857
tony.sk.lee@jpmorgan.com

J.P.Morgan Securities (Asia Pacific) Limited

See page 11 for analyst certification and important disclosures.

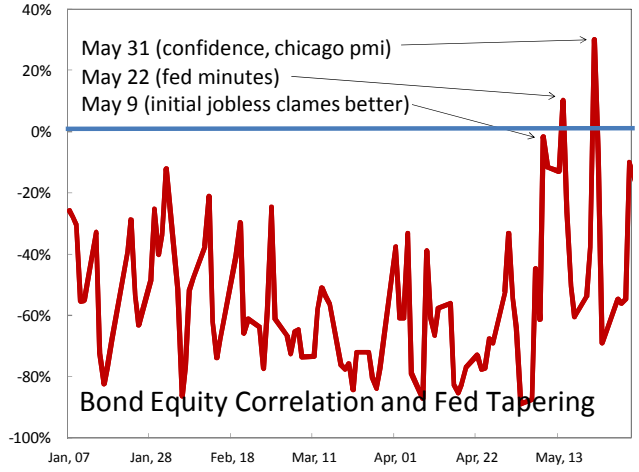
Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Fed Tapering, Cross-Asset Correlations, and Tail Risk

In our report on correlations, we showed how the BoJ stimulus distorted cross-regional equity correlation. Similarly, large Fed stimulus and prospect of its tapering are now causing distortion in correlations of equities, rates, and currencies. Over the last 5 years, Treasuries and Equities had strong negative correlation. This was the risk-on / risk-off (RORO regime) in which Treasuries were the most broadly used 'safe haven' asset. In the RORO regime, investors would hold treasuries and sell them to buy risky assets (and vice versa) while being reassured that Fed will keep the price of Treasuries supported. While we are still on average in a RORO regime, the bond-equity correlation started significantly weakening due to increased risk of Fed tapering and a bond selloff. The effect of the Fed reducing the stimulus could result in lower bond prices as well as lower prices of stocks, commodities and other risky assets whose prices were inflated by the Fed's stimulus.

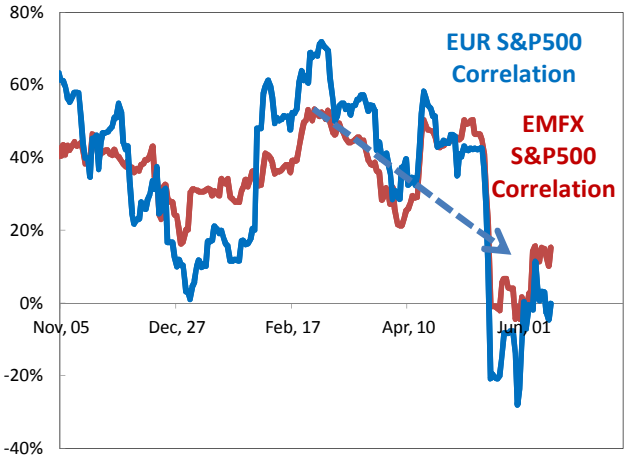
Over the past month, in several instances bonds and stocks moved together as investors re-assessed the probability of early tapering. Figure 1 below shows equity-bond correlation (calculated from high frequency intraday data). Correlation turned positive on May 9, 22, and 31 and most recently over the past few days. May 9th and 31st brought better than expected macro data (jobless claims, consumer confidence and Chicago PMI). Ironically, positive data caused equities and bonds to trade lower on increased probability of tapering (good data were bad for stocks). Similarly, on May 22nd, bonds and stocks sold off as Bernanke indicated the possibility of tapering over the next few meetings.

Figure 1: Bond-Equity correlation and Fed tapering. Recently, correlation turned positive on several days



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Figure 2: Correlation of FX rates to the S&P 500



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

A byproduct of these new bond-equity dynamics is that USD is losing its status as a 'risk off' currency. As expectations of more (less) stimulus pushes up (down) treasuries and US stocks (both USD denominated), resulting currency flows are weakening the historical negative USD-Equity correlation. Historically, USD had strong negative correlation to equities (i.e. EUR and EM currencies had a positive correlation to equities). This recent relationship is now undermined as treasuries are losing their appeal as a safety asset. This weakening of EM FX and EUR correlation to the S&P 500 (Figure 2) was also helped by investors putting money in US stocks, while avoiding European and Emerging markets in the last leg of market rally.

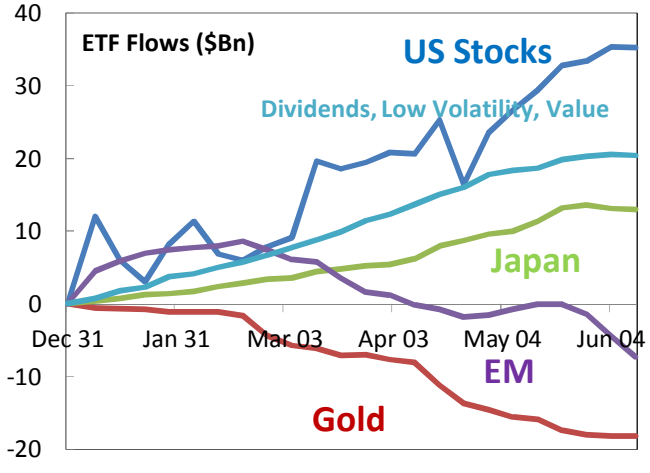
Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

As we discussed above, fears of Fed tapering the massive QE program is now changing bond-equity correlation from a RORO regime towards a 'Fed Model' regime (coincidentally, the name 'Fed Model' was crafted in 90s long before invention of quantitative easing). We do not think equity-rate correlation will fully revert back to the 'Fed Model' regime, but the recent spikes in rate-equity correlation are worrying signs. Recent bouts of positive correlation of equities, bonds and commodities, suggest that the Fed's stimulus inflated prices of a broad range of financial assets, and removal of the stimulus could create a tail event in which prices of all assets could go down. While it is expected that the Fed will try to avoid such a scenario by maintaining an appropriate level of stimulus, in the absence of more robust growth, this may turn out to be a difficult task (akin to driving a car without brakes). On this account, we expect more volatility in H2 as compared to the first part of the year. To reduce risk of a bond and equity tail event, investors could diversify 'safe haven' assets away from treasuries and into other assets that are at lower risk in case of tapering. For instance investors could increase allocations to cash or Equity Put options.

2013 Macro Trades and ETF Flows

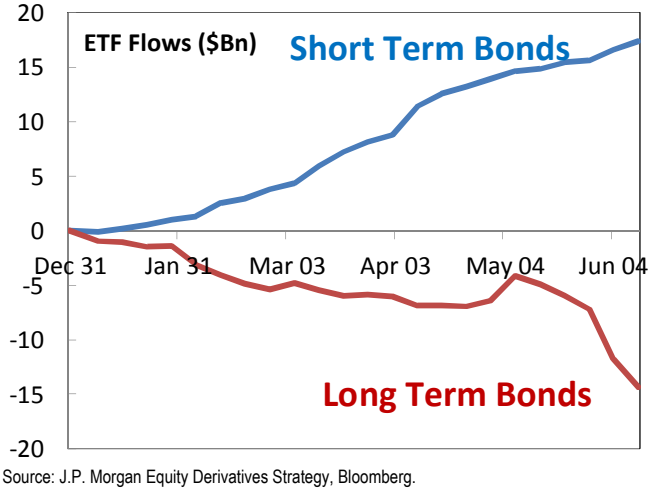
ETFs are used by fast money institutional investors to express views across asset classes. For this reason ETF flows can often reveal popular macro trades. Year-to-date, US ETFs experienced ~$70bn of inflows. Figure 3 shows that these flows occurred in a relatively small number of assets. Almost all ETF inflows were experienced by US and Japan stocks, short-term bonds and specific equity styles that are appealing to bond investors: high dividend yielding stocks, low volatility stock strategies, and value stocks. Almost all of the YTD outflows occurred from Gold, Emerging Market equities and long term bonds. These trends particularly accelerated in May and can be linked to fears of Fed tapering. Figure 4 shows flows in long-term and short-term bond ETFs, clearly illustrating the fears of tapering that intensified after Bernanke's speech in May.

Figure 3: YTD ETF flows by asset class



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Figure 4: YTD ETF flows in long- and short-term bonds



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

The question is will these trends continue, and what can cause its reversal. To shed some light on that, we note that EM Equity ETFs experienced rapid inflows in Q4 2012 shortly after the announcement of QE3. As investors started fearing tapering,

these inflows completely reversed in May, sending the price of emerging market stocks lower (outflows from gold ETFs went even further, with holdings returning to 2009 levels). US and Japan equities experienced similar fast paced inflows in Q1 but so far we have not seen significant ETF outflows from US and Japan equities. For this reason they could be at risk of net outflows should the tapering fears intensify. Investors usually assume tapering would be triggered by stable or improving US macro data. This indicates perhaps a larger risk (than tapering) for US and Japan equities and that is Central Bank stimulus failing to spur long term growth.

Fed Tapering and outlook for VIX and Equity Risk

In our note last month we suggested the VIX should trade higher from then-low levels of ~12. A relatively small S&P 500 correction since, triggered a significant increase in the VIX to current levels of ~17. The question equity investors are asking is whether this signals that a spike in volatility and a market correction is ahead of us. Year-to-date, Emerging Market equities, corporate and government bonds, and most commodities are trading lower. Most of the weakness in these asset classes can be attributed to concerns about a reduction of the Fed's stimulus (tapering). US equities appear to be one of the few asset classes that did not react significantly despite volatility in Rates, Credit and FX. As an example, the level of the S&P 500 and its YTD return currently appear to be more than 3 standard deviations rich relative to HY corporate spreads.

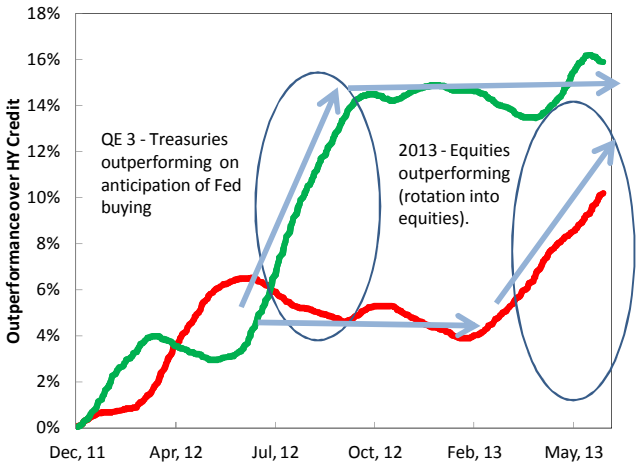
To assess how much downside risk from Fed tapering there is for US equities, we looked at the relative performance of stocks, bonds and credit spreads since the start of QE3 in 2012. In particular, we compare prices of the S&P 500 and 20Y Treasury bond to performance of US HY credit.[1] Figure 5 shows how Treasuries started outperforming credit and equities in early summer 2012 on account of the anticipated start of QE3. In early 2013, the Fed's money started flowing over from bonds into equities leading to **outperformance of stocks over HY bonds of about ~6%**. Additionally, if we look at the **~14% YTD price return of S&P 500, most of it came from increased multiples**, rather than from stronger corporate revenues (in fact, as equities increased, estimated earnings declined).

Another evidence that money from bond investors propped equities is the unusual outperformance of defensive sectors and higher yielding 'bond like' sectors (Staples, Utilities, Telecoms) that led the rally. At the same time, the price behavior of these sectors started closely resembling bond performance. Figure 6 shows the correlation of US sectors to bonds. Our analysis suggests that equities experienced significant outperformance due to the ongoing level of the Fed's stimulus (both in absolute terms, and relative to HY bonds). This outperformance might be at risk, should we see reduction of this stimulus.

[1] Actual performance of Stocks and Bonds versus the model performance derived from actual levels of CDX HY 5Y Credit spreads. While comparison of bonds and equities to credit spreads may not be the most appropriate (equities prices tend to trend with inflation and bond levels are subject to the Fed's buying such as QE2 and QE3, while credit spreads represent a default probability and tend to be mean reverting) we think that the comparison is meaningful over relatively short periods of time such as the one analyzed.

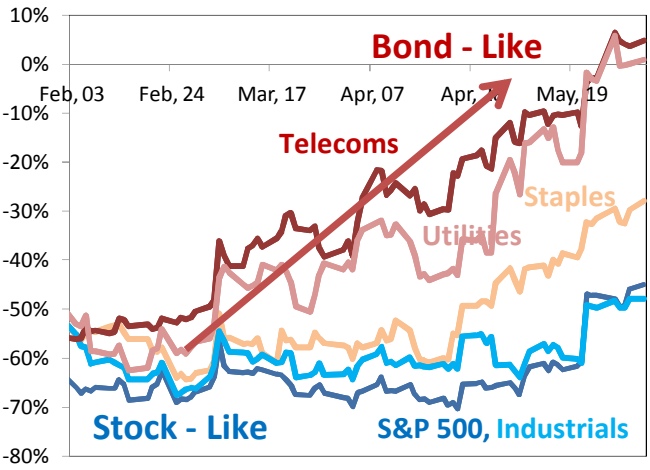
Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Figure 5: Treasuries started underperforming equities ahead of the start of QE3 and in 2013



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Figure 6: Correlation of US sectors to bonds



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Volatility technicals currently show an elevated probability of a VIX spike. As the market pulled back from the May peak, our estimate is that dealers had to buy ~25% of the volatility exposure purchased by clients via index put options. This helped push the VIX higher over the past few days. We also estimate that dealers' gamma positions are fairly flat to long gamma above ~1600 level in the S&P 500. The impact of these positions helped keep S&P 500 realized volatility relatively contained during the recent VIX increase. However, we estimate that below ~1600, dealers will acquire significant short gamma exposure (gamma imbalance of puts to calls of ~10bn) which could push realized volatility higher.

The term structure of VIX is now flat. Almost all significant spikes in the VIX were preceded by several days of VIX term structure inversion. While we have not experienced consecutive days of VIX inversion yet, the term structure did invert on several days in May and June. Another risk for a volatility spike comes from potential short covering of various yield generation strategies. Given the low yield environment, many investors started selling volatility premium to generate yield. If volatility were to increase further, some of these strategies would need to buy back volatility, which could increase the magnitude of a spike.

Is NYSE Margin Debt a bearish signal?

Last month, NYSE published April data on aggregate debt balances in stock margin accounts. This measure shows how much funds were borrowed to purchase securities, and it reached all time high of $384bn. Net margin debt (calculated as a difference of debt in margin accounts and all credit balances) also reached a high level of $106bn, and the pace of net margin debt increase YTD ($87bn) was the highest on record. We have been asked whether this increase in leverage is a sign of an impending market selloff. To analyze the relationship between S&P 500 prices and margin debt we look at their historical levels over the last 15 years. Figure 7 shows a strong correlation between S&P 500 and NYSE net margin debit. Positive correlation between the S&P 500 and net margin debt indicates that clients tend to finance a fraction of their equity exposure with margin debt. We also note that peaks in margin debt are usually followed with a sharp market correction. However, this on its own does not imply that high margin debt leads to market correction (given the

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

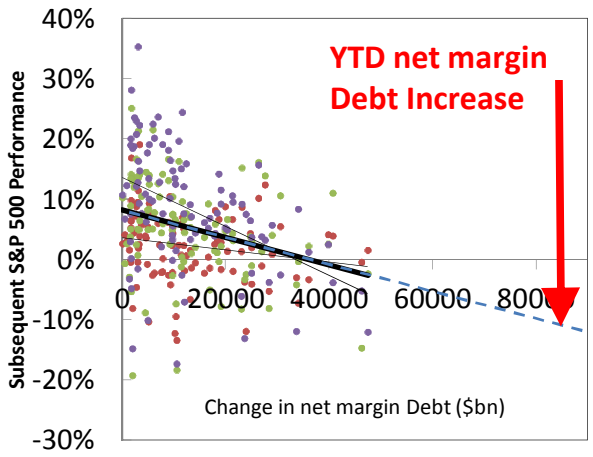
positive correlation of net margin debt and S&P 500, highs in margin debt coincide with highs in S&P 500).

To test for a causal relationship we looked at the changes in net margin debt against S&P 500 performance 3, 6 and 9 months afterwards. Figure 8 shows that large increases of net margin debt are indeed on average followed by weak equity returns. Note that the YTD increase of margin debt is the highest on record, as indicated by the arrow.

Figure 7: S&P 500 vs. NYSE Net Margin Debt

Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Figure 8: Subsequent market performance after an increase in net margin debt

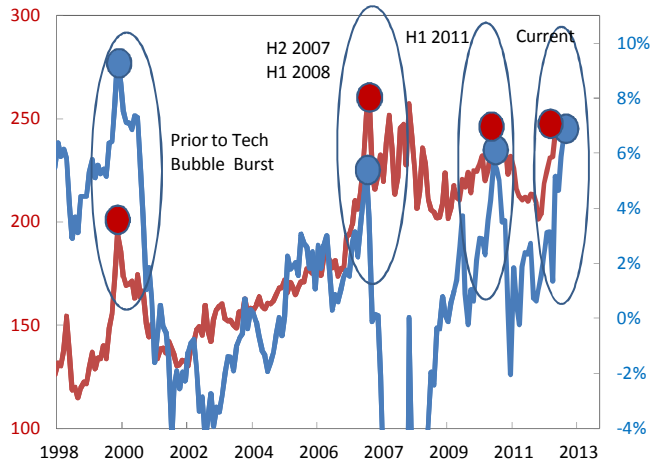


Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Another test we performed is to look at levels of margin debt normalized by the level of the S&P 500. Dividing margin debt by the level of the S&P 500 may give a more accurate measure of leverage (by remove the bias coming from correlation of S&P 500 and margin debt levels). Figure 9 shows the ratio of margin debt to S&P 500 (red) as well as ratio of net margin debt to S&P 500 (blue). One can see that these normalized measures of leverage peaked prior to the tech bubble burst, in H2 2007 and H1 2008, and in H1 of 2011 – in all cases ahead of significant market corrections. While these are effectively only three data points and hence do not amount to a reliable statistical sample, we think that the quick increase of net margin debt, and high ratio of margin debt to S&P 500 do point to an increased probability of a market correction and volatility increase in the second half of the year.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Figure 9: Ratio of margin debt to S&P 500 (red) and ratio of net margin debt to S&P 500



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Risks of Common Option Strategies

Risks to Strategies: Not all option strategies are suitable for investors; certain strategies may expose investors to significant potential losses. We have summarized the risks of selected derivative strategies. For additional risk information, please call your sales representative for a copy of "Characteristics and Risks of Standardized Options." We advise investors to consult their tax advisors and legal counsel about the tax implications of these strategies. Please also refer to option risk disclosure documents.

Put Sale. Investors who sell put options will own the underlying asset if the asset's price falls below the strike price of the put option. Investors, therefore, will be exposed to any decline in the underlying asset's price below the strike potentially to zero, and they will not participate in any price appreciation in the underlying asset if the option expires unexercised.

Call Sale. Investors who sell uncovered call options have exposure on the upside that is theoretically unlimited.

Call Overwrite or Buywrite. Investors who sell call options against a long position in the underlying asset give up any appreciation in the underlying asset's price above the strike price of the call option, and they remain exposed to the downside of the underlying asset in the return for the receipt of the option premium.

Booster. In a sell-off, the maximum realized downside potential of a double-up booster is the net premium paid. In a rally, option losses are potentially unlimited as the investor is net short a call. When overlaid onto a long position in the underlying asset, upside losses are capped (as for a covered call), but downside losses are not.

Collar. Locks in the amount that can be realized at maturity to a range defined by the put and call strike. If the collar is not costless, investors risk losing 100% of the premium paid. Since investors are selling a call option, they give up any price appreciation in the underlying asset above the strike price of the call option.

Call Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying asset's price is below the strike price of the call option.

Put Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying asset's price is above the strike price of the put option.

Straddle or Strangle. The seller of a straddle or strangle is exposed to increases in the underlying asset's price above the call strike and declines in the underlying asset's price below the put strike. Since exposure on the upside is theoretically unlimited, investors who also own the underlying asset would have limited losses should the underlying asset rally. Covered writers are exposed to declines in the underlying asset position as well as any additional exposure should the underlying asset decline below the strike price of the put option. Having sold a covered call option, the investor gives up all appreciation in the underlying asset above the strike price of the call option.

Put Spread. The buyer of a put spread risks losing 100% of the premium paid. The buyer of higher-ratio put spread has unlimited downside below the lower strike (down to zero), dependent on the number of lower-struck puts sold. The maximum gain is limited to the spread between the two put strikes, when the underlying is at the lower strike. Investors who own the underlying asset will have downside protection between the higher-strike put and the lower-strike put. However, should the underlying asset's price fall below the strike price of the lower-strike put, investors regain exposure to the underlying asset, and this exposure is multiplied by the number of puts sold.

Call Spread. The buyer risks losing 100% of the premium paid. The gain is limited to the spread between the two strike prices. The seller of a call spread risks losing an amount equal to the spread between the two call strikes less the net premium received. By selling a covered call spread, the investor remains exposed to the downside of the underlying asset and gives up the spread between the two call strikes should the underlying asset rally.

Butterfly Spread. A butterfly spread consists of two spreads established simultaneously – one a bull spread and the other a bear spread. The resulting position is neutral, that is, the investor will profit if the underlying is stable. Butterfly spreads are established at a net debit. The maximum profit will occur at the middle strike price; the maximum loss is the net debit.

Pricing Is Illustrative Only: Prices quoted in the above trade ideas are our estimate of current market levels, and are not indicative trading levels.

Possible Risks of Investing in ETFs

The following is an incomplete list of possible risks of investing in ETFs. Not all of the risks will apply to each investment in ETFs and the applicable risks will depend on the particular ETFs invested in and the particular facts and circumstances and investment objectives of the individual investor.

Commodities Risk. Certain ETFs invest in commodities. The commodities industries can be significantly affected by the level and volatility of commodity prices; world events including international monetary and political developments; import controls and worldwide competition; exploration and production spending; and tax and other government regulations and economic conditions.

Concentration Risk. An ETF may, at various times, concentrate in the securities of a particular industry, group of industries, or sector, and when a fund is overweighted in an industry, group of industries, or sector, it may be more sensitive to any single economic, business, political, or regulatory occurrence than a fund that is not overweighted in an industry, group of industries, or sector.

Costs of Investing in Underlying ETFs. Certain ETFs invest in other ETFs, and will bear a pro rata portion of the underlying ETFs' expenses (including operating costs and management fees).

Credit Risk. An ETF could be subject to the risk that a decline in the credit quality of a portfolio investment could cause the ETF's share price to fall. The ETF could lose money if the issuer or guarantor of a portfolio investment or the counterparty to a derivatives contract fails to make timely principal or interest payments or otherwise honor its obligations.

Early Closing Risk. An unanticipated early closing of the exchange on which an ETF's shares trade may result in a shareholder's inability to buy or sell shares of the ETF on that day.

Emerging Markets Risk. There is an increased risk of price volatility associated with an ETF's investments in emerging market countries, which may be magnified by currency fluctuations relative to the U.S. dollar.

Equity Risk. The prices of equity securities in which an ETF may invest rise and fall daily. These price movements may result from factors affecting individual companies, industries or the securities market as a whole.

Fixed Income Risk. An ETF's investments in fixed income securities are subject to the risk that the securities may be paid off earlier or later than expected. Either situation could cause the ETF to hold securities paying lower-than-market rates of interest, which could hurt the ETF's yield or share price.

Foreign Currency Risk. Currency movements may negatively impact the value of an ETF's underlying securities, even when there is no change in the value of the security in the issuer's home country.

Foreign Securities Risk. An ETF's investments in securities of foreign issuers involve certain risks including, but not limited to, risks of adverse changes in foreign economic, political, regulatory and other conditions, or changes in currency exchange rates or exchange control regulations (including limitations on currency movements and exchanges). In certain countries, legal remedies available to investors may be more limited than those available with respect to investments in the United States. In addition, the securities of some foreign companies may be less liquid and, at times, more volatile than securities of comparable U.S. companies.

High Yield Risk. Certain ETFs may invest in high yield securities and unrated securities of similar credit quality (commonly known as "junk bonds"). High yield securities generally pay higher yields (greater income) than investment in higher quality securities; however, high yield securities and junk bonds may be subject to greater levels of interest

rate, credit and liquidity risk than funds that do not invest in such securities, and are considered predominantly speculative with respect to an issuer's continuing ability to make principal and interest payments.

Income Risk. An ETF may derive dividend and interest income from certain of its investments. This income can vary widely over the short- and long-term. If prevailing market interest rates drop, distribution rates of an ETF's income producing investments may decline, which then may adversely affect the ETF's value.

Interest Rate Risk. An ETF's investments in fixed income securities are subject to the risk that interest rates rise and fall over time.

Investment Risk. An investment in an ETF is not a bank deposit and is not insured or guaranteed by the Federal Deposit Insurance Corporation or any other government agency.
Jurisdiction US-listed ETFs may not be marketed to foreign investors in certain jurisdictions, and vice versa.

Liquidity Risk. The market for certain investments may become illiquid under adverse or volatile market or economic conditions, making those investments difficult to sell. The market price of certain investments may fall dramatically if there is no liquid trading market. The lack of liquidity in an ETF can result in its value being more volatile than its underlying portfolio securities.
Loss of Money. Loss of money is a risk of investing in an ETF.

Market Risk. Due to market conditions, an ETF's investments may fluctuate significantly from day to day. This volatility may cause the value of your investment in the Fund to decrease.

Strategy Risk. ETFs use different strategies, all of which are associated with different risks. For example, an equities-based ETF may use a large-capitalization, mid-capitalization, small-capitalization or other type of strategy.

Tracking Error Risk. Although many ETFs may seek to match the returns of an index, an ETF's return may not match or achieve a high degree of correlation with the return of its applicable index.

Trading Risks. An ETF faces numerous market trading risks, including the potential lack of an active market for its shares, losses from trading in secondary markets, and disruption in the creation/redemption process of the ETF. Any of these factors may lead to the ETF's shares trading at a premium or discount to net asset value ("NAV"), which may be material. In certain markets, ETF prices have dropped precipitously and experienced greater volatility than prices of other stocks.

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IB clients*	54%	47%	38%
JPMS Equity Research Coverage	42%	50%	9%
IB clients*	74%	64%	57%

*Percentage of investment banking clients in each rating category.
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J.P.Morgan

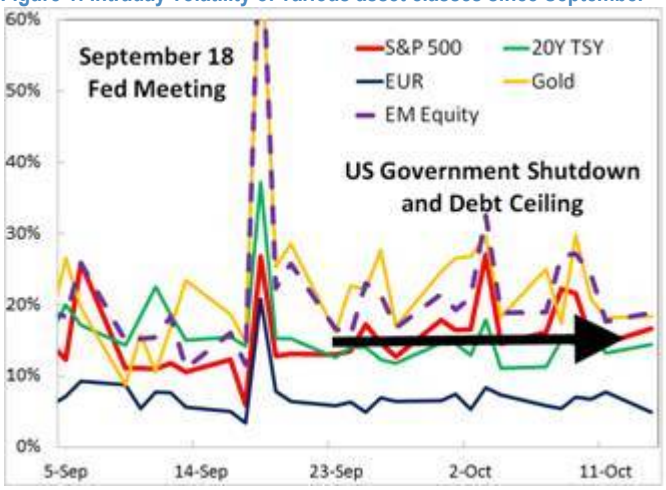
Global Quantitative and Derivatives Strategy
16 October 2013

Market and Volatility Commentary

Fed's Impact on Optimal Asset Allocation, Debt Ceiling, and Options Expiry

- **Political Risk**: Two weeks into the US government shutdown and one day before the debt ceiling deadline, investor activity and asset prices show little concern about the political risk and potential impact on the real economy. Figure 1 shows intraday volatility of various asset classes since September. After a significant spike in volatility around the last Fed meeting, there has been virtually no market reaction to the Washington showdown. US equity volumes are near five-year lows, and surprisingly low for this time of the year (total US volumes are below 5th percentile over the past five years, and ~40% lower than the average October volumes). Low equity activity suggests that investors are not expecting any lasting impact of political crisis.

Figure 1: Intraday volatility of various asset classes since September



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

- While the reaction of asset prices was largely muted, option markets did show some level of stress. Equity, Emerging markets and Gold options show increased level of risk aversion (Figure 2), while Bonds and EUR/USD implied volatility did not react significantly. While the market is most likely correct in its assessment that the US will not default, it may be underestimating the probability of market disruption. In fact, it may take an adverse market reaction to push politicians to close the debt deal. Past the immediate concern of default, there is a possibility of larger damage on consumer and business sentiment from ongoing uncertainty. **We believe that it is prudent for investors to hedge until the solution in Washington is finalized** (e.g., in our note yesterday, we suggested investors buy equity puts on Industrial stocks).

Equity Derivatives Strategy
Marko Kolanovic AC
(1-212) 272-1438
marko.kolanovic@jpmorgan.com
Bram Kaplan, CFA
(1-212) 272-1215
bram.kaplan@jpmorgan.com
Arjun Mehra (AJ)
(1-212) 622-8030
arjun.mehra@jpmorgan.com
J.P. Morgan Securities LLC

Global Quantitative and Derivatives Strategy
Marko Kolanovic (Global)
(1-212) 272-1438
mkolanovic@jpmorgan.com
J.P. Morgan Securities LLC
Davide Silvestrini (EMEA)
(44-20) 7134-4082
davide.silvestrini@jpmorgan.com
J.P. Morgan Securities plc
Tony Lee (Asia Pacific)
(852) 2800-8857
tony.sk.lee@jpmorgan.com
J.P. Morgan Securities (Asia Pacific) Limited

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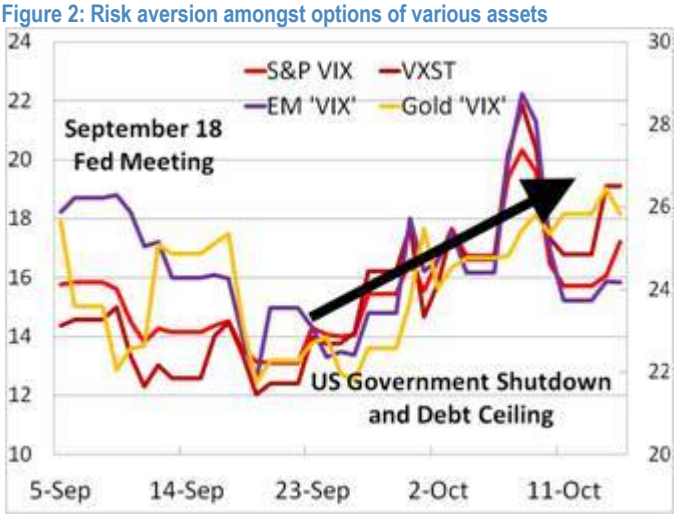
Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Figure 2: Risk aversion amongst options of various assets



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

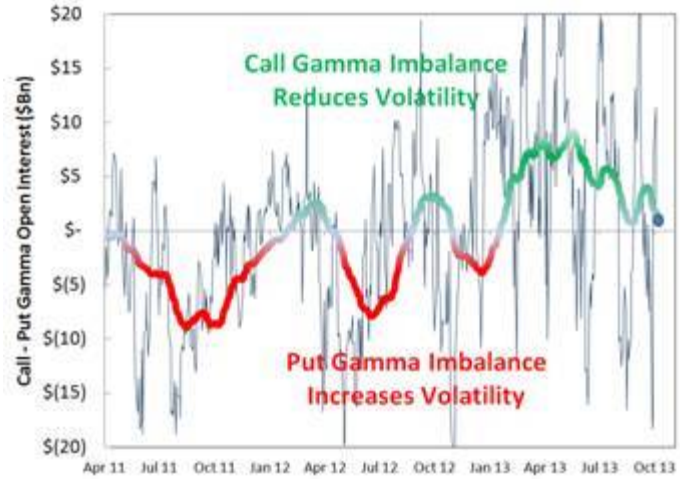
- Asset Correlations: During the past five years, monetary stimulus of central banks had a large impact on cross-asset correlations. The mere discussion of FED stimulus tapering earlier this year caused significant changes in correlation of equities to other asset classes. In particular, historical negative correlation of bonds to stocks started weakening. The weakening of correlations is a result of expectation that reduced stimulus will impact both bonds and stocks. USD Bonds losing appeal as a global 'risk off' haven, and improving conditions in Europe also resulted in weaker (negative) correlation of USD to equities (e.g. EUR/USD). Weakening of USD in relation to equities mechanically resulted in a weakening of commodity-equity correlations. Transmission of correlation from Treasuries to currencies (USD) and then to commodities works as follows: as treasuries are less used as a global 'risk off' asset, USD loses some of its 'risk off' status and equity-USD correlation weakens; weak equity-USD correlations spills over to commodity-equity correlations as commodities are priced in USD (we discussed Treasury – USD – Commodity correlation in rise in cross-asset correlations report). Figure 3 shows a dramatic change in correlation of equities to bonds, gold, Oil and EUR/USD which is largely a result of Fed's stimulus and anticipated tapering (see rise our updated reports on correlation and tapering). Implications of these correlation changes on multi-asset portfolios are significant. Most importantly investors should realize that the diversification benefit of bonds has been reduced, while the benefit of holding commodities (gold, oil) and currencies (EUR) has increased. As correlations tend to persist for extended periods of time, multi-asset portfolios would likely benefit from decreased exposure to bonds and increased exposure to commodities (Gold, Oil) and currencies (EUR). On margin, these shifts would likely reduce average portfolio correlation and hence portfolio volatility.

Marko Kolanovic
(1-212) 272-1438
marko.kolanovic@jpmorgan.com

Figure 3: Asset correlation to S&P 500

Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

Figure 4: Call-Put Gamma Imbalance



Source: J.P. Morgan Equity Derivatives Strategy, Bloomberg.

- Option Expiry: This Friday, $600bn notional value of S&P 500 options are set to expire ($400bn of puts and $200bn of calls). Despite the larger amount of puts outstanding, call gamma is roughly equal to put gamma at ~$20bn each (per 1% of S&P 500). Flat call-put imbalance is not expected to impact realized volatility over the next few days (absent a large move that would shift imbalance). Through most of this year, gamma imbalance was towards the call and that pressured S&P 500 realized volatility lower (Figure 4). As the market rally slowed, and investors increased allocation to downside protection, Call imbalance was reduced and is now roughly flat. Large amount of options outstanding caused swings in call-put gamma imbalance (especially close to expiry) and

this poses a risk for a quick increase of volatility in case of a market sell-off. Since the last expiry, market performance is roughly flat – for this reason we don't expect a significant impact of option delta hedging during the expiry week, or mean reversion during the following week (for more details see our report on expiry price patterns).

- US Small Caps: Fund flows can cause dislocation between equity sectors, regional and style indices. Unless there is a fundamental rationale for a divergence, equity sector dislocations tend to mean revert over time. We screened for market segments that have experienced statistically significant and unusual moves. Currently, Russell 2000 (US small cap) looks expensive against most other asset classes (~35 assets) with an average divergence of 1.6 standard deviations (at the same time Russell 2000 implied volatility also looks expensive against volatility of other assets, average of ~1.3 sigma). Although our strategists continue to OW small-caps globally, the equity rerating theme for small and mid-caps might have played out already in the US . Specifically, US small caps trade close to historical peak multiples vs. other stocks in other regions. We suggest clients sell Russell 2000 and buy S&P 100 to capture potential mean reversion of Russell outperformance. Over the past 6 months Russell 2000 outperformed S&P 100 by ~11% (~2.2 standard deviations). Additionally, long large cap and short small cap spread historically acted as a long volatility position and is expected to outperform in case of escalation of Washington-related risk or its spillover to the real economy. To take advantage of rich Russell 2000 volatility, clients can sell calls instead of a short Russell 2000 position.

Risks of Common Option Strategies

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Put Sale. Investors who sell put options will own the underlying asset if the asset's price falls below the strike price of the put option. Investors, therefore, will be exposed to any decline in the underlying asset's price below the strike potentially to zero, and they will not participate in any price appreciation in the underlying asset if the option expires unexercised.

Call Sale. Investors who sell uncovered call options have exposure on the upside that is theoretically unlimited.

Call Overwrite or Buywrite. Investors who sell call options against a long position in the underlying asset give up any appreciation in the underlying asset's price above the strike price of the call option, and they remain exposed to the downside of the underlying asset in the return for the receipt of the option premium.

Booster. In a sell-off, the maximum realized downside potential of a double-up booster is the net premium paid. In a rally, option losses are potentially unlimited as the investor is net short a call. When overlaid onto a long position in the underlying asset, upside losses are capped (as for a covered call), but downside losses are not.

Collar. Locks in the amount that can be realized at maturity to a range defined by the put and call strike. If the collar is not costless, investors risk losing 100% of the premium paid. Since investors are selling a call option, they give up any price appreciation in the underlying asset above the strike price of the call option.

Call Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying asset's price is below the strike price of the call option.

Put Purchase. Options are a decaying asset, and investors risk losing 100% of the premium paid if the underlying asset's price is above the strike price of the put option.

Straddle or Strangle. The seller of a straddle or strangle is exposed to increases in the underlying asset's price above the call strike and declines in the underlying asset's price below the put strike. Since exposure on the upside is theoretically unlimited, investors who also own the underlying asset would have limited losses should the underlying asset rally. Covered writers are exposed to declines in the underlying asset position as well as any additional exposure should the underlying asset decline below the strike price of the put option. Having sold a covered call option, the investor gives up all appreciation in the underlying asset above the strike price of the call option.

Put Spread. The buyer of a put spread risks losing 100% of the premium paid. The buyer of higher-ratio put spread has unlimited downside below the lower strike (down to zero), dependent on the number of lower-struck puts sold. The maximum gain is limited to the spread between the two put strikes, when the underlying is at the lower strike. Investors who own the underlying asset will have downside protection between the higher-strike put and the lower-strike put. However, should the underlying asset's price fall below the strike price of the lower-strike put, investors regain exposure to the underlying asset, and this exposure is multiplied by the number of puts sold.

Call Spread. The buyer risks losing 100% of the premium paid. The gain is limited to the spread between the two strike prices. The seller of a call spread risks losing an amount equal to the spread between the two call strikes less the net premium received. By selling a covered call spread, the investor remains exposed to the downside of the underlying asset and gives up the spread between the two call strikes should the underlying asset rally.

Butterfly Spread. A butterfly spread consists of two spreads established simultaneously – one a bull spread and the other a bear spread. The resulting position is neutral, that is, the investor will profit if the underlying is stable. Butterfly spreads are established at a net debit. The maximum profit will occur at the middle strike price; the maximum loss is the net debit.

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