Systematic fixed income trading strategies

Global Asset Allocation
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- Given the low yield environment that is forcing investors to look for alternative ways to enhance returns on fixed income portfolios, we present and update on systematic, or rule-based, strategies for outright and cross-market fixed income trading previously developed in the JPM *Investment Strategies* series and published previously in *Rule-based Fixed Income Monthly* and *GMOS*. These signals are intended to provide a complement to more qualitative and discretionary strategies in each of the sections in *GFIMS*.
- We discuss how these signals have performed in both bull and bear markets for bonds, as well as different central bank regimes.
- Our outright duration signals point to a small short bias on duration, with the largest shorts in the Euro area, Japan and Sweden, and a slight long bias in the US, UK and Australia. This is driven mainly by the carry-to-risk signal, which points to the slope of the curve relative to volatility being very flat compared to its 10Y history in the Euro area and Japan, and the equity price momentum signal, which gives a short duration signal in all countries in our sample.
- Our cross-market signals are relatively mixed, with the real yield signal, which has been the best performing cross-market signal for the past year, favouring longs in Antipodean vs. Euro area and Japanese duration.

See page 10 for analyst certification and important disclosures.

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Given the low yield environment that is forcing investors to look at alternative ways to enhance returns on fixed income portfolios, we present and update on systematic, or rule-based, strategies for outright and cross-market fixed income trading previously developed in the JPM *Investment Strategies* series and published previously in *Rule-based Fixed Income Monthly* and *GMOS*. These signals are intended to provide a complement to more qualitative and discretionary strategies in each of the sections in *GFIMS*.

Broadly speaking, these strategies cover a number of signals that typically fall in two key categories: 1) momentum signals based on either price momentum or economic momentum; and 2) value. Momentum signals exploit positive serial correlation in economic indicators and returns, and essentially rely on markets not fully accounting for this serial correlation. For economic indicators, this is consistent with a degree of "anchoring" of expectations, with new information only gradually being incorporated into economists' and investors' view of the economy, while for return momentum it is consistent with investors initially underreacting to news, and perhaps later overreacting.

Value signals, on the other hand, essentially rely on buying assets that are 'cheap' and selling assets that are 'expensive'. In bond markets an obvious example is carry, or the slope of the curve. A steep curve means high carry, and tends to be associated with higher term premia. It generally also signals an accommodative monetary policy supporting a weak economy, and can thus provide a slow-moving cyclical signal that complements the more fast-moving momentum signals. Additionally, since returns on momentum and value signals are typically negatively correlated, we can take advantage of this relationship in combining different signals to achieve better risk-adjusted returns through diversification[1].

Duration signals

We adapt previous JPM research on systematic rules to trade duration to a larger sample of countries. The country sample includes the US, Germany, Japan, UK, Australia, Canada, Sweden and Switzerland (links to GMOS). We expand this further to include New Zealand and Norway, which necessitates a shift to apply the rules to 10Y total return swap indices rather than 10Y futures. The combination of these changes increases the information ratio of these signals from 1.1 to 1.3. We put this down to benefits from diversification across countries as well as signals, but note that it does have implications for implementation. For simplicity, we use equal weights for countries, but recognise that for practical implementation higher weights for more liquid G4 countries may be necessary. The current signals and performance are shown in **Exhibit 9** below, and the performance of each signal shown in Appendix 1.

Exhibit 1: The correlation in signal returns is generally low, meaning that combining the signals can provide a diversification benefit
Correlation of duration signal returns

	Bond price momentum	Equity price momentum	PMI	Revision ratio	Carry-to-risk
Bond price mom	1.00				
Equity price mom	0.22	1.00			
PMI momentum	0.41	0.55	1.00		
Revision ratio	0.21	0.61	0.62	1.00	
Carry-to-risk	-0.21	-0.28	-0.42	-0.19	1.00

The signals we use are based on[2]:

1. **Manufacturing PMI momentum**: Short duration in each country if both local country and global manufacturing PMI increased over past two months, long duration if both fell, and neutral otherwise.
2. **Earnings revision ratio momentum**: Short duration in each country if the local and global IBES equity earnings revision ratio increased over the past three months, long duration if both fell, and neutral otherwise.
3. **Bond price momentum**: Long duration if our bond futures return indices are above both 1-month and 12-month average, short if below both 1-month and 12-month average, neutral otherwise.
4. **Equity price momentum**: Long duration in each country if local equity market is below its 6-month average, and short if it is above 6-month average (net of cash).
5. **Carry-to-risk**: Long duration if carry-to-risk (10Y – 3M slope) is above its 10Y average, short duration if below its 10Y average, with position size proportional to how far carry to risk is above or below average.

[1] Academic studies have also suggested that using momentum and value can be used as complements. See for example *Fact, Fiction and Momentum Investing*, C. Assness et al, 2014, http://ssrn.com/abstract=2435323

[2] Signals discussed in more detail in *Simple rules to trade duration*, S. Mac Gorain, October 2012. For consistency, these signals are rebalanced on the second working day of the month, i.e. a day after the release of the global PMI, except the revision ratio signal which rebalances during the month a day after release.

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These signals combine two price momentum and two economic momentum signals, and at face value one might expect these to be very highly correlated. **Exhibit 1** shows, however, that the correlation coefficients of returns are generally quite low, meaning that combining these signals can provide a diversification benefit. The highest correlation is typically between the economic momentum signals and equity momentum, suggesting that these signals provide similar information, while bond momentum exhibits a relatively high correlation only to the PMI signal. The carry signal by contrast exhibits negative correlation with the other signals, illustrating the diversification benefit from combining momentum and value signals. Given these correlations, we prefer to give greater weight to the carry signal in combining the signals across the various indicators[3].

It is worth noting that the correlation between equity and bond returns does depend on the underlying driver in both the equity and the bond markets. A negative correlation between the two is clearly evident during periods of flight-to-safety. The correlation also tends to be negative when the main macro driver is growth revisions, for example as positive growth revisions are typically beneficial for corporate earnings but also tend to be associated with rises in expected future policy rates. Inflation has relatively ambiguous implications. Higher inflation is clearly negative for holders of fixed income securities with nominal cash flows, either due to higher inflation expectations or through a monetary policy response. But inflation can also be negative for equities if it reflects a negative supply shock (e.g higher oil prices) or triggers a policy response. If the driver for returns is monetary policy, the correlation between equity and bond returns is likely positive as lower policy rates reduce discount rates (or at least the default risk-free component of discount rates) for all assets. Indeed, this is likely the reason why the performance of the equity price momentum signal has been negative over the year, as easy monetary policy has been a key driver in supporting both risky and safe assets.

Given the signals we use are applied over a period where bond returns have been strongly positive given the secular bull market, there are at least four natural questions that arise: 1) does the positive return simply reflect a bullish bias in the signals; 2) relatedly, do these signals provide value in bond market sell-offs; and 3) is the performance of the signals linked in some way to central bank policy cycles?

Exhibit 2: The overall position of the combined signal does vary significantly over time, with a slight bias to be long…
Overall position of the combined duration signal

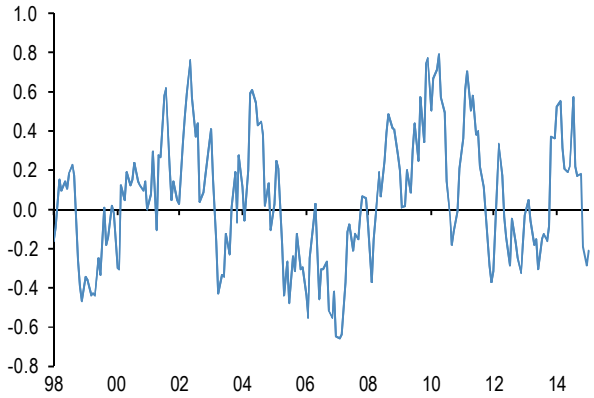
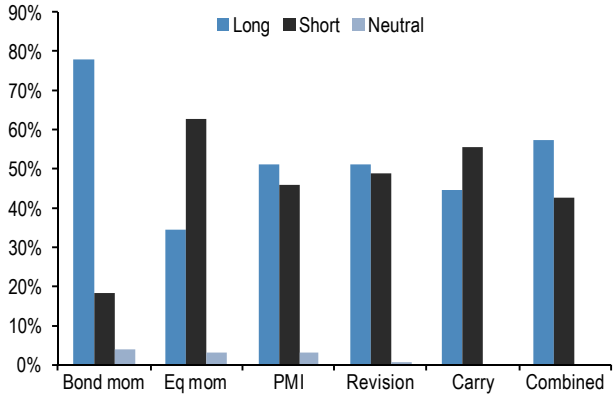


Exhibit 3: … driven entirely by the bond momentum signal, which is partially offset by the equity price momentum signal exhibiting a short bias
Proportion of time each signal is long or short; %



First, the combined signal does exhibit some bias to be long duration, being long around 57% of the time and short 43%. That overall position does vary significantly over time, with periods where the combined signal is persistently short and persistently long (**Exhibit 2**). **Exhibit 3** shows that the long bias in the combined signal is based entirely on the bond momentum signal – it is long nearly 80% of the time. That said, the bias is offset in part by the fact that the equity price momentum signal tends to exhibit a short bias. In addition, the information ratio of the combined signal, 1.3, is significantly higher than the information ratio of simply being long G4 bond markets, 0.8[4]. This is driven primarily by the fact that the

[3] In addition, academic studies suggest that momentum and value signals work better when used as complements – see, for example, *Fact, Fiction and Momentum Investing*, C.S. Assness, A. Frazzini, R. Israel and T.J. Moskwitz, 2014

[4] The information ratio of being long an equal weighted basket of the 10 countries in our sample gives an information ratio of 0.6.

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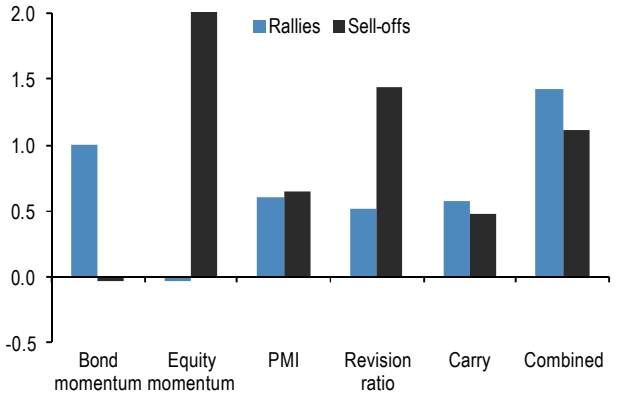
combined signal exhibits around a third of the volatility of an outright long.

Second, the signals also provide different characteristics in terms of return to risk in rallies and sell-offs. **Exhibit 4** shows the information ratio of each of the signals when the overall bond market rallies (defined as a month where the average total return on G4 swaps is positive) and when it sells off. Here, the bond price momentum unsurprisingly performs well in rallies but has produced close to zero returns during sell-offs – this is likely due to the momentum signal being a combination of 1M and 12M momentum, such that a longer period of underperformance is required for the overall signal to turn short. The equity price momentum, by contrast, performs very well during bond market sell-offs, but with slightly negative returns on average during rallies. The other signals are less asymmetric in their performance during different bond market regimes. It is also worth noting that in the absence of the equity momentum and revision ratio signals, the information ratio of the combined signal would be slightly negative, showing the diversification benefit provided by these signals.

Third, the signals do exhibit some differentiation in terms of return characteristics and positioning during Fed policy cycles (**Exhibits 5** and **6**). We define an easing (hiking) regime as one that starts a month before the first Fed cut (hike) and ends a month after the last cut (hike) in a cycle. In addition, periods where the Fed has conducted asset purchases are defined as an easing cycle. The analysis has been replicated for ECB and BoE cycles (not shown), but the results are qualitatively similar. While the bond and equity momentum signals exhibit similar biases to be long and short in each regime, the bond momentum tends to be less long, and the equity price momentum signal shorter, on average during central bank hiking cycles. Overall, the combined signal tends to be long duration during easing cycles, short during tightening cycles, and hold a small long bias when central banks are on hold.

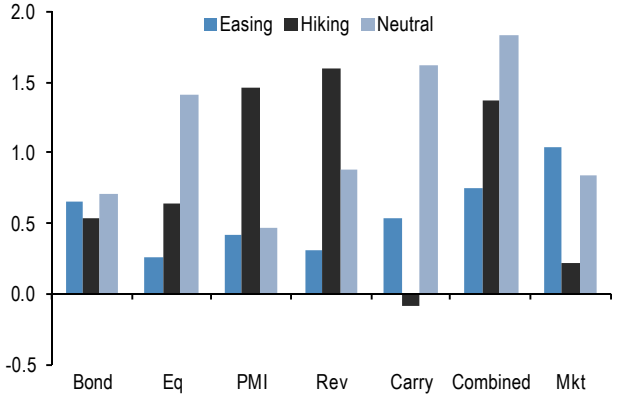
How do we interpret the signals in **Exhibit 9** below? Each signal for each individual country simply reflect a long, short or neutral stance for that particular signal. The weighted average for each country gives an overall signal for 10Y duration for that country, with the size of the unit reflecting the strength of the signal. The combined value by signal gives an overall duration signal provided by that signal. And finally, the overall combined signal (bottom right, currently -0.2) can be thought of as an overall duration bias for DM 10Y duration. The size of the

Exhibit 4: The signals provide quite different characteristics in terms of return profiles in bond market rallies and sell-offs
Information ratio of each signal during bond market rallies* and sell-offs



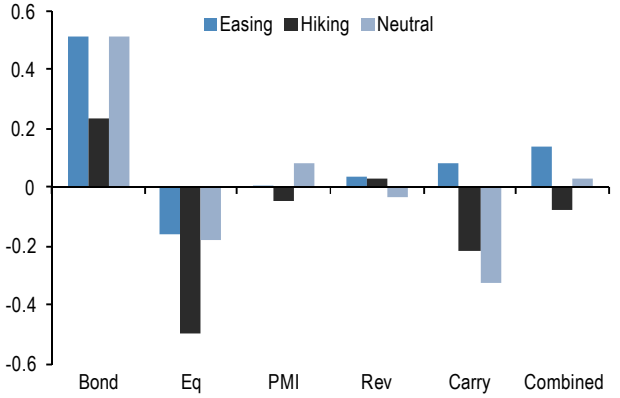
* A rally (sell-off) defined as positive (negative) average total return for G4 10Y swaps in a month

Exhibit 5: The signals exhibit some differentiation in terms of return characteristics in different stages of the Fed cycle…
Information ratios of each signal, the combined signal and the market* during Fed policy cycles**



* Using average total return and return volatility for G4 10Y swaps
** An easing (hiking) regime as one that starts a month before the first Fed cut (hike) and ends a month after the last cut (hike) in a cycle. In addition, the periods the Fed conducted QE purchases are defined as easing cycles.

Exhibit 6: …as well as different biases in terms of positioning
Average positions during Fed policy cycles



* An easing (hiking) regime as one that starts a month before the first Fed cut (hike) and ends a month after the last cut (hike) in a cycle. In addition, the periods the Fed conducted QE purchases are defined as easing cycles.

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coefficient could also be thought of as a scalar that can be applied to a risk budget[5].

Finally, what is the rationale behind the weights we use in Exhibit 9? In previous analysis, we investigated different options for weighting together the signals, ranging from equal weights to optimised weights[6]. At the time, we found that the information ratio improved only marginally when moving from equal to optimised weights. In principle, equal weights thus capture the majority of available diversification benefit. That said, when combining the signals, we have preferred to give a greater weight to the carry-to-risk signal, as is the least correlated of the signals and as a general preference to balance momentum and value signals.

The current signals point to an overall small short bias for DM duration, with the largest shorts in the Euro area, Japan and Sweden, and a slight long bias in the US, UK and Australia. This is driven mainly by the carry-to-risk signal, which points to the slope of the curve relative to volatility being very flat compared to its 10Y history in the Euro area and Japan, and the equity price momentum signal, which gives a short duration signal in all countries in our sample.

Cross-market signals

In addition to the positioning signals for outright duration, we also monitor a number of signals for cross-market allocations, and apply these to 10Y interest rate swaps in developed markets. These signals include:

1. **Carry and carry-to-risk**: Overweight countries with high carry (10Y swap rate – 1M Libor rate), and overweight countries where carry is high relative to volatility[7].
2. **Reversal** (change in curve slope): Overweight countries where curve (10Y - 1Y slope) has steepened most, relative to average over past 6M[8].
3. **Real yield**: Overweight markets with high real yields, measured as 10Y swap rate less consensus forecasts of inflation over the next 10Y[9].

Exhibit 7: Similar to the duration signals, the different cross-market signals tend to exhibit relatively low return correlation with each other
Correlation of cross-market signal returns

	Carry	Carry-to-risk	Change in slope	Real yield	Unemployment
Carry	1				
Carry-to-risk	0.59	1			
Change in slope	0.18	0.00	1		
Real yield	0.06	-0.11	0.01	1	
Unemployment	0.22	0.13	0.07	-0.01	1

4. **Unemployment**: Overweight countries where unemployment has been rising the most (current level less its average over the past 10 months)[10].

Of these signals, the carry, reversal and real yield signals are value signals, while the unemployment signal is a macroeconomic momentum signal. The carry signals are obviously positive carry trades, and the carry also partly reflects the tendency for forward rates to overpredict future interest rates. Steeper curves usually mean investors expect short rates to rise by more in the future, but also incorporate higher risk premia as faster hikes tend to create uncertainty, meaning that the trading rule can make money earning term premia over time. The reversal signal overweights duration in markets where yield curves have steepened most against those that have steepened the least, and benefits from a tendency for mean reversion in cross-market spreads – i.e. that bond markets that have underperformed relative to their peers tend to catch up as more transient influences such as short-lived economic divergences reverse.

Exhibits 16-20 in Appendix 2 below show the performance of each signal based on two long-short pairs (i.e. for each signal long in the most attractive country and short in the least attractive, and the second most favoured vs. the second least favoured). Similar to the duration signals, **Exhibit 7** suggests the correlations between returns for each of these signals are relatively low. Unsurprisingly, the highest correlation coefficient being between the two carry signals, while the real yield signal is relatively uncorrelated with any of the other signals.

The cross-market signals also exhibit different characteristics in terms of performance during bond market 'regimes' (**Exhibit 8**). In particular, the carry and real yield signals tend to perform well in bond market rallies, and less well during sell-offs. For the latter, this arises partly from the fact that the countries with the highest real yields tend to be in the Antipodes, both of

[5] As we note above, we use equal weights for each country in calculating returns for simplicity, but in principle these could vary by the benchmark weight or by size and liquidity of each bond market.
[6] *Simple rules to trade duration*, S. Mac Gorain, October 2012.
[7] See *A cross-market bond carry strategy*, N. Panigirtzoglou, March 2006.
[8] See *Exploiting reversals in cross-market yield spreads*, S. Mac Gorain, March 2012.
[9] See *Rule-based Fixed Income Monthly*, S. Mac Gorain, November 2012.
[10] See *Using unemployment to trade bonds*, S. Mac Gorain, November 2011.

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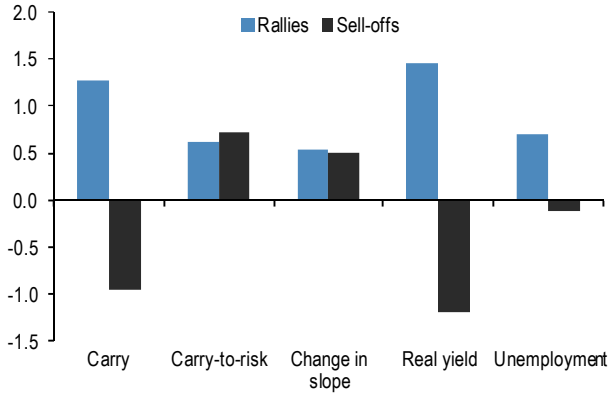
which typically exhibit a high beta relative to global yields, while the country with the lowest real yield for much of the past decade has been Japan, which typically exhibits a low beta to global yields. This means that the signal tends to exhibit a long duration bias, but the performance of the signal is not dependent on this bias – indeed, previous analysis found that removing Japan from the sample did not meaningfully change the information ratio of the signal[11]. The carry signal has displayed a less clear bias, with USD and EUR swaps tending to be on average the most attractive.

Currently, the cross-market carry signals favour longs in US and UK duration and shorts in New Zealand and Norway. The reversal signal favours Swiss and Japanese duration vs. US and UK duration. The real yield signal, which has been the best performing cross-market signal for the past year, favours longs in Antipodean duration against shorts in Euro area and Japanese duration. And the unemployment change signal points to longs in Norway and Australia vs. shorts in UK and US duration given the ongoing tightening in labour market conditions in the latter two.

We have not combined these signals to an overall cross-market signal, as these long-short pairs can in some cases be offsetting. However, going forward one potential avenue for further work would be to investigate ways to combine the signals.

Exhibit 8: The cross-market signals also exhibit different characteristics in terms of performance during bond market 'regimes', with the carry and real yield signals in particular performing well in rallies and less well in sell-offs

Information ratio of each signal during bond market rallies* and sell-offs



* A rally (sell-off) defined as positive (negative) average total return for G4 10Y swaps in a month

[11] *Rule-based Fixed Income Monthly*, S. Mac Gorain, November 2012.

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Exhibit 9: Current systematic model signals and recent performance

Signals and returns as at 1 April 2015.

Duration

Current signal by country

	Weight	Euro area	Japan	UK	US	Australia	Canada	Sweden	Switzerland	New Zealand	Norway	Combined
PMI momentum	15%	-1	0	-1	0	0	0	0	0	-1	0	-0.3
Revision ratio momentum	15%	0	1	1	1	0	1	0	0	0	1	0.5
Bond price momentum	20%	1	1	1	1	1	1	1	1	1	1	1.0
Equity price momentum	15%	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1.0
Carry to Risk	35%	-1.5	-1.9	0.0	-0.1	0.2	-1.1	-1.3	-1.0	-0.6	-1.0	-0.8
Combined		-0.6	-0.5	0.1	0.2	0.1	-0.2	-0.4	-0.3	-0.3	-0.1	-0.2

Returns*, %

1M	3M	6M	12M	5Y	10Y	Since 1998	IR
-0.6	0.0	2.1	2.3	2.5	2.7	2.4	0.59
1.3	2.6	6.5	6.1	4.7	4.3	3.7	0.84
0.4	1.5	7.0	13.1	5.1	3.4	3.0	0.64
-1.6	-1.5	-2.6	-7.3	-0.1	2.8	3.5	0.66
-0.8	-0.5	0.0	6.0	4.2	2.2	2.4	0.59
-0.3	0.2	1.7	3.6	2.8	2.3	2.2	1.31

* Holding period returns for 1M - 6M; annualized for 12M and longer.

Cross-market

Current basket

	First pair		Second pair	
	Long	Short	Long	Short
Carry	USD	NZD	GBP	NOK
Carry to Risk	USD	NZD	SEK	NOK
Change in slope	CHF	USD	JPY	GBP
Real yield	NZD	EUR	AUD	JPY
Unemployment change	NOK	GBP	AUD	USD

Returns*, %

1M	3M	6M	12M	5Y	10Y	Since 1996**	IR
1.6	1.0	1.5	1.7	1.1	0.7	2.3	0.56
1.3	0.5	-2.2	-3.2	-0.3	1.2	2.5	0.65
-0.9	-1.2	-4.1	-6.6	-2.7	0.1	1.9	0.48
0.3	3.2	6.1	6.3	1.4	1.6	1.6	0.39
-1.5	-0.8	0.6	1.4	-0.5	0.1	1.0	0.24

* Holding period returns for 1M - 6M; annualized for 12M and longer.

** Except for the real yield signal, which starts in 2004

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Appendix 1: Duration signals

Exhibit 10: Bond price momentum
All countries combined index

Exhibit 11: PMI momentum
All countries combined index

Exhibit 12: Carry to risk
All countries combined index

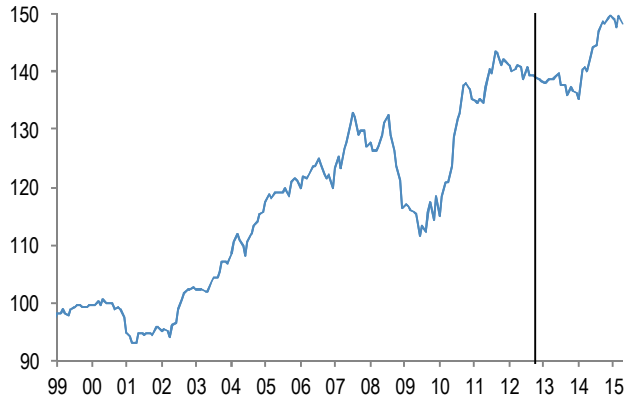


Exhibit 13: Equity price momentum
All countries combined index

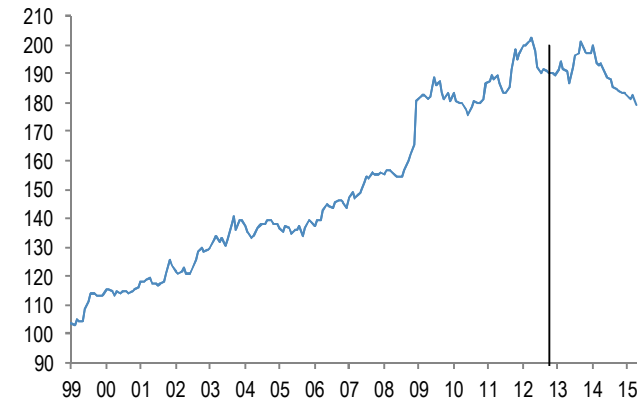


Exhibit 14: Revision ratio momentum
All countries combined index

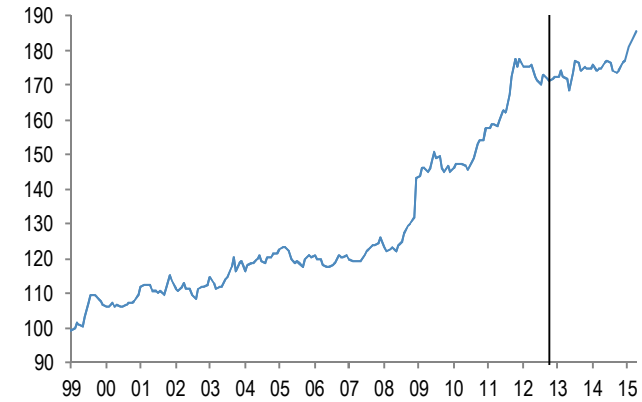
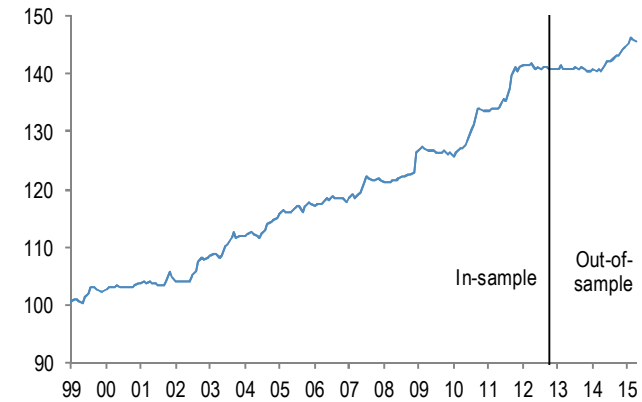


Exhibit 15: Combined signal
All countries combined index



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Appendix 2: Cross-market signals

Exhibit 16: Cross-market carry
Index, 1996 = 100

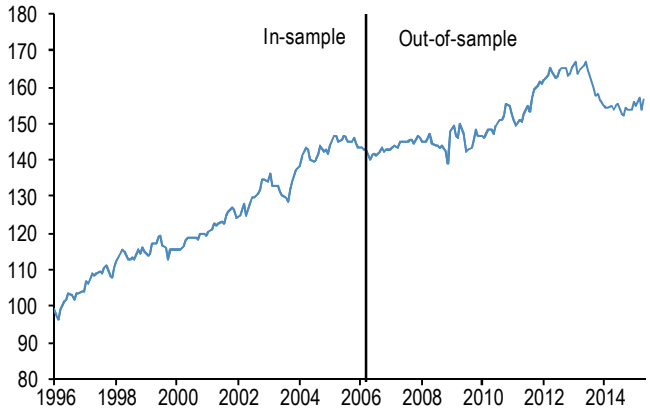


Exhibit 17: Change in slope
Index, 1996 = 100

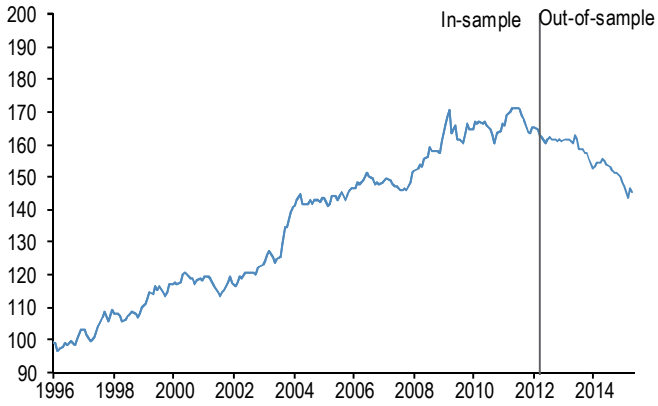


Exhibit 18: Unemployment
Index, 1996 = 100

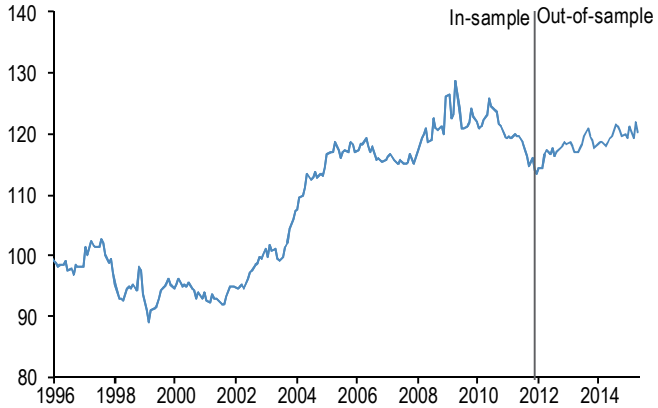


Exhibit 19: Carry-to-risk
Index, 1996 = 100

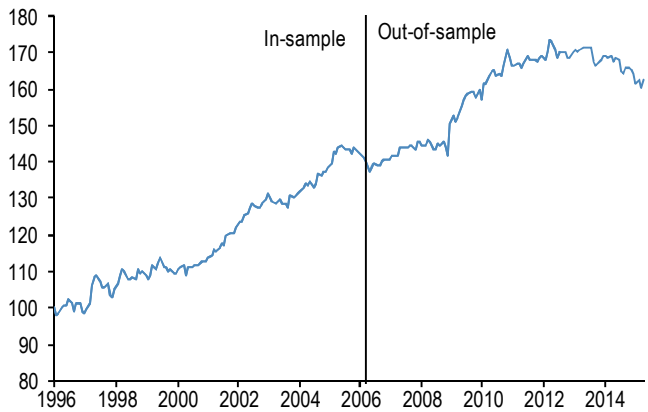
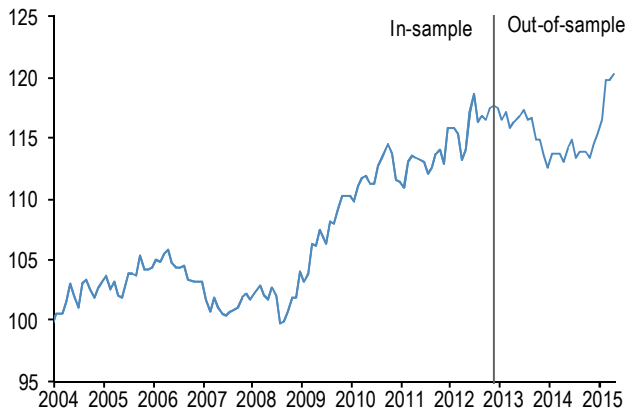


Exhibit 20: Real yield
Index, 2004 = 100



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