EMERGING MARKETS FIXED INCOME

Fundamental Factor Model

Author(s): Yingjin Gan and Luiza Miranyan

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Bloomberg

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> INTRODUCTION

Overview

This document describes the implementation of the emerging market fixed income factor model. The model covers bonds issued by developing countries in hard (e.g. USD, EUR, GBP, JPY) as well as local (e.g. MXN, CNY, PLN) currencies.

The list of developing countries consists of all the countries that are not classified as developed or EURO zone countries. The covered countries include, but are not limited to the ones listed below:

Albania	Dominican Republic	Israel	Nigeria	Seychelles
Argentina	Ecuador	Jamaica	Oman	Singapore
Azerbaijan	Egypt	Jordan	Pakistan	South Africa
Bahrain	El Salvador	Kazakhstan	Panama	Sri Lanka
Belarus	Fiji	Korea	Paraguay	Taiwan
Belize	Gabon	Kuwait	Peru	Thailand
Brazil	Georgia	Latvia	Philippines	Trinidad and Tobago
Bulgaria	Ghana	Lebanon	Poland	Tunisia
Chile	Guatemala	Lithuania	Qatar	Turkey
China	Hong Kong	Malaysia	Romania	Ukraine
Colombia	Hungary	Mexico	Russian Federation	United Arab Emirates
Costa Rica	India	Mongolia	Saudi Arabia	Uruguay
Croatia	Indonesia	Morocco	Senegal	Venezuela
Czech Republic	Iraq	Namibia	Serbia	Viet Nam

Note that countries like Singapore, Hong Kong, Taiwan are already considered developed countries however they are covered by the emerging markets model since they are part of the popular Emerging Markets indices.

The rest of the document is organized as follows. First, we describe the universe of securities the model intends to cover and identify the subset of that universe used to construct the model. Next, we present the basic model structure and go over each group of factors in detail. Finally, we discuss model performance in various tests and conclude.

Estimation Universe

The estimation universe is constructed from a few sources: Bloomberg-Barclays emerging market indices, Bloomberg security terms and conditions, BVAL pricing and Bloomberg analytics. In general, bonds in the estimation universe have at least one year remaining term to final maturity, and satisfy some minimum amount outstanding requirements.

Hard Currencies Model

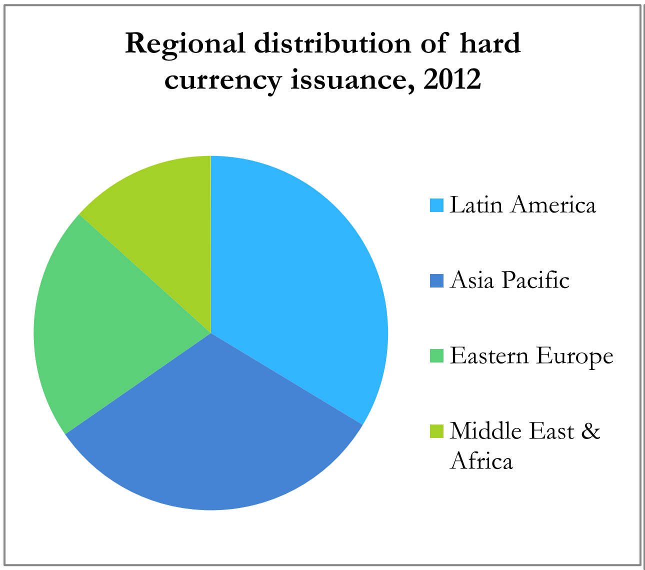
Data from several Bloomberg-Barclays indices is collected to extract securities issued by developing countries in hard currencies. The data set includes sovereign as well as corporate bonds. From the table below one can see that vast majority of securities is issued in USD measured either in number of securities or market value:

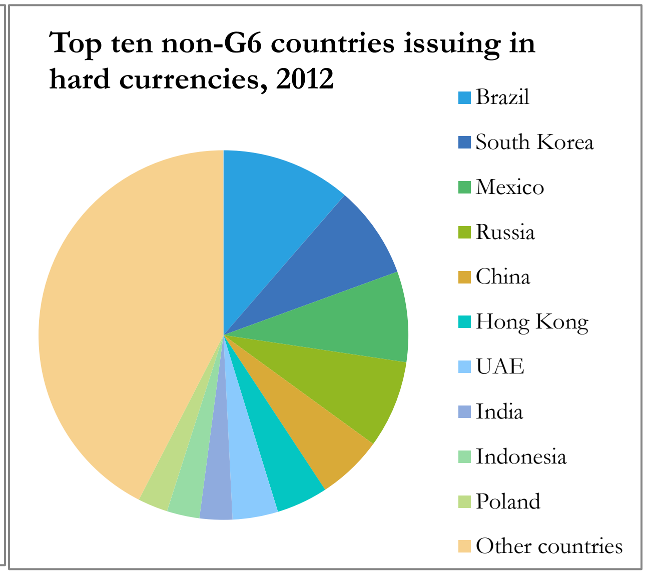
Estimation Universe in January, 2013

Currency	Market Value (billions, $)	Number of securities

USD	1396	1542
EUR	209	163
JPY	9	24
GBP	13	16
AUD	3	9
CAD	0.3	1

The geographic distribution of the number of securities can be seen in the two charts below: by region on the left and by country on the right chart:





Local Currencies Model

Generally the data on debt issued in local currencies is less available than the hard currencies data. An exception to this is China and bonds issued in CNY currency. Bloomberg has obtained a large universe of bonds issued primarily by Chinese corporations in the local CNY currency, which allows us to build a more detailed CNY local currency model. In the future when local currency data becomes more available, more detailed local currency models will be added.

> MODEL STRUCTURE

In general, the total return of a generic security n over time period t can be written as the sum of several return components, each in turn can be expressed as the product of a factor return and exposure to the factor. The risk (or volatility) of this return comes from the volatility of all these factors as well as their correlations. To simplify, consider a bond with price $B(t, y, OAS, \sigma)$ where t stands for time, y stands for yield, OAS is Option Adjusted Spread and σ is volatility. Performing Taylor expansion and ignoring almost all higher order terms we obtain:

$$Total\ Return = \frac{B}{\Delta B} = \frac{1}{B}\frac{\partial B}{\partial t}\Delta t + \frac{1}{B}\frac{\partial B}{\partial y}\Delta y + \frac{1}{2B}\frac{\partial^2 B}{\partial y^2}(\Delta y)^2 + \frac{1}{B}\frac{\partial B}{\partial \sigma}\Delta\sigma + \frac{1}{B}\frac{\partial B}{\partial OAS}\Delta OAS. \quad (1)$$

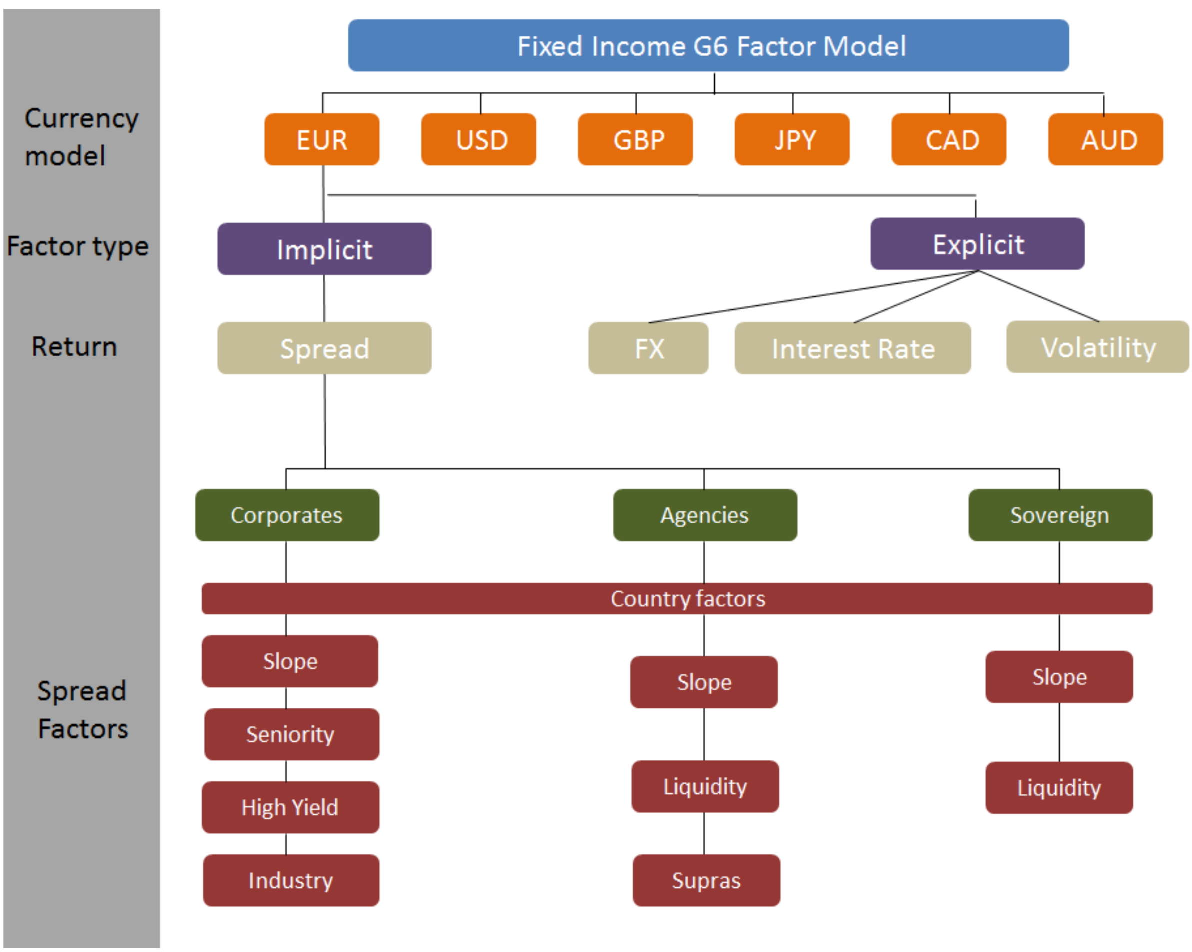
The terms in this decomposition are called time, curve, convexity, volatility and spread returns.

The time return is different from other components: it is the return due to the passage of time with all other factors held constant. This component is deterministic and therefore we explicitly subtract it from the total return. The difference between the total return and the time return is called the stochastic return and is modeled using linear multi-factor representation, i.e. can be written as:

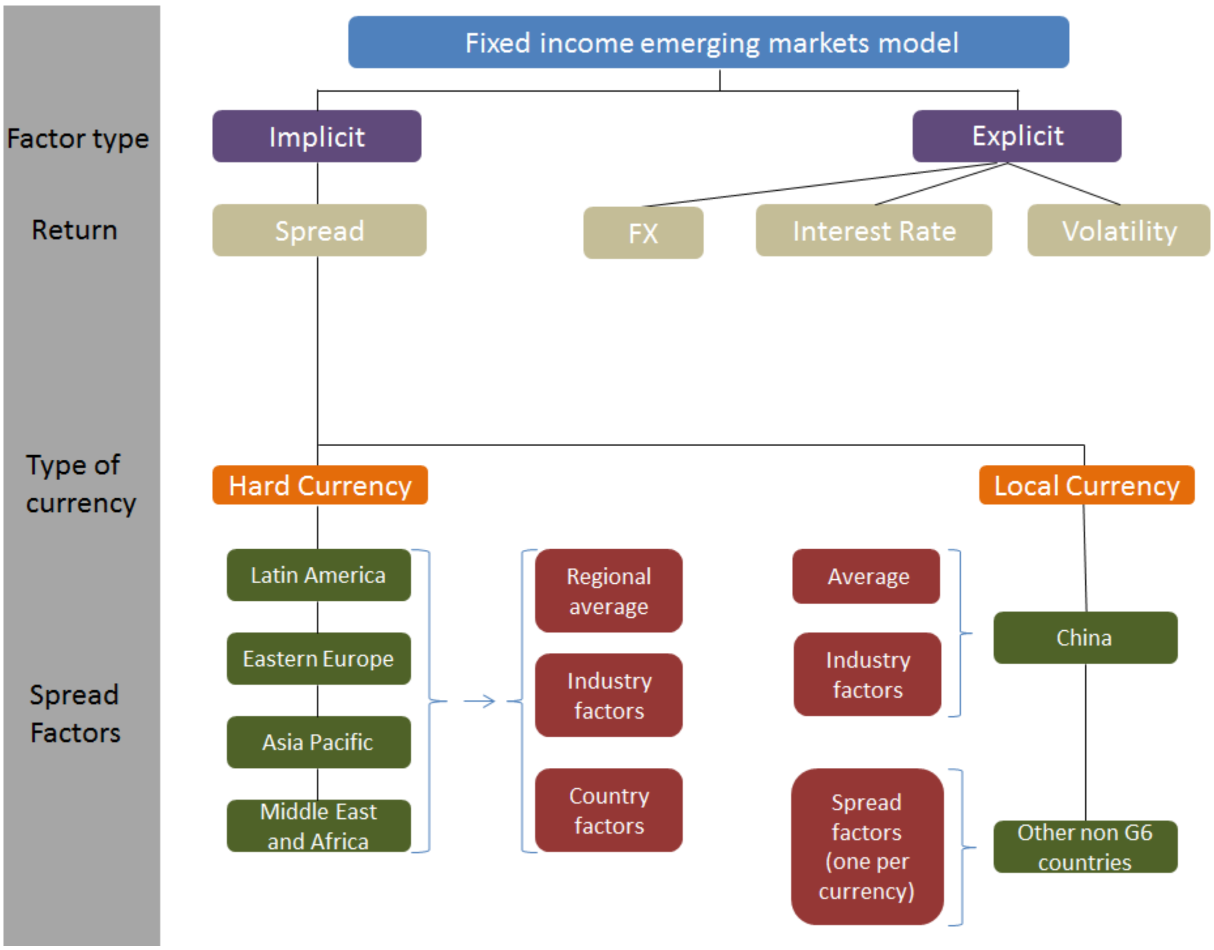
$$R_n^t - R_n^{t,time} = \sum_{k=1}^{K} X_{nk}^t \cdot F_k^t + \varepsilon_n^t, \text{ where} \tag{2}$$

R_n^t is the total return for security *n* during time period *t*,
$R_n^{t,time}$ is the time return for security *n* during time period *t,*
X_{nk}^t is a pre-defined factor exposure of security *n* to a factor *k*, at time *t* with *K* factors in total,
F_k^t is the factor *k* at time *t* to be derived from running the above regression,
ε_n^t is residual return of security *n* at time *t*.

Generally, factors can be explicit or implicit. **Explicit factors** are observable in the market and therefore we simply use the observed change directly - currency, curve and volatility factors are the explicit factors in our model. **Implicit factors** are obtained via cross-sectional regression - spread factors are the implicit factors. To illustrate, below is the structure of the Bloomberg EUR model:



Other developed world currency models (USD, GBP, etc) are similar in spirit. However, emerging markets model has a different structure outlined below:



> SYSTEMATIC FACTORS

Curve Factors

Most fixed-income securities' prices are largely impacted by the movement of the yield curve. We explicitly define curve factors as the changes in yield on a set of pre-determined tenor points along the yield curve. The curve factors are nine par rate changes along the 6M, 1Y, 2Y, 3Y, 5Y, 7Y, 10Y, 20Y, and 30Y tenors and the square of the average curve change to capture the second-order effect. The exposures to these factors are the key rate durations and the option-adjusted convexity, i.e.

$$R_{yc} = -\sum_{i=1}^{9} KRD_i \cdot \Delta y_i + \frac{1}{2} OAC \cdot (\overline{\Delta y})^2 \quad (3)$$

Where R_{yc} is the return due to curve change, Δy_i is the rate change of the par swap curve at i-th tenor point and $\overline{\Delta y}$ is the simple average of changes across all tenor points.

Overall curve risk coverage is as follows:

- Securities issued in USD, EUR, GBP, JPY, AUD, CAD, CNY and CHF have exposure to sovereign or swap curves depending on whether the security is issued by a government or a corporation.
  The factors are the nine key rates and exposures are the corresponding key rate durations.
- Securities issued in other currencies where we have complete curve data will have exposure to sovereign curves only. For example, curve risk of Brazil corporation as well as a government issued bond will come from Brazil sovereign curve. The risk factors will be the nine key rates, and exposures are the corresponding key rate durations. The following currencies fall into this category:

BGN	BRL	CLP	COP	CZK	DKK	HKD	HUF	IDR	ILS	INR	KRW	MXN	MYR	NOK	
NZD	PEN	PHP	PKR	PLN	RON	RUB	SEK	SGD	SKK	THB	TRY	TWD	ZAR		

- For securities issued in currencies with incomplete curve data we describe the curve risk in terms of one single factor representing the average parallel shift of the partial curve that we have available. The exposure to this factor is bond's modified duration. For example a bond issued in Philippines Peso will have one factor curve risk representing parallel shift of the curve, and the sensitivity to this factor is the bond's modified duration. The following currencies fall into this category:

HRK	ISK	UAH	VND	LKR

- For securities with no curve data available we created regional proxy curves. Currencies falling into this category are all the currencies in the world that are not listed in the three previous bullet points. The following table explains the composition of the regional curve proxies:

Latin America	Asia Pacific	Emerging Eastern Europe	Middle East & Africa
BRL	**CNY**	**BGN**	**ILS**
CLP	**IDR**	**CZK**	**ZAR**
COP	**INR**	**HUF**	**PKR**
MXN	**MYR**	**PLN**	
PEN	**PHP**	**RON**	
	THB	**RUB**	
		TRY	

For example, the Latin America regional proxy curve is the average of Brazil, Chile, Colombia, Mexico and Peru sovereign curves. If a bond is issued in Ecuadorean Sucre, its curve risk will be described via the regional Latin America proxy curve. The factor return here is represented by the average returns of the major curves in the region. The exposure to this factor is the modified duration.

Currency Factors

- Vast majority of currencies have deep historical data available which allows us to incorporate individual currencies into the risk models. However for currencies that lack historical data we constructed regional proxies, similar to regional curve proxies described above. For example, Belizean Dollar would be proxied using Latin America proxy currency. Generally, we cover 154 currencies, and there are four regional proxies, similar to regional curve proxies described above. For example, Belizean Dollar would be proxied using Latin America proxy currency. Generally, we cover 154 currencies, and there are four regional proxies. The following table explains the composition of the regional currency proxies:

Latin America	Asia Pacific	Emerging Eastern Europe	Middle East & Africa			
GYD	KHR	AMD	SOS	MVR	GHS	SDG
DOP	FJD	GEL	SBD	SCR	GNF	CDF
PYG	THO	KGS	LRD	TOP	NGN	RWF
BZD	XPF	ALL	DZD	YER	STD	AOA
GTQ	VUV	AZN	MZN	ETB	SLL	BWP
HTG	WST	MDL	ZMK	TZS	LYD	KMF
			BND	UGX	MRO	MGA

Volatility Factors

For bonds with embedded options (e.g., callable or puttable corporate), an important factor is changes in implied interest rate volatilities[1]. Bloomberg fixed income model uses a single volatility risk factor that is based on the average changes of a selected group of grid points on the implied at-the-money swaption volatility surface. The exposure to the volatility factor is measured by the bond's "volatility duration", which is computed as the bond's vega divided by its full price. Hence the volatility return can be expressed as

$$R_{vol} = \frac{vega}{P + AI} \cdot \Delta\sigma \tag{4}$$

Where R_{vol} is the return due to volatility change, P and AI are the clean price and accrued interest, and $\Delta\sigma$ is the average change in volatility.

Not all countries have volatility data available, currently the countries that have volatility factors are:

Australia	Euro zone	Hong Kong	Japan	Mexico	Singapore	Taiwan
Canada	United Kingdom	Indonesia	South Korea	Malaysia	Thailand	United States

Spread Factors

Most fixed income securities often trade at a spread to the base curve. The level of the spread reflects the additional premium an investor requires for taking the additional credit, liquidity and other types of risks. The change of the spread, which reflects primarily the change in perceived risk of a security, comes from both the common forces, affecting all bonds with similar characteristics, and specific shock to that particular issuer.

Emerging markets model differs from the rest of the Bloomberg fixed income models. Hard and local currency securities are modeled differently.

Hard currencies model

[1] The implied volatilities can be observed in the interest rate options market, i.e., caps, floors, and swaptions.

Hard currencies are defined as currencies of the developed countries with most emerging market securities being issued in USD, EUR, GBP, JPY. The model is a union of four regional sub-models: Latin America, Emerging Eastern Europe, Asia Pacific, Middle East & Africa.

Within each region spread returns are modeled as follows:

$$\frac{R_n^{ex}}{-OASD_n} = OAS_n^+ \cdot \left(Base\ spread + F_{Industry(n)} + F_{Country(n)}\right), \text{where} \qquad (5)$$

OAS_n^+ – floored Option Adjusted Spread, with the floor value set to 0.05 or 5 bps;
$Base\ spread$ – weighted average percentage spread change for the given region; regression intercept.
$F_{Industry(n)}$ – weighted average percentage spread change in addition to the intercept for the given industry within given region.
$F_{Country(n)}$ – weighted average percentage spread change in addition to the intercept for the given country within given region.

Market value weighted contribution to duration is utilized as regression weights in order to stabilize the regression.

In more detail, Latin America region is modeled with:

- Intercept: Base spread
- Three industry factors: Government, Basic Materials+Utilities+Energy+Industrials (combined into one industry bucket), and Other
- Five country factors: Argentina, Brazil, Mexico, Chile, Other.

Asia Pacific region is modeled with:

- Intercept: Base spread
- Three industry factors: Government, Financial, Other
- Six country factors: Hong Kong, Singapore, Philippines, Korea, China, Other.

Emerging Europe region is modeled with:

- Intercept: Base spread
- Three industry factors: Government, Financial, Other
- Four country factors: Hungary, Russia, Turkey, Other.

Middle East & Africa region is modeled with:

- Intercept: Base spread
- Two industry factors: Government, Other.

For example, an emerging markets portfolio would have the following view in Bloomberg PORT in terms of exposures, factor risk and spread risk decomposition:

<HELP> for explanation.

11) View 12) Actions 13) Settings 14) Trade Simulation — Portfolio & Risk Analytics

Intraday | Characteristics | Holdings | Tracking Error/Volatility | VaR | Scenarios | Performance | Attribution

Main View | Summary | Factors | Risk Bets | Trends | Exposures

Port (EMCB) ML Eme vs Default (None by BICS Sectors in USD — As of 06/26/15

Model Bloomberg Ris Unit Returns (%) — Horizon 1 Year

Type Fixed Inc Display Spread (Currency Lat Am — Hide zero exposures

Securities	Base Spre	Gov	Ind;Mat;U	Oth Indus	AR	BR	CL	MX	Oth Cntry
25. PETBRA 5 5/8 05/20/43	55.96	0.00	55.96	0.00	0.00	55.96	0.00	0.00	0.00
26. PETBRA 7 1/4 03/17/44	55.66	0.00	55.66	0.00	0.00	55.66	0.00	0.00	0.00
27. BUENOS 4 05/15/35	55.14	55.14	0.00	0.00	55.14	0.00	0.00	0.00	0.00
28. PETBRA 6 3/4 01/27/41	54.83	0.00	54.83	0.00	0.00	54.83	0.00	0.00	0.00
29. BRASKM 7 1/8 07/22/41	54.63	0.00	54.63	0.00	0.00	54.63	0.00	0.00	0.00
30. PETBRA 6 7/8 01/20/40	54.03	0.00	54.03	0.00	0.00	54.03	0.00	0.00	0.00
31. EDNAR 9 3/4 10/25/22	52.67	0.00	52.67	0.00	52.67	0.00	0.00	0.00	0.00
32. MAXTEL 6 06/15/20	51.63	0.00	0.00	51.63	0.00	0.00	0.00	51.63	0.00
33. BUENOS 9 5/8 04/18/28	51.00	51.00	0.00	0.00	51.00	0.00	0.00	0.00	0.00
34. VOTORA 7 1/4 04/05/41	50.44	0.00	0.00	50.44	0.00	50.44	0.00	0.00	0.00
35. GOLLBZ 8 7/8 01/24/22	50.41	0.00	0.00	50.41	0.00	50.41	0.00	0.00	0.00
36. MASHER 12 5/8 07/03/21	50.15	0.00	0.00	50.15	50.15	0.00	0.00	0.00	0.00
37. CENSUD 6 5/8 02/12/45	49.87	0.00	0.00	49.87	0.00	0.00	49.87	0.00	0.00
38. ODEBRE 6 5/8 10/01/22	49.46	0.00	49.46	0.00	0.00	49.46	0.00	0.00	0.00
39. VALEBZ 5 5/8 09/11/42	49.10	0.00	49.10	0.00	0.00	49.10	0.00	0.00	0.00
40. ECOPET 5 7/8 05/28/45	49.03	0.00	49.03	0.00	0.00	0.00	0.00	0.00	49.03
41. VALEBZ 6 7/8 11/10/39	48.89	0.00	48.89	0.00	0.00	48.89	0.00	0.00	0.00
42. ODEBRE 6 3/4 10/01/22	48.25	0.00	48.25	0.00	0.00	48.25	0.00	0.00	0.00
43. ECOPET 7 3/8 09/18/43	47.94	0.00	47.94	0.00	0.00	0.00	0.00	0.00	47.94
44. ODBR 5 1/4 06/27/29	47.10	0.00	47.10	0.00	0.00	47.10	0.00	0.00	0.00

In the screenshot above exposures are a product of spread duration (OASD) and option adjusted spread (OAS) computed with respect to sovereign or swap curves, depending on whether the security is issued by the government or a corporation. For example, the user can check that the duration for PETBRA 5.625% 5/20/43 is about 11.76 years and OAS is 475.74 bps, which results in exposure of 55.96 when expressed as percentage.

	Exposure			Risk			
Factor	Portfolio	Benchmark	Active	Factor Vol (Std %)	Tot. Active (Std)	Marginal (X100)	Contribution %
1. Lat Am:Base Spread	6.61	0.00	6.61	0.098	0.65	0.07	38.05
2. E Eur:Base Spread	2.69	0.00	2.69	0.109	0.29	0.08	16.55
3. Asia Pac:Base Spre	3.85	0.00	3.85	0.058	0.23	0.04	11.67
4. Currency:EUR	0.09	0.00	0.09	3.281	0.30	1.18	8.87
5. USD YC:7Y KR Swp	0.93	0.00	0.93	0.203	0.19	0.06	4.66
6. USD YC:5Y KR Swp	0.84	0.00	0.84	0.194	0.16	0.06	4.22
7. Mid E & Af:Base Spre	1.08	0.00	1.08	0.068	0.07	0.04	3.72
8. USD YC:10Y KR Swp	0.72	0.00	0.72	0.208	0.15	0.06	3.28
9. Lat Am:Ind;Mat;Util	4.40	0.00	4.40	0.028	0.12	0.01	3.20
10. E Eur:RU	1.61	0.00	1.61	0.080	0.13	0.02	2.47
11. USD YC:3Y KR Swp	0.53	0.00	0.53	0.149	0.08	0.05	1.99
12. Lat Am:BR	2.51	0.00	2.51	0.031	0.08	0.01	1.55
13. USD YC:20Y KR Swp	0.44	0.00	0.44	0.219	0.10	0.04	1.52
14. USD YC:30Y KR Swp	0.42	0.00	0.42	0.220	0.09	0.04	1.27
15. Asia Pac:Oth Cntry	1.25	0.00	1.25	0.021	0.03	0.01	0.73
16. Lat Am:Oth Cntry	1.70	0.00	1.70	0.027	0.05	0.01	0.71
17. USD YC:2Y KR Swp	0.23	0.00	0.23	0.105	0.02	0.03	0.56
18. USD YC:5Y KR Sov	0.08	0.00	0.08	0.208	0.02	0.06	0.40
19. USD YC:7Y KR Sov	0.08	0.00	0.08	0.218	0.02	0.06	0.39
20. Asia Pac:CN	1.78	0.00	1.78	0.020	0.04	0.00	0.27

PORTFOLIO & RISK ANALYTICS

	Risk (Std)			Factor Risk (Std)		
Item	Total Risk	Factor	Non-Factor	Yield Curve	Spread (bps)	Currency
Portfolio	1.22	1.22	0.08	0.83	1.18	0.30
Benchmark	0.00	0.00	0.00	0.00	0.00	0.00
Active	1.22	1.22	0.08	0.83	1.18	0.30

Click a number to see breakdown

	Risk Contribution (%)			Factor Risk Contribution (%)		
Item	Total Risk	Factor	Non-Factor	Yield Curve	Spread (bps)	Currency
Portfolio	100.00	99.52	0.48	18.96	71.69	8.87
Benchmark	0.00	0.00	0.00	0.00	0.00	0.00
Active	100.00	99.52	0.48	18.96	71.69	8.87

Some examples:
When Brazil government issues debt in USD, these securities would be exposed to:

- USD sovereign curve
- Base spread: Latin America
- Country factor: Brazil
- Industry factor: Government

When Brazil energy company issues debt in USD, these securities would be exposed to:

- USD swap curve
- Base spread: Latin America
- Country factor: Brazil
- Industry factor: Basic Materials+Utilities+Energy+Industrials single factor

When Colombian government issues debt in EUR, these securities would be exposed to:

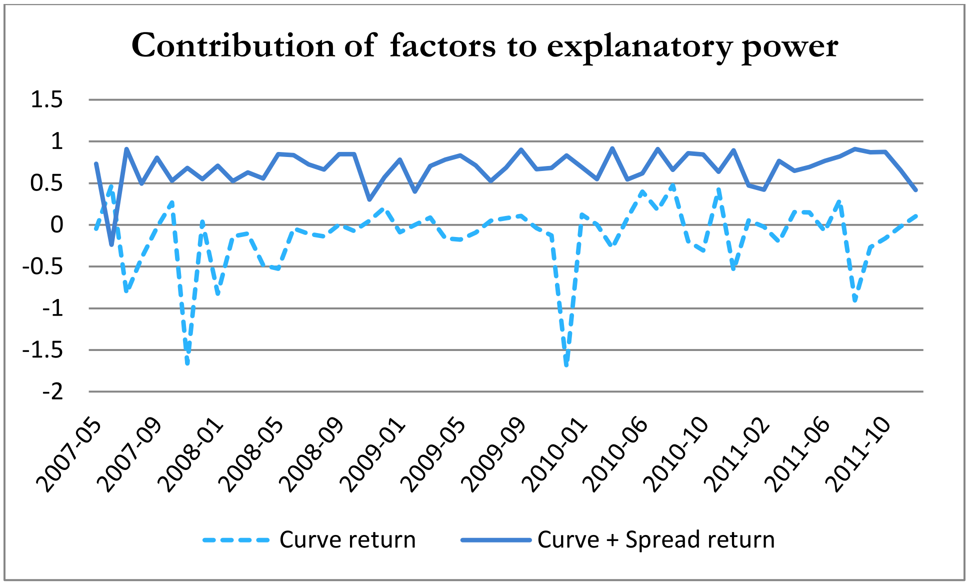
- EUR sovereign curve
- Base spread: Latin America
- Country factor: Other

- Industry factor: Government

When Bolivian financial corporation issues debt in EUR, these securities would be exposed to:

- EUR swap curve
- Base spread: Latin America
- Country factor: Other
- Industry factor: Other

The contribution of curve and spread factors to the explanatory power of the model is presented on the plot below. One can observe that the spread model adds significantly to the overall explanatory power:



<u>Local currencies model</u>

CNY local currency model

There is better coverage for securities issued in CNY currency, which allowed us to build an implicit spread factor model similar the regional models in hard currencies. Securities issued in CNY currency are modeled with:

- Intercept: Base spread
- Two industry factors: Financials, Other.

Other local currencies model

For securities issued in local currencies other than CNY the data on corporate debt is not sufficient to build an implicit credit spread model. We approximate the credit risk by a single factor by looking at the difference between the sovereign and swap curves, i.e. for each local currency we define a swap spread factor:

$$SwapSpread_t = average(swap\ curve_t) - averge(sovereign\ curve_t)$$

We make an assumption that the change in OAS for an individual bond will be the proportional to the change in SwapSpread, i.e.

$$\Delta OAS \approx \Delta SwapSpread$$

so that the model for the local currency bonds becomes:

$$\frac{R_n^{ex}}{-OASD_n} = \Delta SwapSpread.$$

To summarize: the risk of the government bonds issued in local currencies would be modeled in terms of the corresponding curves, for corporate bonds in local currencies we have an additional spread factor.

> NON-FACTOR RISK

The systematic factors explain a significant portion of the returns variability. However, for a long-short portfolio or a portfolio that is not well diversified, non-systematic risk can represent a significant portion of total risk.

We build a model for the non-systematic risk utilizing the error term ε_n^t in (2). We model the **absolute magnitude** $|\varepsilon_n^t|$ rather than standard deviation since the magnitude is less sensitive to outliers. We utilize the same peer groups used in the systematic regression, i.e. after we run the regression to obtain the systematic factors, we subsequently fit a model for its residuals $|\varepsilon_n^t|$, using the aforementioned groups for each type of bonds:

$$|\varepsilon_n^t| = \sum_{I(n)=1}^{I} Y_{I(n)}^t G_{I(n)}^t + \varphi_n^t \qquad (6)$$

where

- $Y_{I(n)}^t$ is an indicator function of group $I(n)$ (i.e., 1 if a member of that group, 0 otherwise)
- $G_{I(n)}^t$ are coefficients determined by the regression (6). We refer to them as residual factors --they represent the average cross-sectional variances of non-systematic spread in each group.

The residual factor regression (6) is run each month to obtain time series of residual factor returns $G_{I(n)}^t$. Historical residual factor returns are aggregated into a prediction using Exponentially Weighted Moving Average (EWMA) and a final forecast of the non-factor volatility is produced as:

$$Residual\ Volatility = OASD_n \times OAS_n^+ \times E[|\varepsilon|] \times \sqrt{\frac{\pi}{2}},$$

where we used the expression

$$\sqrt{E[\varepsilon^2]} = E[|\varepsilon|] \times \sqrt{\frac{\pi}{2}}$$

to convert expectation of the magnitude into the volatility space under the assumption that ε are normally distributed $N(0,\sigma)$.

Construction of factor covariance matrices

The detailed methodology of constructing covariance matrices is described in [1]. In order to attach the emerging markets model to the rest of the fixed income model we need to define core factors (please refer to [1] for details). We have defined 12 core factors: four hard currency regional factors, four local currency regional factors and four yield curve factors.

> MODEL PERFORMANCE

In this section we present the results of backtesting of emerging markets fixed income factor model.

Bias Testing

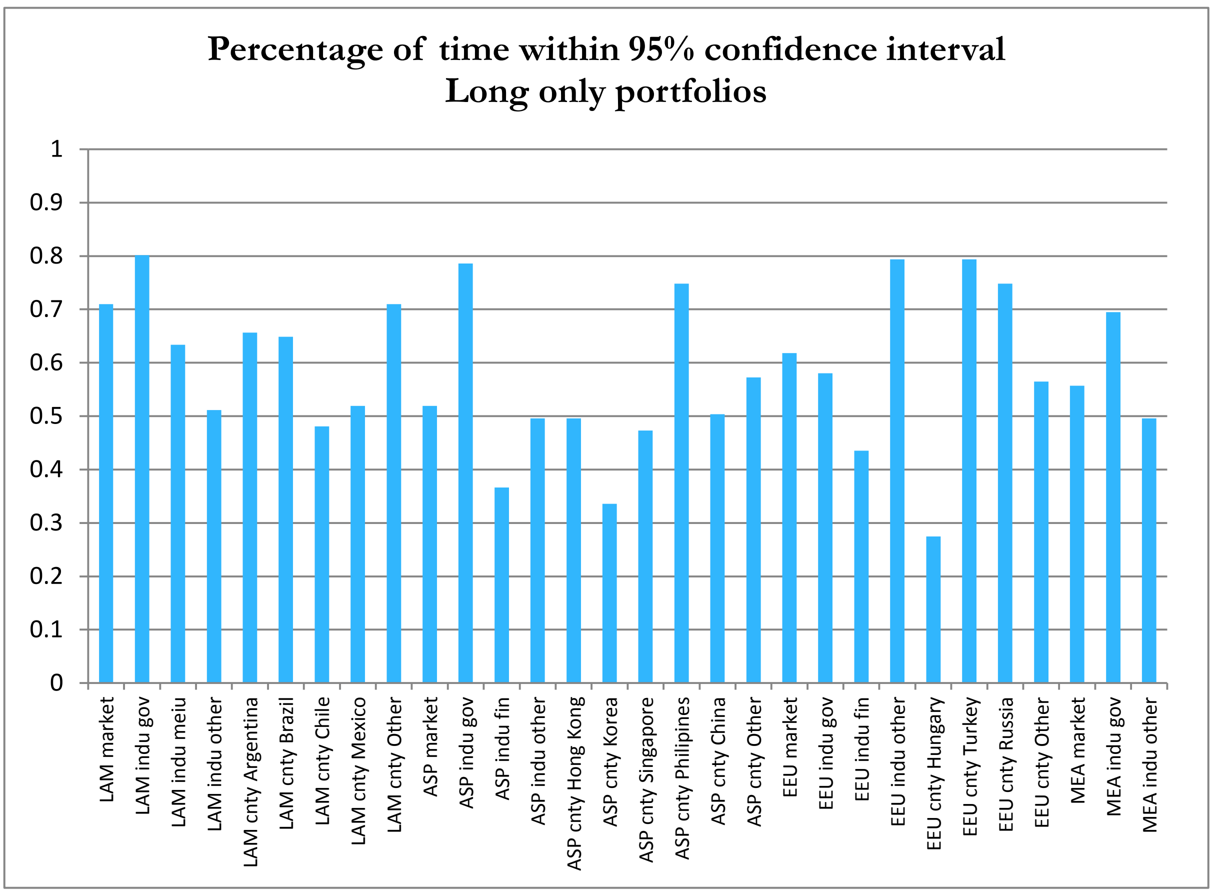
In order to measure the bias of the model let us introduce *normalized portfolio returns*: $q_t = \frac{P_t}{\hat{\sigma}_t}$ which is a ratio of realized portfolio return and the predicted volatility of the return. Bias of the model is defined as:

$$Bias = Std\ Dev\left(\frac{Realized\ Return}{Forecast\ Risk}\right) = Std\ Dev(q_t).$$

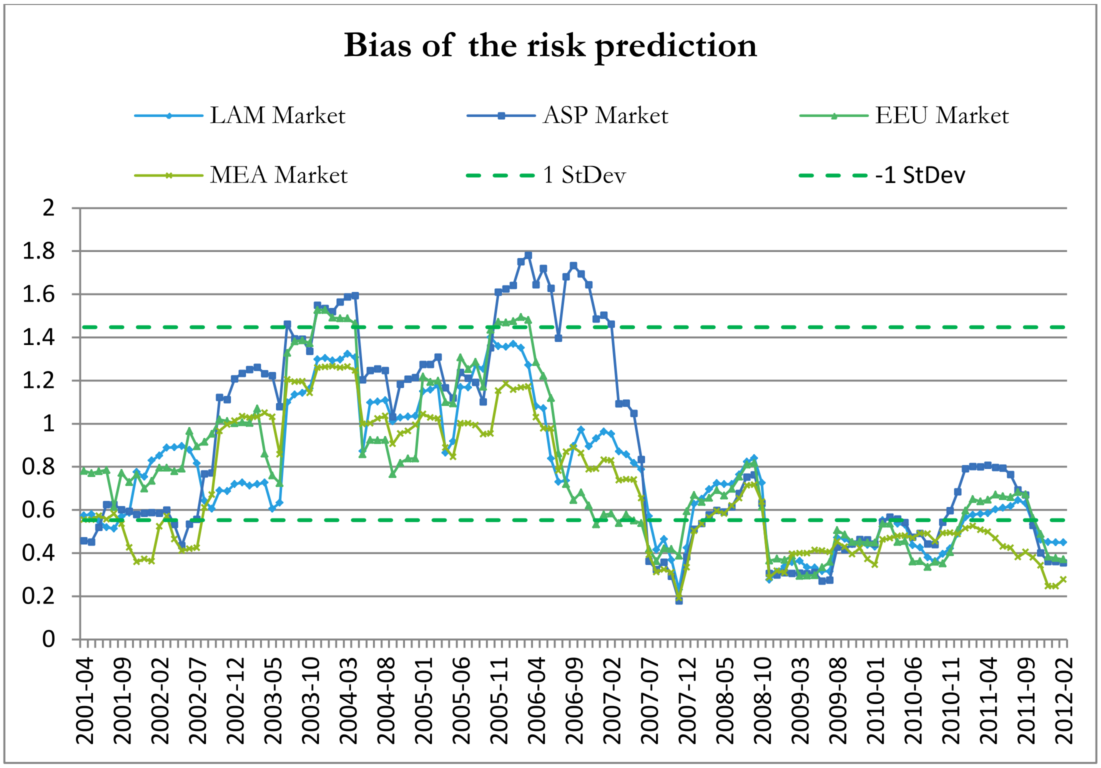
For more details on the bias testing please see [1]. In the figures below we report the percentage of observations the estimate $\widehat{StDev(q_t)}$ falls within the 95% confidence interval:

$$1 - \sqrt{\frac{2}{T}} < \widehat{StDev(q_t)} < 1 + \sqrt{\frac{2}{T}}$$

where $T = 10\ months$ is the size of the rolling window used for estimation of the standard deviation $StDev(q_t)$.

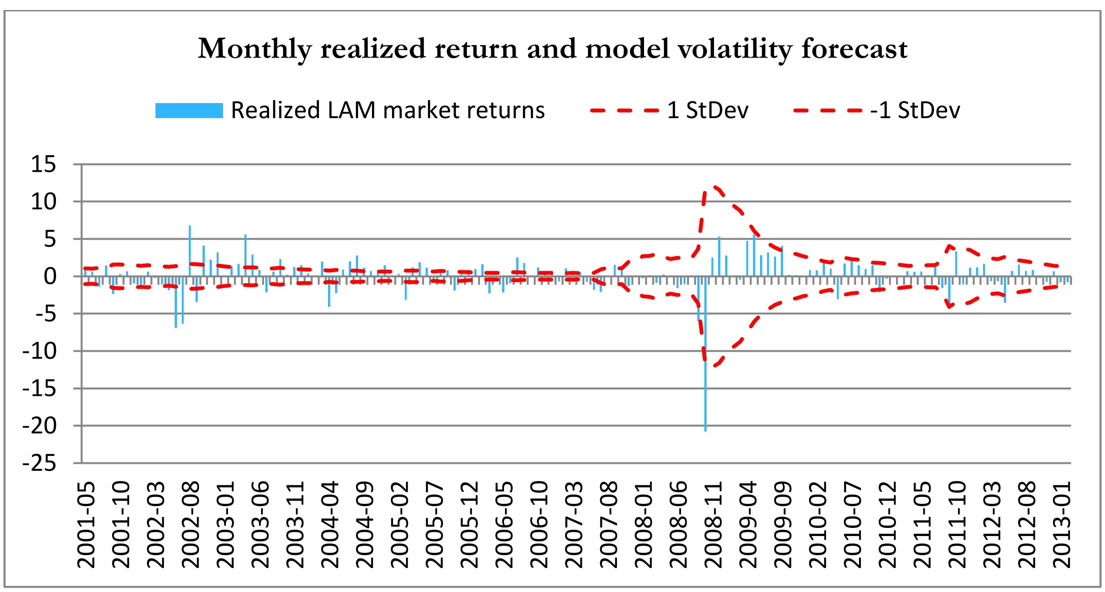


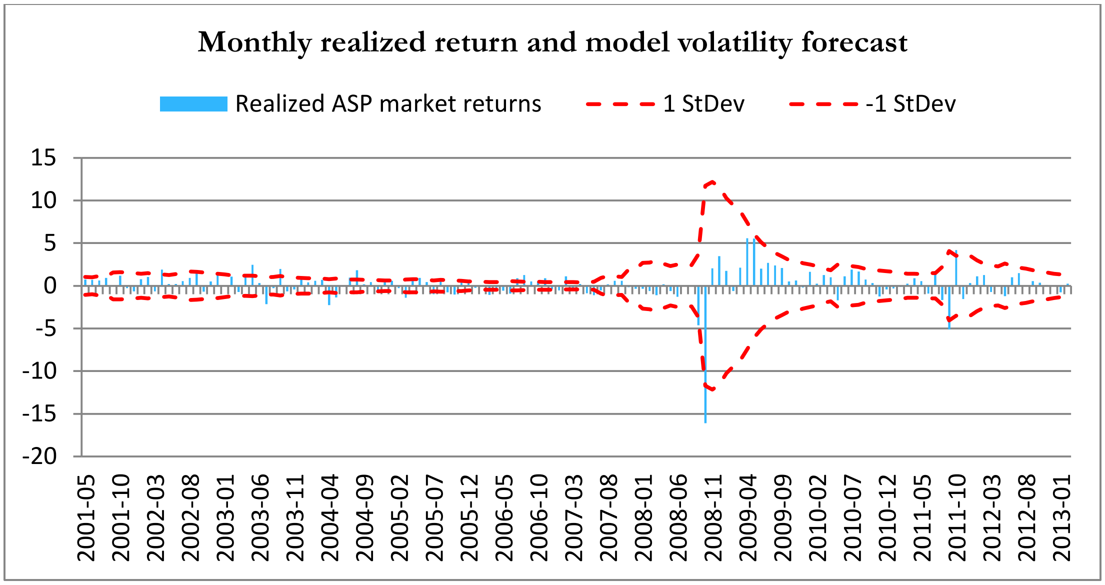
Next plot demonstrates the evolution of the model bias over time for four regional market portfolios:



Portfolio Returns vs. Predicted Risk

The plots below demonstrate the realized portfolio returns against the volatility predicted by our model. The results indicate that the model responds promptly to the volatility of the realized portfolio returns which is a highly desirable feature of the model.





> SUMMARY AND CONCLUSIONS

- We have presented a new Bloomberg Fixed Income Emerging Markets factor model based on fundamental factors.
- A single fixed income model providing risk forecast *of* a wide variety of portfolios ranging from those concentrated in a single market to large, international multi-asset class portfolios.
- The model offers broad coverage as well as in-depth analysis.
- The model is carefully constructed from a wide variety of data such as OAS, volatility, convexity, yield curves; market data on countries, industries and currencies.
- The structure of the model is chosen to be intuitive and with fully transparent methodology.
- At the same time, the model has high explanatory power for contemporaneous returns, maintains high forecasting ability in the high and low volatility environments and stays unbiased with no significant under- or over-forecasting of risk for a broad variety of portfolios.

> REFERENCES

[1] Yingjin Gan and Luiza Miranyan, "Fixed Income Fundamental Factor Model", September, 2013.

[2] Luiza Miranyan and Yingjin Gan, "Fixed Income Fundamental Factor Model: Emerging Markets", April 2013.

> CONTACT US

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BEIJING +86 10 6649 7500	**FRANKFURT** +49 69 9204 1210	**LONDON** +44 20 7330 7500	**NEW YORK** +1 212 318 2000	**SÃO PAULO** +55 11 2395 9000	**SYDNEY** +61 2 9777 8600
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