

Risk Characteristics of Emerging Market Bonds

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In 2009, emerging market bonds were among the top-performing assets in comparison to both the global equity and fixed income asset classes. The recent, rapid rise in US Treasury yields and the concern over tightening monetary policies in certain countries led us to evaluate the relationship between global interest rate risks and emerging market bonds. In this publication, we attempt to address this relationship with an emphasis on the risk characteristics of the market, along with the historical relationship of emerging market bonds with US Treasuries, other developed market sovereign bonds, and equity market volatility. We consider possible warning signals of impending volatility in emerging market bonds during the period we observed, as well as possible ways to have improved the diversification benefits with equities during this period. Using the fixed income component of the Barra Integrated Model (BIM), the following correlations and risks are analyzed:

1. emerging market bonds versus US Treasuries and other developed market sovereign bonds,
2. sensitivity of emerging market bonds to equity volatility,
3. relative performance of emerging to developed markets for bonds versus that for equities,
4. correlation of emerging market bonds with global equity styles.

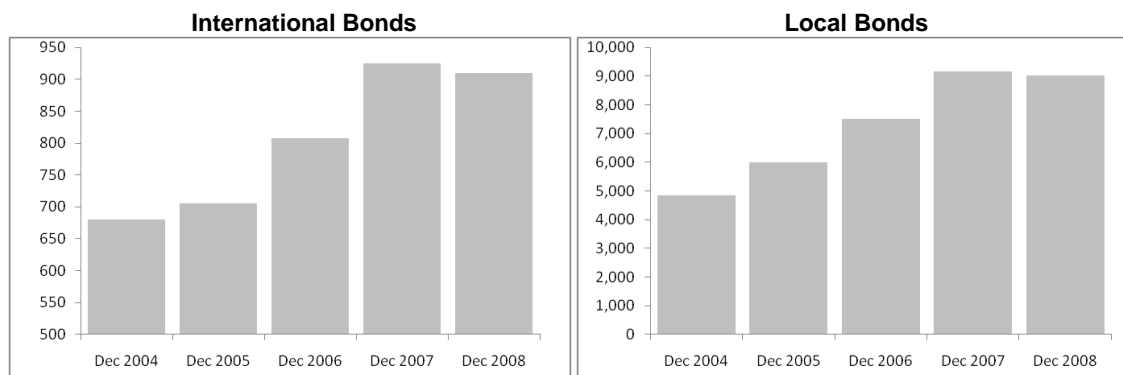
We found that possible warning signals of difficult market conditions and opportunities in emerging market bonds may be derived from their relationships with developed market sovereigns and with equity volatility, as well as from the divergence of the relative performance of emerging market assets in fixed income and equity markets. In addition, during the period we observed the diversification between emerging market bonds and global equities may have been increased by appropriately tilting the equities portion of a portfolio away from some equity styles.

Introduction

In 2009, emerging market bonds were one of the top performers in the global fixed income universe. Some of the major emerging market countries have pursued growth-oriented and somewhat conservative fiscal policies, increased their foreign currency reserves, and as a result their currencies have commensurately strengthened relative to their developed market brethren. The strength in emerging market equities also has indirectly helped to improve investor interest in and perception of emerging market bonds.

As such, the global market for emerging market bonds has grown significantly in recent years. Exhibit 1 highlights the consistent growth in emerging market debt over the last five years for which data is available, with a compound annual growth rate of 8.0% for international bonds and 18.8% for local bonds. The charts indicate that, as of December 2008, the total outstanding amount, including both groups, stood at close to USD 10 trillion.

Exhibit 1: Growth in Emerging Market Debt Instruments (in USD billions)



Source: Bank of International Settlements

In addition, the diversity of emerging market local bonds has been increasing. Exhibit 2 shows the four main categories for local emerging market bonds. Traditional instruments, such as those with a straight fixed rate, have been declining moderately in proportional terms. On the other hand, as inflation increasingly becomes a concern in emerging market countries, inflation-protected bonds have shown a rising share in many of these countries.

Exhibit 2: Emerging Markets Local Bond Issuance (as percent of total outstanding)

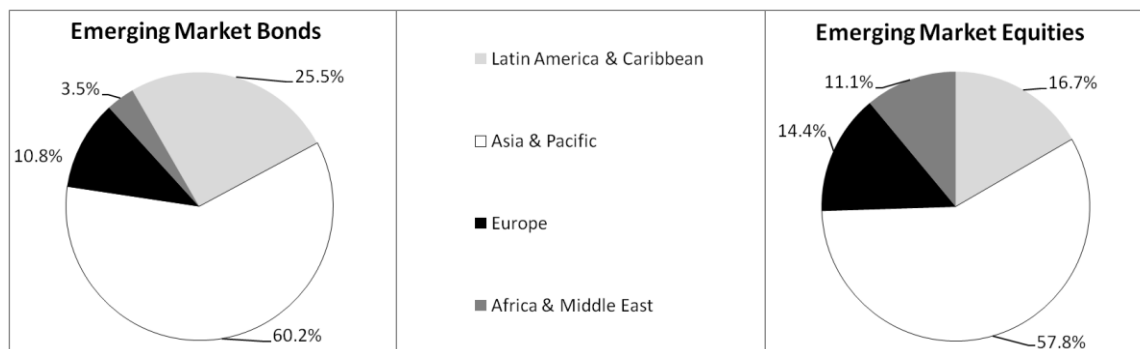
	2004	2005	2006	2007	2008
Floating rate	19%	20%	19%	19%	18%
Straight fixed rate	69%	67%	69%	67%	66%
Inflation indexed	8%	9%	10%	11%	12%
Exchange rate linked	3%	3%	2%	2%	3%

Source: Bank of International Settlements

Regional Distribution

It is interesting to examine the distribution of bonds and equities across the various countries and regions. This distribution is shown in Exhibit 3, which displays the regional and country breakdown for both the bond and equity markets in the emerging world. From a regional standpoint, the rankings for the two asset types are the same. In fact, the Asian Pacific region was ahead by a large margin in both equities and bonds. In the country breakdown, China is the main reason behind the large size of Asian Pacific equity and fixed income markets. In addition, the top four countries in equities are the BRIC countries, which together accounted for three-quarters of the market capitalization of the top ten countries. In addition to China and India, markets such as Korea, Taiwan, and Malaysia contribute to the pie for the Asian Pacific region. As for emerging market bonds, the market size in terms of outstanding amounts of issuance is smaller than in equities.

Exhibit 3: Regional and Country Distribution of Emerging Market Bonds and Equities
(in USD billions, as of Jun 2009)



Top 10 Countries by Bond Issuance
(International & domestic bonds)

	Amount Outstanding (USD)
China	2,329
Brazil	1,168
South Korea	1,058
India	549
Mexico	415
Turkey	247
Taiwan	216
Malaysia	200
Poland	199
Thailand	172

Top 10 Countries by Listed Equities
(by country of incorporation)

	Market Capitalization (USD)
China	4,238
Russia	1,420
Brazil	1,274
India	1,109
Korea	773
Taiwan	691
Mexico	372
S Africa	371
Saudi Arabia	285
Malaysia	226

Source: Bank of International Settlements, MSCI Barra

To conduct our analysis of emerging market bonds, we used the Barra Integrated Model (BIM), described briefly below.

The Barra Integrated Model (BIM)

The Barra Integrated Model is a multi-asset class, multi-factor model for forecasting the asset- and portfolio-level risk of global equities, bonds, currencies, and other asset classes. BIM combines broad asset coverage with the detailed analysis of Barra risk models that focus on particular markets. This makes it designed for a wide range of investment purposes, from conducting an in-depth analysis of a single-country portfolio to understanding the risk profile of a broad set of international investments.

The model is built upon a foundation of factor models of local equity and bond markets. By modeling each market individually, it provides precise forecasts of local market risk and also enables investors to see their exposures to the style and industry factors that drive price volatility in each market. For example, interest rate risk is modeled using a set of Principal Components Analysis factors (called Shift, Twist, and Butterfly) built using local market data that represent common yield curve movements. Structural models containing global factors are then used to link local factors across markets. The structural models decompose local factor returns into one part due to global factors and another part that is purely local. The global factors are used to estimate the correlation structure across markets and asset classes.

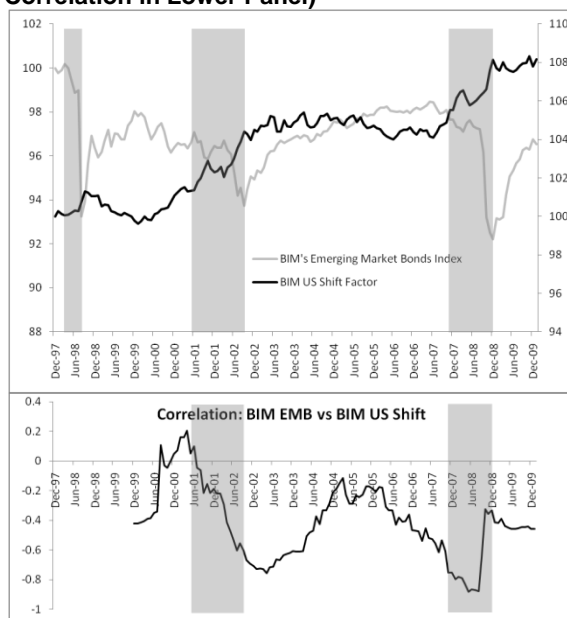
Our use of structural models provides a unique framework for global analysis. One of the global risk factors is a Global Emerging Market Bonds factor that captures the risk of emerging market bonds. This factor covers the risk of fixed income assets issued in an external currency, either by a government in an emerging market country, or by a corporation that is domiciled in such a country. A rise in this factor indicates that the prices of emerging market bonds are increasing, and vice versa.

Emerging Market Bonds and Developed Market Sovereigns

First we consider the relationship between emerging market bonds and US Treasuries. The latter is represented by the US Sovereign Shift factor within BIM. Changes in the US sovereign term structure may be due to either shifts or changes in the slope or curvature of the treasury yield curve, and these changes are captured by three separate factors in BIM. However, since shifts in the curve are most representative of changes in the general level of bond prices across all maturities, and because they account by far for most of the changes in the term structure, the shift factor is used to represent the general price level of US Treasuries.

The US Sovereign Shift Factor is plotted together with the Global Emerging Market Bonds Factor in the upper panel of Exhibit 4. The three shaded intervals highlight the periods in which the Global Emerging Market Bonds Factor declined sharply. In contrast, during those periods, the US Sovereign Shift Factor moved up, which demonstrates a flight to safety and the safe-haven nature of US Treasury bonds. There are times when the two moved in the same direction, however, such as between 2002 and 2003, when both were rallying. Nonetheless, the chart in the lower panel of Exhibit 4 indicates that the correlation between them during the observed period tended to be negative. However, during this period large declines in emerging market bonds were preceded by an increase in correlation to -0.2 or above. When the correlation stayed at that high level for an extended period, as in 2000-2001 and 2004-2005, it was followed by market decline or turbulence. Similarly, during this period whenever the correlation remained consistently below -0.7 , a selloff was near its end and emerging market bonds then experienced a recovery rally.

Exhibit 4: BIM Global Emerging Market Bonds Factor versus US Sovereign Shift Factor (24-month Correlation in Lower Panel)



US Treasuries rallied as emerging market bonds declined during crises — flight to quality

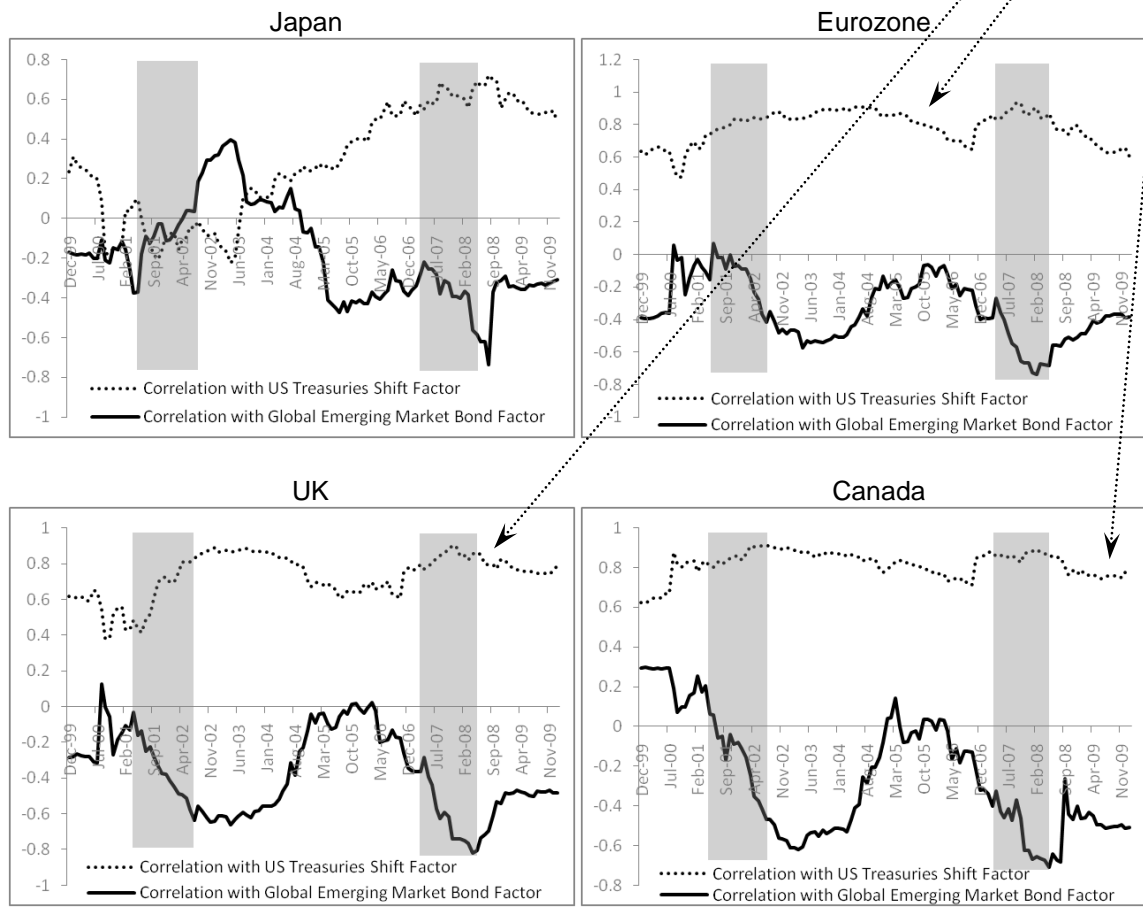
Note: This correlation has a shorter half-life than that in the BIM correlation matrix, which is 48-month exponentially weighted.

Comparing sovereign bonds from other developed markets, the picture is largely similar. Exhibit 5 shows the correlation between the respective sovereign shift factors of several major industrialized countries and the Global Emerging Market Bonds Factor, as well as against the US Treasuries Shift Factor. The first observation is that, except for Japan, the correlation during the observed period that these developed market sovereign shift factors have with the US Shift Factor is generally highly positive and stable, even during volatile periods. This implies strong co-movement among developed market sovereign bonds during this period. In addition, the movement of the correlation with the Global Emerging Market Bonds Factor is also very similar across all developed market bonds during this period, again with the exception of Japan. In particular, correlations with the Global Emerging Market Bonds Factor tended to fall sharply during selloff periods (marked in gray). Like US Treasuries, the sovereign bonds of other developed markets benefitted from the flight to quality during such periods of risk aversion.

As for Japan, there is evidence to suggest that its co-movement with the rest of the developed world is rising. The dotted line in the top left panel of Exhibit 5, which denotes the correlation between the Japanese and US shift factors, was close to zero for the first part of the sample period, up to 2003, but has since steadily picked up and is now at a level close to those of other developed markets.

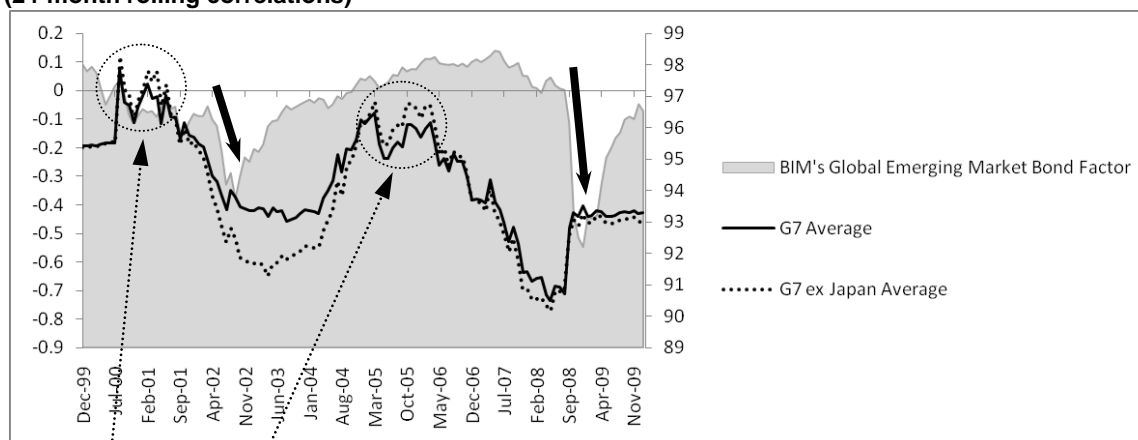
Exhibit 5: Comparison with Government Bonds from Other Developed Markets (24-month rolling correlations)

Correlation with US Treasuries is highly positive



Taking the average of the respective correlations with emerging market bonds enables us to examine this relationship in the context of the G7 countries as a whole. Given Japan's difference from the rest, we computed this average with and without Japan. These results are shown in Exhibit 6, together with the Global Emerging Market Bonds Factor. Generally both averages moved rather closely together, and so the impact of Japan on the average was not especially large. It is interesting to note that the average correlation peaked near zero before a sharp decline in emerging market bonds. A sharp change in correlation could be taken as one of a suite of monitoring measures to provide early warning signals for upcoming market volatility or a decline/rise in emerging bond markets. Intuitively, a falling correlation implies that investors are beginning to treat emerging market and developed market bonds differently, which in turn indicates that risk appetite may be waning. Correlations of -0.2 or above preceded these selloffs.

Exhibit 6: Average Correlations of G7 Shift Factors with Global Emerging Market Bonds Factor (24-month rolling correlations)



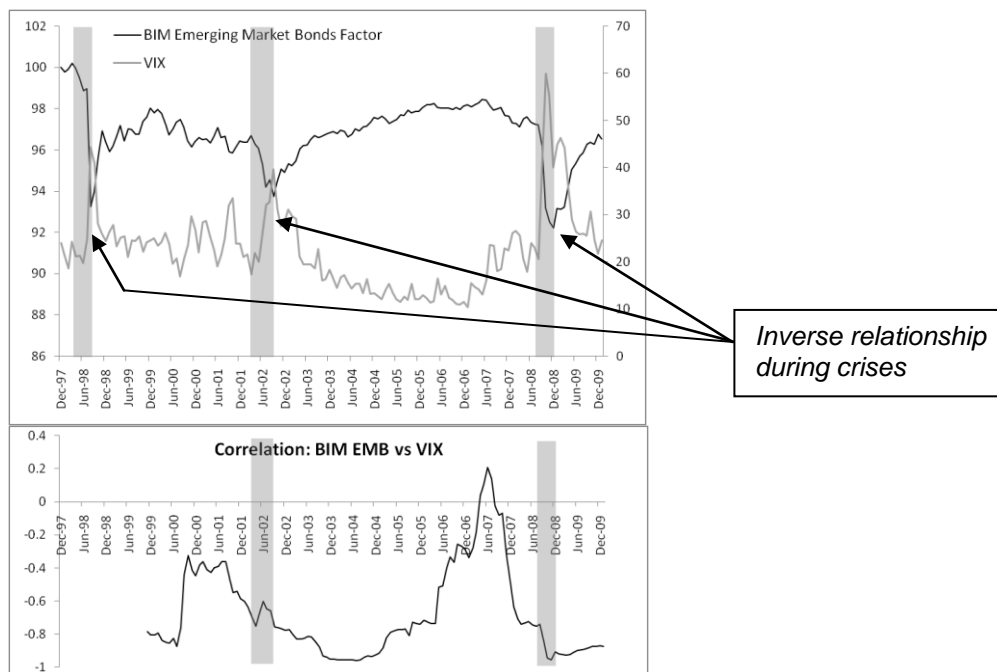
Correlations peaked near zero and fell before sharp declines in emerging market bonds

Emerging Market Bonds and the VIX Index

Next, let us consider the sensitivity of emerging market bonds to the general level of risk aversion. The Chicago Board Options Exchange Volatility Index (VIX), which measures the implied volatility of US equities, is used here, since it is regarded not just as a risk barometer of US equities, but more generally as a measure of the global market's risk appetite. The upper panel in Exhibit 7 plots the BIM Global Emerging Market Bonds Factor, together with the VIX Index. The shaded areas represent three periods of sharp decline for emerging market bonds, corresponding to the Asian/LTCM crisis, the IT bubble, and most recently, the financial crisis in late 2008. In these periods, it is clear that the VIX index rose markedly, signaling much higher levels of risk aversion in the overall market. This indicates that emerging market bonds sold off together with equities during these volatile periods.

The correlation between these two series is shown in the lower panel of Exhibit 7, and it suggests that the two are usually negatively correlated during the observed period. This is consistent with our earlier observation that they tend to move in opposite directions during crises. This negative correlation also implies that there were limited diversification benefits between equities and emerging market bonds during the observed period, especially during crises.

Exhibit 7: BIM Global Emerging Market Bonds Factor versus VIX Index (24-month Correlation in Lower Panel)



As with the correlation with US Treasuries and other developed market bonds discussed in the last section, the correlation during the observed period between emerging market bonds and the VIX might have signaled upcoming volatility in financial markets. However, there are differences between the VIX and developed market sovereigns that deserve further attention. While both of them reflect risk aversion in the market, US treasury yields also integrate the unique demand characteristics of US Treasuries, such as the Fed's monetary policy decisions. This is reflected in the correlations displayed in Exhibits 4 and 7.

After falling in 2002, the correlation between the Global Emerging Market Bonds Factor and the US Sovereign Shift Factor in Exhibit 4 rose to a high point of around zero in 2005, while the correlation with the VIX Index in Exhibit 7 was still near its low. The reverse was true when the VIX correlation reached its peak in 2007. In the US, interest rates were rising in 2004, as economic growth strengthened and the stock market recovered, putting downward pressure on the prices of US Treasuries.

Emerging market bonds, however, continued to rally until 2007, due to relatively easy monetary policies and optimism about economic growth prospects in those countries. This divergence caused correlations between emerging and developed market bonds to fall, without any rise in the market's risk aversion. Therefore, the VIX correlation during the observed period may have provided a near-term measure of how emerging market bonds were affected adversely by the changing risk appetite. During this period, when the correlation between Emerging Market Bonds Factors and the VIX was -0.4 or above, then an emerging bond market decline followed. Similarly, a correlation of -0.8 or below during this period suggested that the emerging bond markets had bottomed out and were poised for a recovery rally.

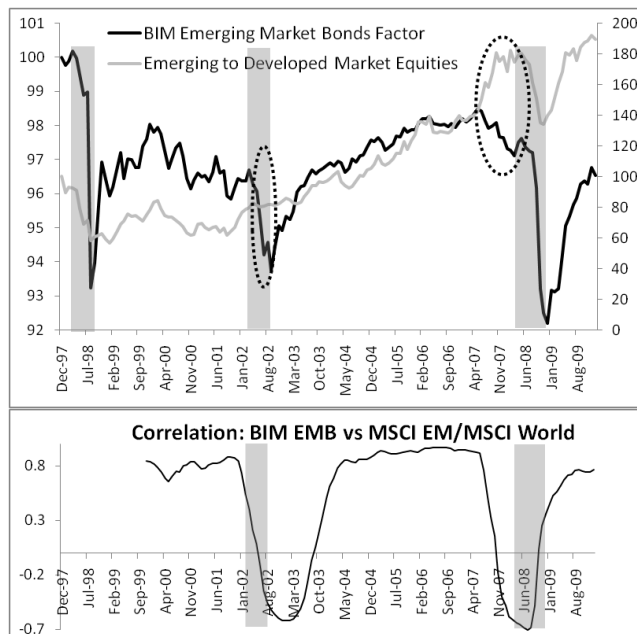
Relative Emerging Market Performance in Bonds and in Equities

Developed market assets generally are considered to be less risky than emerging market assets. We would like to examine the extent to which this is true for equities and for bonds. Therefore, it is of interest to compare the relative performance of emerging to developed markets in the fixed income world with that in equities. The former may be represented by the Global Emerging Market Bonds Factor, since, as a spread factor, developed market interest rates have been removed from its construction. As for equities, the ratio of the MSCI Emerging Markets Index to the MSCI World Index (which covers developed market equities) is used as a measure of relative performance. These two series are shown together in the upper panel of Exhibit 8, with the black line denoting the relative performance of the emerging markets in fixed income, while the gray line represents the relative performance of emerging market to developed market equities.

Generally, the two lines moved in the same direction over the period monitored. When emerging markets were outperforming developed markets in the bond markets, the same was true in equities. However, this positive relationship tended to break down near crisis periods, which are highlighted with dotted ovals in the upper panel of Exhibit 8. In these two highlighted periods, in 2002 and 2007-2008, emerging market bonds were underperforming relative to their counterparts in the developed markets (black line moving down), while the reverse was true for emerging market equities (gray line moving up). This is also reflected in a sharp drop in correlation during these two periods, as shown in the lower panel. For the most part, the correlation hovered around 0.8 during normal periods, but dropped below 0.5 before sharp declines in emerging market bonds. On the other hand, when the correlation continued to fall and reached levels below -0.5, the market was nearing a bottom prior to a recovery.

During the observed period, when emerging market equities were sold off during crises, developed market equities also tended to suffer. In fixed income, while emerging market bonds also fell during crises, developed market bonds fared much better due to their safe-haven characteristic. This implies during this period that developed market bonds offered more diversification benefits than developed market equities.

Exhibit 8: BIM Global Emerging Market Bonds Factor versus Ratio of MSCI Emerging Markets Index to MSCI World Index (24-month Correlation in Lower Panel)



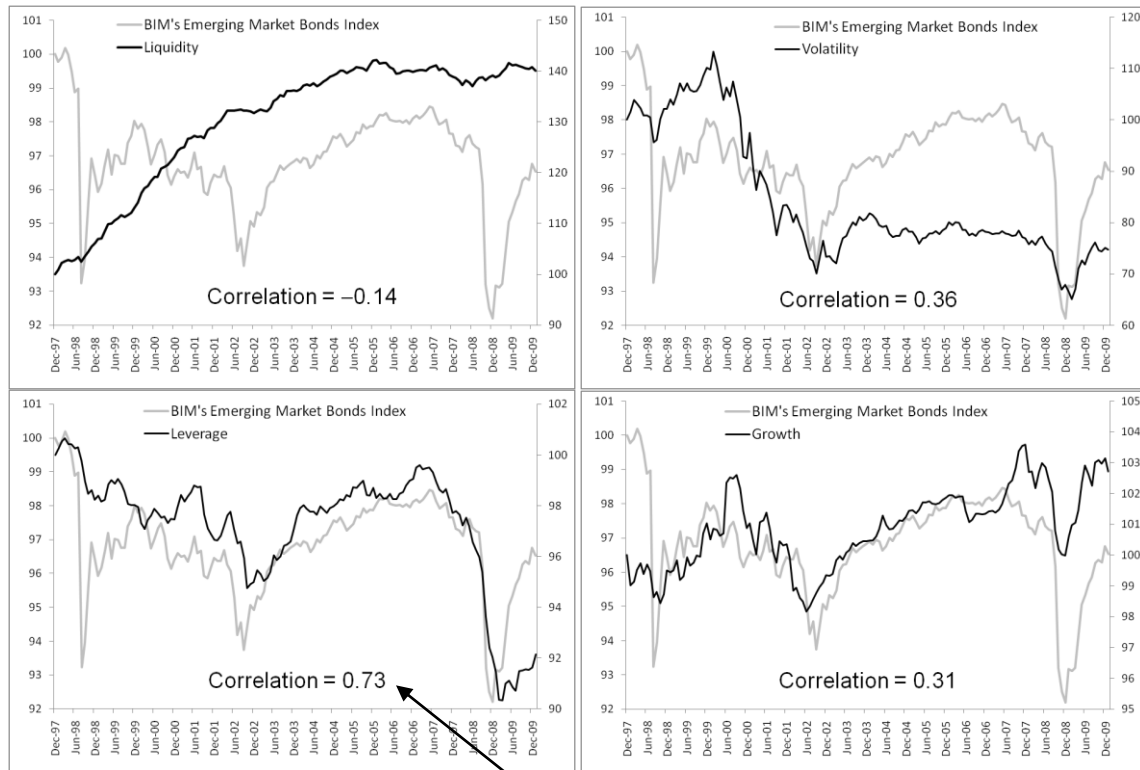
Sharp declines in emerging market bonds (gray zones) were preceded by a reduction in correlation to below 0.5.

Emerging Market Bonds and Global Equity Styles

Finally, we consider the relationship between emerging market bonds and certain global equity styles. The Barra Global Equity Model (GEM2) style factors, which capture style effects in global equities, are therefore used here. Exhibit 9 plots the Global Emerging Market Bonds Factor with four equity style factors: Liquidity, Volatility, Financial Leverage, and Growth.

The Liquidity factor captures the relative performance of stocks with high trading volumes, while the Volatility factor reflects the relative performance of volatile stocks. The Financial Leverage factor shows how the stock prices of highly leveraged or indebted firms perform relative to those of companies with better balance sheets, and the Growth factor reflects the performance of growth stocks. During the observed period the Liquidity factor has the lowest correlation with emerging market bonds. The Volatility and Growth factors displayed moderate positive correlation, while the Leverage factor had high and positive correlation with the Global Emerging Market Bonds Factor. This implies that in order to maximize the diversification benefits between global stocks and emerging market bonds during this period, a stock portfolio should have especially tilted away from stocks of highly indebted companies and towards equities with high trading volume (Liquidity factor). This is consistent with the fact that EM bonds historically tend to be issued by sub-investment grade rated issuers.

Exhibit 9: BIM Global Emerging Market Bonds Factor versus Equity Style Factors



Especially high positive correlation implies little diversification effect between this equity style and emerging market bonds

Conclusion

This paper examines the risk characteristics of emerging market bonds using the Barra Integrated Model (BIM). Our findings are as follows:

1. We found that during the period we observed the correlation between emerging and developed market bonds was cyclical, but generally negative. When the factor correlation embarked on a declining trend from a high level, it implied that investors were starting to differentiate between DM and EM bonds, and a sharp decline in emerging market bonds tended to ensue (Exhibit 6).
2. We found that during the period we observed the prices of emerging market bonds were closely related to uncertainty in the equity markets and to risk aversion in general. As the correlation between emerging market bonds and the VIX Index peaked and then trended downwards, a sharp fall in emerging market bonds and equities tended to occur shortly thereafter (Exhibit 7). This implies that the downtrend in correlation indicated that risky assets were becoming less attractive as risk aversion increased. On the other hand, when risk aversion became excessive and the correlation was sufficiently low, it may have been a sign that the selloff was nearing its end and a recovery rally could occur.
3. The performance of emerging markets relative to developed markets during the observed period was different in global bond and equity markets near crisis periods (Exhibit 8). This divergence between the relative performance of emerging market assets in equity and fixed income markets was therefore a possible indicator of upcoming market turbulence. On the other hand, when this divergence was at an extreme, the market tended to show signs of a recovery.
4. Emerging market bonds were correlated positively during the observed period to some equity styles, namely financial leverage. To maximize the diversification benefits in a portfolio with emerging market bonds and global equities during this period, an investor should have therefore considered tilting the equity part of the portfolio towards liquid stocks, and especially away from equities with high financial leverage.

Summary: Possible Indicators during the Observed Period of Impending Emerging Market Bond Selloffs and Recoveries

Indicator	Signal	Observations	Results	Rationale
Correlation, EMB Factor versus Sovereign Bond Factors of G7	<u>Selloff Signal</u> When the average correlation reached a high point (-0.2 or above) and then declined by 0.3 or more.	This signal was triggered twice, in March 2002 and in December 2006. See Exhibit 6.	<u>Activation in March 2002:</u> Emerging market bonds fell sharply from March to September 2002. <u>Activation in December 2006:</u> Market started to drop sharply only from June 2008, one-and-a-half years later.	Correlation between EM and DM bonds reached a high point when the risk appetite neared its peak. A subsequent fall in correlation indicated that the market was starting to differentiate bonds from emerging and developed markets, a sign of rising risk aversion that preceded the market selloffs.
	<u>Recovery Signal</u> Unreliable.			
Correlation between EMB Factor and VIX Index	<u>Selloff Signal</u> Correlation reached a high point (-0.4 or above) and then fell by at least 0.3.	Triggered twice, in February 2002 and November 2007. See Exhibit 7, lower panel.	<u>Activation in February 2002:</u> Emerging market bonds fell sharply from March to September 2002. <u>Activation in November 2007:</u> Market started to drop sharply from June 2008, seven months later.	Again, a high point reflected that risk appetite was at its height, and the subsequent fall revealed that the market was becoming more risk averse. On the other hand, when this correlation became highly negative, risk aversion peaked and a recovery occurred. Overall, this signal may have been more accurate than the previous one, because it reflects risk appetite more directly. The first indicator involves sovereign bonds that are affected by other factors, such as monetary policy.
	<u>Recovery Signal</u> When correlation falls to -0.8 or below, the selloff was over and a recovery rally was near.	Activated on March 2003 and September 2008.	<u>Activation in March 2003:</u> Although the market hit bottom six months earlier, in September 2002, it went on 4-year rally, since activation to 2007. <u>Activation in September 2008:</u> Market bottomed out in December 2008, three months later.	

Correlation of EM-to-DM performance in equities versus fixed income	<p>Selloff Signal: Correlation tended to hover around 0.8. A fall to below 0.5 preceded an upcoming market decline.</p>	<p>Triggered in March 2002 and September 2007. See Exhibit 8.</p>	<p>Activation in March 2002: Emerging market bonds fell sharply from March to September 2002.</p> <p>Activation in September 2007: Market started to drop sharply from June 2008, nine months later.</p>	<p>The relative performance of EM to DM assets tended to coincide in equity and fixed income markets. A divergence indicated that equity markets had become excessively bullish, and the subsequent correction also dragged down EM bonds. When this divergence became extreme, the market became overly risk sensitive, and a recovery followed.</p>
	<p>Recovery Signal: When correlation continued to fall to -0.5 or below, the market bottomed out and a recovery rally followed.</p>	<p>Activated on September 2002 and February 2008.</p>	<p>Activation in September 2002: Market hit the bottom in September 2002.</p> <p>Activation in February 2008: Market bottomed out in December 2008, ten months later.</p>	

Note: EMB and Sovereign Bond factors refer to BIM Global Emerging Market Bonds Factor and Sovereign Shift Factors, respectively.

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