

POINT® Global Risk Model Update

This version corrects the description of the new US ABS risk model on page 4 by removing the manufactured housing DTS factor.

As part of the continuous effort of the POINT Global Risk Model (GRM) to provide asset and portfolio managers with enhanced risk forecasts, we expand our risk coverage in the GRM into new markets. This is driven by both increased demand from our clients for certain types of instruments and more historical data becoming available to construct standalone models. We introduce new functionalities and instruments to the risk model such as FX options. Finally, we review and update some of our existing risk models for which market conditions have changed recently.

This note discusses various enhancements to the POINT® GRM to be integrated in our November release (please refer to [POINT®3.14.9 release notes](#), 19 November 2014). These changes affect multiple components/asset classes of the GRM and are summarized as follows:

Calibrations:

- Officially release our new Mixed Frequency Calibration (please refer to [Mixed-frequency models and term structure of risk](#), July 2014).
- **Discontinue** our current model for daily risk under the weighted calibration. Clients looking for a daily horizon forecast should use the new mixed frequency calibration.

FX:

- Support of FX options in the GRM
- Introduce new FX factors for various EMG local markets: DOP, KES, GHS, MUR, MWK, NGN, RON, RSD, RWF, TND, UAH, UGX, UYU, VND, XOF and ZMW

Fixed Income:

- Update our existing US ABS, US MBS Hybrid Arm and US MBS Strip IO risk models.
- Expand our EM hard currency fixed income model to Croatia, Czech Republic, Jamaica, Pakistan and Romania. In addition, we differentiate corporate bonds from sovereign bonds by having separate risk factors for each bucket for issuers from Brazil, China, Chile, Colombia, the Arab Emirates, India, Indonesia, Mexico, Russia, South Korea and Turkey
- Introduce new treasury risk factors for Egypt, Nigeria and Romania
- Extend the treasury and swap spread risk factors to six key rates for AUD, CNH, CNY and SGD, in line with the other developed models with tenors for the 6m, 2y, 5y, 10y, 20y and 30y.
- Introduce detailed class 3 level credit models for CHF and CNY (similar level of details to the European Credit model)
- Introduce detailed class 2 level credit models for AUD and CNH (with different factors for local agencies, financials, industrials, utilities, non-corporate and collateralized bonds)

PLEASE SEE ANALYST CERTIFICATIONS AND IMPORTANT DISCLOSURES STARTING AFTER PAGE 16

Amine El Khanjar

+1 212 526 9415

amine.elkhanjar@barclays.com

Changxiu Li

+1 212 526 1745

changxiu.li@barclays.com

www.barclays.com

Equities:

- Introduce a new Emerging Markets equity risk model which significantly enhances our EM coverage and relies on similar estimation techniques used in our developed markets equity models. The model incorporates country risk factors, Fundamental/technical risk factors and GICS2 residual industry risk factors.
- Introduce a residual country factor for Canadian stocks to help better capture their systematic risk.
- In the current weighted calibration, developed market equities are treated differently than any other asset class and calibrated using a mixed frequency approach (please refer to [US Equity risk model](#), 29 March 2009). With the official release of a separate mixed-frequency calibration model across all asset classes, we terminate this different treatment. Specifically, for the weighted calibration, developed equities will now follow the exact same calibration as all other asset classes in that calibration – a standard Exponentially-Weighted Moving Average (EWMA) with a half life of one year, using only monthly data. Therefore, we expect volatility forecasts for this asset class in the weighted calibration to potentially change significantly. Clients looking for a mixed frequency approach for their equity portfolios should use the newly released Mixed Frequency Estimation.

All of these features were made available to clients in a preview mode (accessed by logging to POINT Preview). After the November release, all these enhancements will be used as the default features in the POINT® Global Risk Model.

The following sections explain the motivation behind the changes and discuss certain details on the relevant models. We also discuss the effect of these changes on risk forecasts for certain portfolios and indices.

FX-options in the GRM

We expanded our coverage to support FX-options in this release. All FX-options in POINT are user-defined instruments that are represented as a delta equivalent amount of an underlying FX-forward, as well as a head to capture additional analytics.

FX-options are fully supported in the Global Risk Model. The risk is classified into three categories, delta risk, convexity risk, and implied volatility risk. For complete documentation on the FX-option risk model, please refer to Barclays' publication *FX-options in POINT*, 15 October 2014.

US Securitized Products Risk Update

In this release we have updated three fundamental risk models in the universe of the US securitized products, namely, US ABS, US MBS Hybrid ARM and US MBS Strip IO. We have witnessed a significant change in the securitized product sector over the past years, brought on by such factors as the financial crisis, the unprecedented and persistent low level of interest rates, government and policy intervention in this market. We are continuing to update the securitized products risk models into their second generation, incorporating new market factors and these environment changes. This is the second round of upgrades following the US MBS fixed rate and US subprime risk models changes released in 2013.

The New US ABS Risk Model

The new US ABS risk model is estimated with security level data underlying Barclays US ABS (fixed rate) and US ABS floating rate indices. As of end of October 2014, the indices contain around 600 bonds collateralized by auto loans (including loans and floor plans), credit card, student loans and utility.

Motivation

The major motivation to revisit this model is the back performance of the old US ABS risk model, especially after the credit crisis. In a back performance analysis, one metric we follow closely is the standard deviation of the standardized return, which is defined as the realized return scaled by (ex-ante) forecasted volatility. Though not perfect, this is probably the most widely used and intuitive metric in out-of-sample volatility model evaluation. A perfect risk model implies this metric to equal 1. The old US ABS model reports this metric at 0.69 and 0.85, respectively, for the US ABS and US ABS floating rate indices, respectively, implying significant over forecast of the risk on the indices levels.

The New Model

The new model incorporates the duration-times-spread (DTS) approach, making it consistent with the other non agency mortgage risk models of POINT, such as subprime RMBS and CMBS models. The DTS risk model has been recognized for quickly reacting to changes in the volatility environment, both leading to a crisis as well as in their aftermath.

As a part of Barclays Global Risk Model (GRM), the US ABS risk model follows the general linear factor-based approach, where the total stochastic return of a security is decomposed into a systematic and an idiosyncratic component. The systematic return of a US ABS security is further split into curve risk, swap spread risk and ABS spread risks.

The curve risk and swap spread risk sections follow the standard approach that apply to all fixed income instruments in the GRM, i.e., we use six observed key rate and swap spread factors and one key rate convexity factor to capture the return coming from changes in the treasury and Libor curves. The risk loadings are the key rate durations (KRD), swap spread durations (SSD) and OAC, respectively.

The ABS spread risk includes an ultra high grade spread factor, a floating coupon factor and DTS factors for specific collateral: auto, credit card, student loans and utility.

In summary, the systematic factor model for security i at time t can be represented as:

$$\begin{aligned}
 R_{i,t+1}^{Stochastic} = & \sum_{K=1}^6 KRD_{i,t}^K \times F_{t+1}^{YC,K} + \sum_{K=1}^6 SSD_{i,t}^K \times F_{t+1}^{SS,K} + OAC_{i,t} \times F_{t+1}^{OAC} \\
 & + OASD_{i,t} \times (F_{t+1}^{UHG} + I_{i,t}^{FloatingCoupon} F_{t+1}^{Floating}) \\
 & + DTS_{i,t} \times (I_{i,t}^{Auto} F_{t+1}^{Auto} + I_{i,t}^{Card} F_{t+1}^{Card} + I_{i,t}^{SL} F_{t+1}^{SL} + I_{i,t}^{Utility} F_{t+1}^{Utility}) \\
 & + \varepsilon_{i,t+1}
 \end{aligned}$$

Where I represents an indicator variable, which takes a value of 1 if the bond belongs to its particular category (e.g., has a floating coupon) and 0 otherwise. Besides the observed factors on curve and swap spreads, all spread factors are estimated through robust regressions based on the monthly data underlying the Barclays US ABS and US ABS floating rate indices. The monthly realizations of the risk factors are aggregated into a panel database on which we base our covariance estimation.

The idiosyncratic return of a bond is the part of its return that is not captured by the systematic factors. It is assumed to be uncorrelated across bonds. Therefore the idiosyncratic risk is fully captured by the variance. Specifically, in our new model, the idiosyncratic variance of US ABS securities is driven by its spread duration:

$$\begin{aligned}
 Var(\varepsilon_{i,t+1}) = & OASD_{i,t}^2 \times (\theta_{t+1}^{Spread} + I_{i,t}^{FloatingCoupon} \times \theta_{t+1}^{Floating} \\
 & + I_{i,t}^{Auto} \times \theta_{t+1}^{Auto} + I_{i,t}^{Card} \times \theta_{t+1}^{Card} + I_{i,t}^{Utility} \times \theta_{t+1}^{Utility})
 \end{aligned}$$

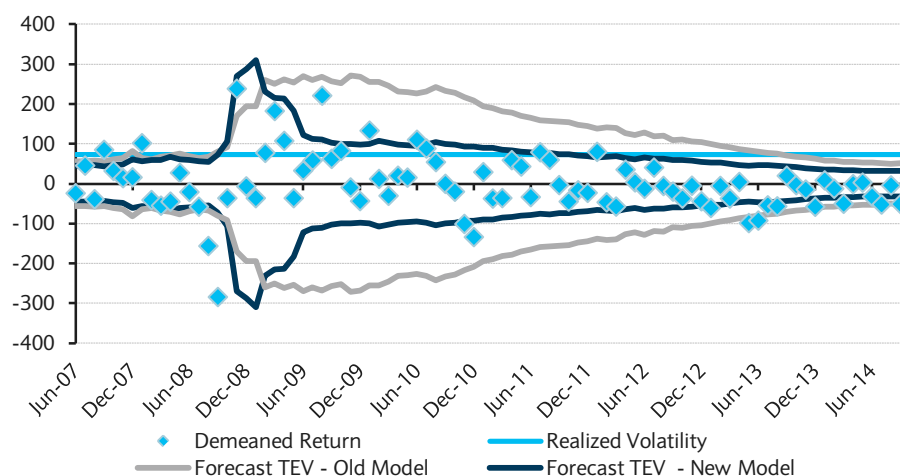
in which θ_{t+1}^{Spread} , $\theta_{t+1}^{Floating}$, θ_{t+1}^{Auto} , θ_{t+1}^{Card} and $\theta_{t+1}^{Utility}$ are the idio parameters estimated monthly using the robust regression.

Impact of the New Model

Figures 1 and 2 show the old and new volatility forecasts for the Barclays US ABS and US ABS floating rate indices. The new model significantly reduces the volatility forecast for these indices. In particular, as of the end of October 2014, we predict monthly volatility at 33bp/month and 19bp/month for US ABS and US ABS floating rate index, a significant risk reduction from 49bp/month and 50bp/month predicted by the old ABS risk model.

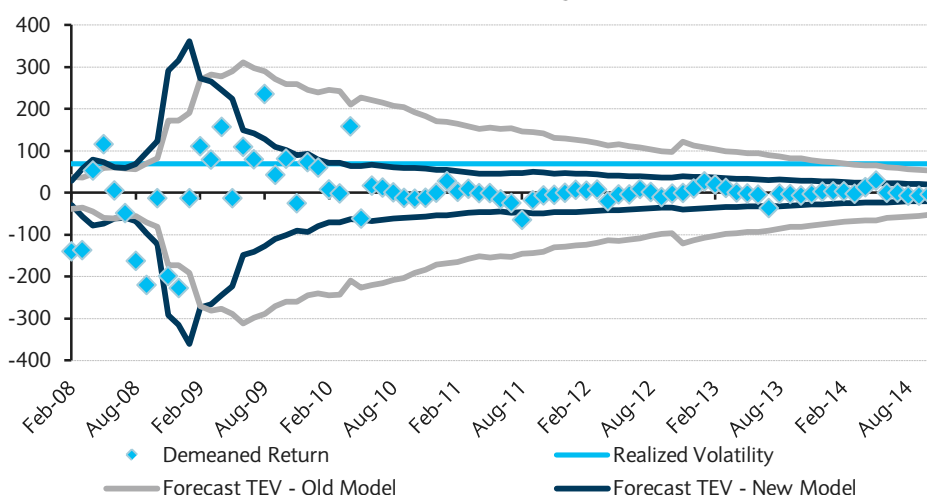
In addition, we can also see that the forecasted volatility under the new model is more in line with the actual return of the indices. Key metrics for measuring the backtesting performance of the models – such as the standard deviations of the standardized return – show significant improvements. They are 0.97 and 0.91 for the Barclays US ABS and US ABS floating rate indices, respectively, compared with 0.69 and 0.85 using the old ABS model.

FIGURE 1
Risk Model Back Performance on the US ABS Index



Source: Barclays Research

FIGURE 2
Risk Model Back Performance on the US ABS Floating Rate Index



Source: Barclays Research

The New US MBS Hybrid ARM Risk Model

The US MBS Hybrid ARM risk model is calibrated to the security level data underlying the Barclays US MBS Hybrid ARM index. As of the end of October 2014, the index contains more than 110 generic bonds collateralized by Fannie, Freddie and GN Hybrid ARM pools.

Hybrid ARM mortgage blends the characteristics of a fixed-rate mortgage and a regular adjustable-rate mortgage. The bond will have an initial fixed interest rate period (three years to 10 years in general) followed by an adjustable rate period after the reset date.

Motivation

The last credit crisis dramatically reshaped the securitized product market, further changed by the persistent low interest rate environment, the tightened underwriting standard and the substantial regulatory changes. Several of the factors in the old model, such as the “discount” and “current” factors, lost context in this new environment. This potentially impairs the explanatory power of the model and prevents it from adapting to new market conditions.

The New Model

Evolving from the current model, the new MBS Hybrid ARM risk model considerably extends the factor space to incorporate directly prepayment risk factors and additional spread factors. The structure of the Hybrid ARM factor model is comparable to the new MBS fixed rate risk model released in 2013 and the new Strip IO model that we will discuss in the next section.

The systematic risk includes curve risk, swap spread risk and MBS spread and vol risks. The curve risk and swap spread risk follow the same standard approach as described in the US ABS risk model earlier. The MBS spread and vol risk is decomposed into volatility risk, prepayment risk and other credit spread risk.

Hybrid ARM bonds are generally only sensitive to the short rate volatility due to the ARM structure after the reset date. We use one Hybrid ARM volatility factor whose loading is defined as the product of the volatility duration and a ramp function so that only Hybrid ARMs with OASD less than 4 have exposure to this factor.

There are two prepayment factors in the new model, dependent on the weighted average loan age (WALA) and the coupon rate. Our research shows that the higher the WALA, the higher the unpredicted prepayment volatility. A similar relationship exists for the coupon rate as well. The risk loadings to those factors are the bond's prepayment duration multiplying wala and coupon rate, respectively (see below).

We allow for five other spread factors to capture the spread risk related to agency credit, liquidity and others. The ultra high grade (UHG) spread factor applies to all hybrid ARMs, regardless of their spread level and programs. The high spread factor only applies to bonds with spread higher than a particular threshold¹. We also have spread factors for GNMA and by reset program types 7/1 ARMs and 10/1 ARMs.

In summary, the systematic factor model can be represented as:

$$\begin{aligned}
 R_{i,t+1}^{Stochastic} = & \sum_{K=1}^6 KRD_{i,t}^K \times F_{t+1}^{YC,K} + OAC_{i,t} \times F_{t+1}^{OAC} + \sum_{K=1}^6 SSD_{i,t}^K \times F_{t+1}^{SS,K} \\
 & + VolDur_{i,t} \times L_{i,t}^{Short} \times F_{t+1}^{Vol} \\
 & + PrepayDur_{i,t} \times [WALA_{i,t} \times F_{t+1}^{WALA} + (Coupon_{i,t} - Coupon_t^{MIN}) F_{t+1}^{Coupon}] \\
 & + OASD_{i,t} \times \left[F_{t+1}^{UHG} + \max(0, LOAS_{i,t} - LOAS_t^{High}) F_{t+1}^{HighSpread} \right] \\
 & + I_{i,t}^{GNMA} F_{t+1}^{GNMA} + I_{i,t}^{7/1} F_{t+1}^{7/1} + I_{i,t}^{10/1} F_{t+1}^{10/1} \\
 & + \varepsilon_{i,t+1}
 \end{aligned}$$

Among the risk factors, yield curve and swap spread factors are calculated from the observed curve shifts. All the MBS spread and volatility factors are estimated through robust regressions based on the monthly bond level data underlying the Barclays US MBS Hybrid ARM index.

In our new US MBS Hybrid ARM risk model, the idiosyncratic variance is driven by its spread duration, outstanding balance and coupon rate:

$$Var(\varepsilon_{i,t+1}) = OASD_{i,t}^2 \times (\theta_{t+1}^{Spread} + Balance_{i,t} \times \theta_{t+1}^{Balance} + Coupon_{i,t} \times \theta_{t+1}^{Coupon})$$

¹ The threshold is calibrated to top 10% of LOAS in the US MBS Hybrid ARM index.

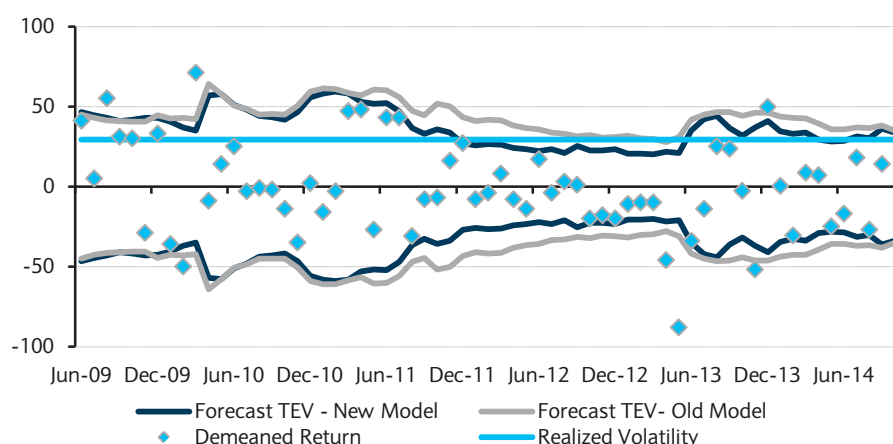
in which θ_{t+1}^{Spread} , $\theta_{t+1}^{Balance}$ and θ_{t+1}^{Coupon} are the idio parameters estimated monthly using the robust regression. We assume zero correlation of idiosyncratic returns across bonds in this market.

Impact of the New Model

We illustrate the impact of the new risk model in forecasting volatilities using the same analysis as in the previous section. Figure 3 shows the returns and volatility forecasts for the Barclays US MBS Hybrid ARM index. In terms of the total forecast volatility, the new model tracks closely the forecasts of the old model, especially before 2011 and again recently. As of the end of October 2014, we predict monthly volatility at 34bp/month, a level similar to the old model forecast of 35bp/month.

The key metric in the back performance, the standard deviations of the standardized return is also enhanced from 0.72 to 0.91 in the new model, signalling better performance with a slight risk overestimation over this period.

FIGURE 3
Risk Model Back Performance on the US MBS Hybrid ARM Index



Source: Barclays Research

The New US MBS Strip IO Risk Model

The new US MBS strip IO model follows a modelling structure similar to the MBS fixed rate model and to the Hybrid ARM model just presented. The estimation sample is a specific proprietary IO portfolio containing comparatively liquid IO securities. The prices on the bonds are proprietary trading prices marked daily by the Barclays secondary trading desk.

Motivation

The major motivation to revisit the model is the same as the one for Hybrid ARM. During the market dislocation of the past several years, the old factor structure lacked representativeness. Clearing up the ineffective factors requires us to steer away from the old factor approach that relies namely on the pricing tiers to their definition.

The New Model

The new factors are consistent with the second generation securitized models in which the systematic risk is decomposed into curve risk, swap spread risk, volatility risk, unpredicted prepayment risk and other spread risk.

Volatility risk factors are calibrated to the US MBS fixed rate index², where both a short and a long vol factor are used to capture the non-parallel shifts of the volatility surface. The risk loadings to these factors are calculated similarly to the MBS fixed rate risk model, as the product of the vol duration and ramp functions are dependent on the collateral's OASD. In particular, an IO bond whose collateral has OASD below 2 only has exposure to the short volatility factor, while above 4 only loads on the long volatility factor. The IO bond whose collateral has an OASD in between would load on both factors with loadings attributed linearly across them.

The prepayment factors include a base prepayment factor that all IO bonds are exposed to, and a refinancing incentive factor for bonds with high prepay tendency. We measure refinancing incentive as the coupon minus the corresponding current coupon rate mapped by issuer and programs. Current coupon is the coupon rate of the passthrough traded at par. A positive difference between the coupon and current coupon signals an excess interest payment above the risk-free discount curve, and therefore indicates a high mortgage prepayment tendency. In the new IO model, only bonds with refi incentive higher than a certain threshold³ load on this factor.

There are two other spread factors that capture the spread risk related to agency credit, liquidity and others: ultra high grade spread factor and a spread factor that depends on the balance factor. The balance factor is the ratio of the current balance over the original balance and it measures how much balance remains in the amortization. Our research shows that the bonds with higher balance factor tend to have higher spread return volatility.

In summary, the systematic factor model can be represented as:

$$\begin{aligned}
 R_{i,t+1}^{Stochastic} = & \sum_{K=1}^6 KRD_{i,t}^K \times F_{t+1}^{YC,K} + OAC_{i,t} \times F_{t+1}^{OAC} + \sum_{K=1}^6 SSD_{i,t}^K \times F_{t+1}^{SS,K} \\
 & + VolDur_{i,t} \times (L_{i,t}^{Short} \times F_{t+1}^{ShortVol} + L_{i,t}^{Long} \times F_{t+1}^{LongVol}) \\
 & + PrepayDur_{i,t} \times [F_{t+1}^{Prepay} + (RI_{i,t} - RI_t^{Median})F_{t+1}^{RI}] \\
 & + OASD_{i,t} \times [F_{t+1}^{UHG} + BalFactor_{i,t} \times F_{t+1}^{BalFactor}] \\
 & + \varepsilon_{i,t+1}
 \end{aligned}$$

Among the risk factors, yield curve and swap spread factors are calculated from the observed curve shifts; volatility factors are calibrated to the Barclays MBS fixed rate index and all the IO prepayment and other spread factors are estimated through robust regressions based on the monthly bond level data underlying the internal IO portfolio.

In the new US MBS IO risk model, the idiosyncratic variance is driven by its spread duration, balance factor and prepayment duration:

$$Var(\varepsilon_{i,t+1}) = OASD_{i,t}^2 \times (\theta_{t+1}^{Spread} + BalFactor_{i,t} \times \theta_{t+1}^{BalFactor}) + PrepayDur_{i,t}^2 \times \theta_{t+1}^{Prepay}$$

in which θ_{t+1}^{Spread} , $\theta_{t+1}^{BalFactor}$ and θ_{t+1}^{Prepay} are the idio parameters estimated monthly using the robust regression. Again, idiosyncratic risk is assumed uncorrelated across bonds.

Impact of the New Model

Figure 4 shows that the new model appears to track closely the old model volatility forecasts, for the calibration IO portfolio. However, this is mostly due to the large scale of the index volatility. For example, as of the end of October 2014, we predict monthly

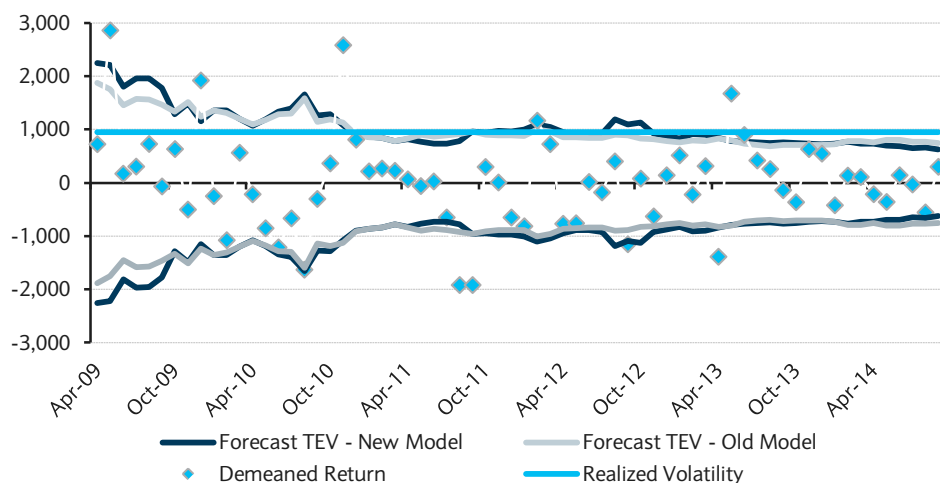
² Please refer to Barclays publication on *US MBS fixed rate risk model* for the details on the MBS volatility factors.

³ The threshold is determined as the median of the refinancing incentive of the IO calibration portfolio.

volatility at 660bp/month, a 12% reduction compared to the old model forecast at 747bp/month.

The key metric in the back performance, the standard deviations of the standardized return improves slightly to 0.85 from the old model at 0.84. It is important to emphasize that the changes to both the Hybrid ARM model and IO model were not mainly motivated by poor forecast performance of the model at the index level, as previously noted, rather than updating the risk factors to better reflect the dynamics of the mortgage markets.

FIGURE 4
Risk Model Back Performance on the IO Portfolio



Source: Barclays Research

Enhancements and updates in equities

Introduction of a new EMG equity risk model

We introduce a second-generation risk model for EMG equities in POINT®. The update of this risk model constitutes a significant enhancement to our emerging markets equity offering. As a result, our coverage in EM equities will expand to more than 16,000 different identifiers with risk model analytics.

The EM model incorporates a set of methodologies that were originally implemented in the US equity risk model (C. Ural, A. Silva, A. Staal *US Equity risk model*, 2009) and were successfully incorporated later into other developed markets equity models. The consistent approach in the methodology and factor structure among all the regional equity models allows us to combine them in an effective way in a global portfolio setting.

The model's structure can be summarized as follows:

- We use a three-step estimation procedure that facilitates a clean interpretation of the risk factors and allows for a more practical hedging of the systematic country risk.
- We estimate country factors for emerging market countries in the first step. The EMG country factors are for Brazil, Chile, China (off-shore), Colombia, Czech Republic, Egypt, Hungary, Indonesia, India, Greece, S. Korea, Mexico, Malaysia, Peru, Philippines, Poland, Russia, Thailand, Turkey, Taiwan and South Africa.
- The estimation of monthly exposures to these country factors (country betas) uses daily/weekly data depending on the liquidity of a given stock. These risk sensitivities are therefore robust and yet very dynamic.

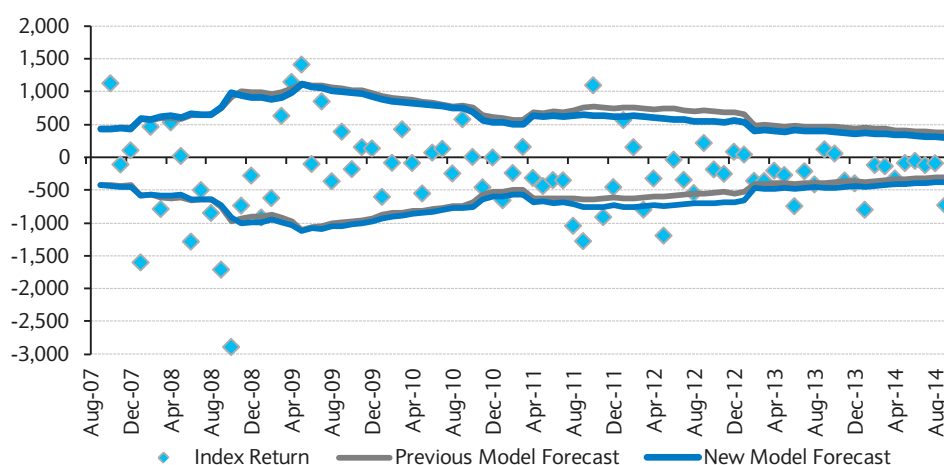
- We estimate eight fundamental/technical factors, as a second step, to account for the risk attributed to Dividend yield, Book to Price, Earnings to Price, Market Value, Corporate Default Probabilities, Momentum, Realized Volatility and Share Turnover.
- Finally, in the last step, we estimate 24 GICS2 residual industry factors. The loading for these factors is a binary loading, which depends on the industry the stock belongs to.
- The model also has 15 country factors for Frontier markets equities for: Argentina, the Arab Emirates, Bahrain, Bangladesh, China (onshore), Croatia, Kazakhstan, Kuwait, Morocco, Nigeria, Oman, Pakistan, Qatar, Saudi Arabia and Sri-lanka. Stocks from countries not covered by our list of Emerging and Frontier country factors will load into one of the model's three regional factors (ie, Americas, Asia, EMEA).
- The idiosyncratic volatility in the EM model also uses daily/weekly data depending on the liquidity of the stock.

We can see below the performance of the new model vs. the previous model over the past seven years using the GRM weighed EWMA calibration for the FTSE-Emerging markets index.

The key metric in the back performance, the standard deviations of the standardized return of the index, improves to 0.91 from the old model at 0.83.

FIGURE 5

The new EMG equity model back performance on the FTSE-Emerging markets index



Source: Barclays Research

Recalibration of the Asia Ex-Japan Equity Model and reclassification of certain countries

Along with the introduction of our second generation Emerging Markets equity model, we review our EM/developed markets classification in equities.

South Korea and Taiwan are now considered Emerging Markets and load on the new EM risk model factors. The Asia Ex-Japan equity model (which previously covered stocks from those two countries) has been re-calibrated to only include equities from Australia, Hong Kong, Singapore and New Zealand.

This resulted in significant volatility changes for certain industry factors in the Asia Pacific region that were dominated previously by companies from South Korea and Taiwan such as Automobiles or Semi-Conductors/Electronics.

Below is the effect of the model recalibration on the “MSCI Singapore” and “MSCI Australia” indices as of October 31, 2014 using our mixed frequency calibration. The TEV change is relatively small for the Singapore index and the TEV decreases by 13% for the Australian index.

FIGURE 6

The impact of the Asia Ex-Japan risk model recalibration

Index	Mxf TEV before	Mxf TEV after
MSCI-Singapore	342.2	330.1
MSCI Australia	556.6	484.6

Source: Barclays Research

Other notable countries’ reclassification in equities include Greece moving from the European equity model to the new Emerging markets model. In addition, Israel is now considered a developed country and would load on the European Equity risk factors.

Introduction of a residual country factor for Canadian equities

We introduce an additional residual country risk factor for Canadian stocks. Previously, Canadian equities had exposures to our detailed US equity model. Our research shows, however, that while correlations between Canadian and US local stock returns are relatively high, the volatilities of the former are typically lower. This implies that the US model tended to overestimate the TEV of Canadian stocks.

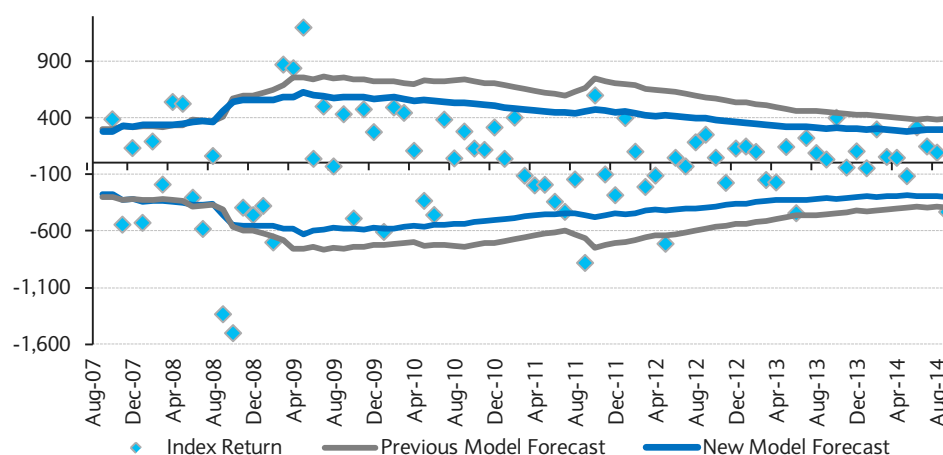
The additional country factor (with a unit loading) is constructed as the market capitalization weighted residual return not explained by industry and fundamental/technical US equity factors. The correlation between the US equity market factor and the newly introduced country factor is currently significantly negative, which tends to bring down the volatility level for Canadian equities.

Figure 7 describes the performance of the new enhanced model over the past seven years for the “FTSE-CANADA” equity index using the GRM weighed EWMA calibration. The new model is clearly performing better over the sample period and correct for the overestimation noticed in the previous model.

The volatility of the standardized return of the “FTSE CANADA” index is 101% under the new model compared to 89% under the previous model.

FIGURE 7

Back performance of the new Canadian equity model on the FTSE-Canada index



Source: Barclays Research

The weighted calibration in the GRM now uses monthly data for equities (EWMA time weighted)

With the official release of the monthly mixed-frequency calibration model, the weighted calibration for equities will use an EWMA calibration (time-weighted monthly data) similarly to the other asset in that calibration.

Historically, equity models used a mixed frequency approach to estimate the factors volatilities. Equity clients interested in the dynamic mixed frequency forecasts can use the monthly MXF calibration available as an option when setting up risk reports.

Enhancements to Emerging Markets Fixed Income models

The Hard Currency model

The November release also included a review of the EMG hard currency risk model. The model is now calibrated to securities issued by emerging markets countries in both USD and EUR. Previously, the model's systematic risk factors were only calibrated to USD securities from the "Barclays EM USD aggregate" and "Barclays Global Aggregate" indices.

In addition, with more historical data available, we introduce country-specific risk factors for Bahrain, Croatia, Czech Republic, Jamaica, Pakistan and Romania.

Furthermore, for certain countries we differentiate sovereign bonds and corporate bonds by having separate risk factors for each category. This was the case for deeper markets such as Brazil, China, Chile, Colombia, the Arab Emirates, India, Indonesia, Mexico, Russia, South Korea and Turkey. The two factors per country, although significantly correlated, can exhibit different volatilities historically. We believe that the new detailed model provides asset and portfolio managers with a better volatility and tail risk estimates as well as a detailed and intuitive breakdown of the sources of risk across all the securities in their EM portfolios.

Below are the changes in TEV forecasts for the relevant Barclays indices, which should provide an idea of the impact clients will see in their portfolios.

Overall, the effect on higher level EM indices is small. Smaller specialized EM indices can, however, have their TEV change noticeably.

FIGURE 8

The impact of the EM hard currency model review

Index	WW TEV before	WW TEV after
EM USD Aggregate	139.7	144.9
EM USD Aggregate Corp	120.7	117.4
EM USD Brazil Sovereign	182.6	202.3
EM USD Aggregate Czech Rep	131.7	142.1

Source: Barclays Research

The local Currency model

With many of the EMG fixed income markets evolving and as part of the GRM effort to provide complete coverage of clients' portfolios, we introduce treasury factors for Egypt, Nigeria and Romania. The factors represent the average change in yield and are based on the recently introduced EM local treasury indices for these three countries.

The table below illustrates the impact of the model change on the relevant Barclays indices. Previously these securities would load on our "other treasury" factor.

FIGURE 9

The impact of the EM local currency model review

Index	WW TEV before	WW TEV after
EM Local Currency Egypt	243.5	214.2
EM Local Currency Nigeria	381.1	270.2
EM Local Currency Romania	182.6	319.1

Source: Barclays Research

New FX factors

As part of the upcoming release, we also introduce new FX factors for many smaller EMG local markets. Namely the GRM now has specific currency (FX) risk factors for DOP, KES, GHS, MUR, MWK, NGN, RON, RSD, RWF, TND, UAH, UGX, UYU, VND, XOF and ZMW.

The addition of these new risk factors constitutes a significant enhancement to our local Fixed Income emerging markets offering as many investors believe that the main source of risk in these smaller EM markets is captured by currency risk.

Introduction of the new CHF Credit model

We also introduce a new detailed CHF credit spread model in this release. Previously, Swiss bonds in CHF would load on our EUR DTS credit spread factors in addition to the local currency, curve and swap spread factors.

The new model, which has a similar structure and level of detail to the European credit model, also uses a DTS approach and has industry factors for basic industrials, capital goods, automobiles, consumer cyclical, consumer non-cyclical, technology and communications, utilities, banking and brokerage, finance companies, insurance, non-corporate and collateralized. In addition, the model has Ultra High Grade and short and long maturity factors (please refer to [A note on the new approach to credit in the Barclays Global risk Model](#), 1 September 2009). The model also includes specific factors for local agencies and for local authorities.

The impact of the model change on higher level credit indices is minimal as can be seen in Figure 10, but we believe that these country-specific factors can play an important role in better explaining the systematic risk of specialized Swiss credit portfolios.

For example, the TEV of the Swiss Franc Securitized index drops 14% in the weighted calibration after the introduction of the new CHF model.

FIGURE 10

The TEV impact of the introduction of the CHF model

Index	WW TEV before	WW TEV after
CHF Agg Corp (FX hedged)	49.2	44.4
CHF Agg Securitized (FX hedged)	73.2	63.2

Source: Barclays Research

Improvement of the Asia Pacific local Fixed Income models

The Australian market

As the Australian Fixed Income market keeps evolving, we expand our AUD treasury and swap spread coverage to six key rate factors (6m, 2y, 5y, 10y, 20y, 30y tenors) in order to better detail the risk exposure across both local treasury and local swap curves. This expansion provides the Australian market a similar level of detail to our other developed markets.

Moreover, we review our current AUD Credit spread model and introduce new factors for local agencies and for local authorities with an OASD loading. The model also incorporate DTS factors for the industrials, financials, utilities, non-corporate and collateralized sectors as well as Ultra High Grade, short and long maturity factors. The inclusion of these factors – that may exhibit different behaviours and volatility dynamics – help highlight better the sources of risk in the AUD portfolios and provide more accurate volatility forecasts.

Figure 11 illustrates the effect of the model change on relevant Australian indices in the EWMA weighted calibration as of October 31, 2014.

FIGURE 11

The TEV impact of the Review of the AUD credit model

Index	WW TEV before	WW TEV after
Australian Agencies	74.7	69.4
Australian Aggregate	88.7	88.9
Australian Local Authorities	85.6	82.8
Australian Corporate	57.1	59.6

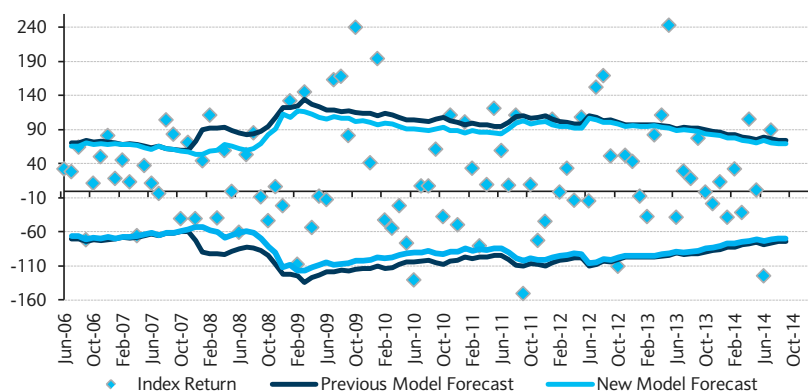
Source: Barclays Research

As an example, we look at the performance of the new AUD credit model in forecasting the volatility of the “Barclays Australian Agencies” index. Figure 12 shows that the introduction of the agency-specific factor helps correct the overestimation of the previous model.

The volatility of the standardized index return is 92% under the new model compared to 81% under the previous model.

FIGURE 12

Back performance of the revised AUD credit model on the Australian Agencies index



Source: Barclays Research

The Chinese on-shore market (CNY)

With the recent introduction of the “Barclays China Aggregate” index, we expand our CNY swap spread coverage to five key rate factors (2y, 5y, 10y, 20y and 30y tenors) to better detail the risk exposure across the local swap curve. These new factors complement the six CNY treasury key rate factors previously in the GRM.

Additionally, because of the depth (albeit short history) of the local corporate Chinese market, we introduce a new detailed class 3 level CNY credit spread model. The new model has a similar level of detail to the European credit model, uses a DTS approach and has industry factors for basic industrials, capital goods, automobiles, consumer cyclical, consumer non-cyclical, energy, technology and communications, transportation, utilities, banking and brokerage and finance companies. In addition, it has Ultra High Grade and short and long maturity factors. The model also includes specific factors for local agencies and for local authorities. Chinese securities with credit exposure were previously treated as treasuries and only had their risk explained by the local treasury curve factors. Because of the short history of the corporate data available, the CNY credit spread factors are only available from the beginning of 2014.

With the new factors, the volatility of the instruments exposed to the Libor curve increased significantly. This is due to the large volatility of our CNY Libor swap curve, especially on the short end. We will continue to monitor the behaviour and performance of the spread model and may adjust it in the future if that becomes necessary.

Figure 13 illustrates the effect of the model change on the main Chinese indices under the EWMA weighted calibration as of October 31, 2014.

FIGURE 13

The TEV impact of the introduction of the CNY credit model

Index	WW TEV before	WW TEV after
China Agencies	79.8	153
China Aggregate	86.7	114

Source: Barclays Research

The Chinese off-shore market (CNH)

With the increasing popularity of the Chinese off-shore (issued in CNH) fixed income instruments, The Global Risk Model update was a good opportunity to expand and improve our CNH fixed income models.

CNH treasury and swap spread factors now have six different tenors (6m, 2y, 5y, 10y, 20y, 30y tenors). The additional factors help detail the risk exposure across both the treasury and local swap curves.

We also introduce a new CNH Credit spread model with a new factor for local agencies with an OASD loading. The model also incorporates DTS factors for the industrials, financials and utilities sectors in addition to Ultra High Grade, short and long maturity factors.

Figure 14 illustrates the impact of the model change on the main CNH Chinese indices in POINT under the EWMA weighted calibration as of October 31, 2014.

FIGURE 14

The TEV impact of the introduction of the CNH credit model

Index	WW TEV before	WW TEV after
Offshore Renminbi (CNH)	66.1	81.8
Offshore Renminbi (CNH) Corporate	63.5	109.3
Offshore Renminbi (CNH) Agencies	68.6	76.6

Source: Barclays Research

The Singapore market

Similar to the AUD, CNY and CNH models previously discussed, we expand our SGD treasury and swap spread coverage to six key rate factors (6m, 2y, 5y, 10y, 20y, 30Yy tenors) to better detail the risk exposure across both local treasury and local swap curves.

References

- A. Silva, *A note on the New Approach to Credit in the Barclays Capital Global Risk Model*, Barclays, September 2009
- C. Ural, *US Equity Risk model*, Barclays, 2009
- C. Li and A. Silva, *US MBS Fixed Rate Risk Model*, Barclays, June 2013
- C. Li, S. Bittker, *FX-options in POINT*, Barclays, October 2014
- N. Schuehle, *POINT Mixed-frequency models and term structure of risk*, July 2014
- A. Lazanas, A. Silva, R. Gabudean, A. Staal, *A Portfolio Manager's Guide to Multi-Factor Fixed Income Risk Models and Their Applications*, June 2011

Analyst Certification

We, Amine El Khanjar and Changxiu Li, hereby certify (1) that the views expressed in this research report accurately reflect our personal views about any or all of the subject securities or issuers referred to in this research report and (2) no part of our compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this research report.

Important Disclosures:

Barclays Research is a part of the Corporate and Investment Banking division of Barclays Bank PLC and its affiliates (collectively and each individually, "Barclays"). For current important disclosures regarding companies that are the subject of this research report, please send a written request to: Barclays Research Compliance, 745 Seventh Avenue, 14th Floor, New York, NY 10019 or refer to <http://publicresearch.barclays.com> or call 212-526-1072.

Barclays Capital Inc. and/or one of its affiliates does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that Barclays may have a conflict of interest that could affect the objectivity of this report. Barclays Capital Inc. and/or one of its affiliates regularly trades, generally deals as principal and generally provides liquidity (as market maker or otherwise) in the debt securities that are the subject of this research report (and related derivatives thereof). Barclays trading desks may have either a long and/or short position in such securities, other financial instruments and/or derivatives, which may pose a conflict with the interests of investing customers. Where permitted and subject to appropriate information barrier restrictions, Barclays fixed income research analysts regularly interact with its trading desk personnel regarding current market conditions and prices. Barclays fixed income research analysts receive compensation based on various factors including, but not limited to, the quality of their work, the overall performance of the firm (including the profitability of the investment banking department), the profitability and revenues of the Fixed Income, Currencies and Commodities Division and the potential interest of the firm's investing clients in research with respect to the asset class covered by the analyst. To the extent that any historical pricing information was obtained from Barclays trading desks, the firm makes no representation that it is accurate or complete. All levels, prices and spreads are historical and do not represent current market levels, prices or spreads, some or all of which may have changed since the publication of this document. Barclays produces various types of research including, but not limited to, fundamental analysis, equity-linked analysis, quantitative analysis, and trade ideas. Recommendations contained in one type of research may differ from recommendations contained in other types of research, whether as a result of differing time horizons, methodologies, or otherwise. Unless otherwise indicated, Barclays trade ideas are provided as of the date of this report and are subject to change without notice due to changes in prices. In order to access Barclays Statement regarding Research Dissemination Policies and Procedures, please refer to <https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-research-dissemination.html>. In order to access Barclays Research Conflict Management Policy Statement, please refer to: <https://live.barcap.com/publiccp/RSR/nyfipubs/disclaimer/disclaimer-conflict-management.html>.

Disclaimer:

This publication has been prepared by the Corporate and Investment Banking division of Barclays Bank PLC and/or one or more of its affiliates (collectively and each individually, "Barclays"). It has been issued by one or more Barclays legal entities within its Corporate and Investment Banking division as provided below. It is provided to our clients for information purposes only, and Barclays makes no express or implied warranties, and expressly disclaims all warranties of merchantability or fitness for a particular purpose or use with respect to any data included in this publication. Barclays will not treat unauthorized recipients of this report as its clients. Prices shown are indicative and Barclays is not offering to buy or sell or soliciting offers to buy or sell any financial instrument.

Without limiting any of the foregoing and to the extent permitted by law, in no event shall Barclays, nor any affiliate, nor any of their respective officers, directors, partners, or employees have any liability for (a) any special, punitive, indirect, or consequential damages; or (b) any lost profits, lost revenue, loss of anticipated savings or loss of opportunity or other financial loss, even if notified of the possibility of such damages, arising from any use of this publication or its contents.

Other than disclosures relating to Barclays, the information contained in this publication has been obtained from sources that Barclays Research believes to be reliable, but Barclays does not represent or warrant that it is accurate or complete. Barclays is not responsible for, and makes no warranties whatsoever as to, the content of any third-party web site accessed via a hyperlink in this publication and such information is not incorporated by reference.

The views in this publication are those of the author(s) and are subject to change, and Barclays has no obligation to update its opinions or the information in this publication. The analyst recommendations in this publication reflect solely and exclusively those of the author(s), and such opinions were prepared independently of any other interests, including those of Barclays and/or its affiliates. This publication does not constitute personal investment advice or take into account the individual financial circumstances or objectives of the clients who receive it. The securities discussed herein may not be suitable for all investors. Barclays recommends that investors independently evaluate each issuer, security or instrument discussed herein and consult any independent advisors they believe necessary. The value of and income from any investment may fluctuate from day to day as a result of changes in relevant economic markets (including changes in market liquidity). The information herein is not intended to predict actual results, which may differ substantially from those reflected. Past performance is not necessarily indicative of future results.

This material has been issued and approved for distribution in the UK and European Economic Area ("EEA") by Barclays Bank PLC. It is being made available primarily to persons who are investment professionals as that term is defined in Article 19 of the Financial Services and Markets Act 2000 (Financial Promotion) Order 2005. It is directed at, and therefore should only be relied upon by, persons who have professional experience in matters relating to investments. The investments to which it relates are available only to such persons and will be entered into only with such persons. Barclays Bank PLC is authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority and is a member of the London Stock Exchange.

The Corporate and Investment Banking division of Barclays undertakes U.S. securities business in the name of its wholly owned subsidiary Barclays Capital Inc., a FINRA and SIPC member. Barclays Capital Inc., a U.S. registered broker/dealer, is distributing this material in the United States and, in connection therewith accepts responsibility for its contents. Any U.S. person wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of Barclays Capital Inc. in the U.S. at 745 Seventh Avenue, New York, New York 10019.

Non-U.S. persons should contact and execute transactions through a Barclays Bank PLC branch or affiliate in their home jurisdiction unless local regulations permit otherwise.

Barclays Bank PLC, Paris Branch (registered in France under Paris RCS number 381 066 281) is regulated by the Autorité des marchés financiers and the Autorité de contrôle prudentiel. Registered office 34/36 Avenue de Friedland 75008 Paris.

This material is distributed in Canada by Barclays Capital Canada Inc., a registered investment dealer and member of IIROC (www.iroc.ca).

Subject to the conditions of this publication as set out above, the Corporate & Investment Banking Division of Absa Bank Limited, an authorised financial

services provider (Registration No.: 1986/004794/06. Registered Credit Provider Reg No NCRCP7), is distributing this material in South Africa. Absa Bank Limited is regulated by the South African Reserve Bank. This publication is not, nor is it intended to be, advice as defined and/or contemplated in the (South African) Financial Advisory and Intermediary Services Act, 37 of 2002, or any other financial, investment, trading, tax, legal, accounting, retirement, actuarial or other professional advice or service whatsoever. Any South African person or entity wishing to effect a transaction in any security discussed herein should do so only by contacting a representative of the Corporate & Investment Banking Division of Absa Bank Limited in South Africa, 15 Alice Lane, Sandton, Johannesburg, Gauteng 2196. Absa Bank Limited is a member of the Barclays group.

In Japan, foreign exchange research reports are prepared and distributed by Barclays Bank PLC Tokyo Branch. Other research reports are distributed to institutional investors in Japan by Barclays Securities Japan Limited. Barclays Securities Japan Limited is a joint-stock company incorporated in Japan with registered office of 6-10-1 Roppongi, Minato-ku, Tokyo 106-6131, Japan. It is a subsidiary of Barclays Bank PLC and a registered financial instruments firm regulated by the Financial Services Agency of Japan. Registered Number: Kanto Zaimukyokuchō (kinsho) No. 143.

Barclays Bank PLC, Hong Kong Branch is distributing this material in Hong Kong as an authorised institution regulated by the Hong Kong Monetary Authority. Registered Office: 41/F, Cheung Kong Center, 2 Queen's Road Central, Hong Kong.

Information on securities/instruments that trade in Taiwan or written by a Taiwan-based research analyst is distributed by Barclays Capital Securities Taiwan Limited to its clients. The material on securities/instruments not traded in Taiwan is not to be construed as 'recommendation' in Taiwan. Barclays Capital Securities Taiwan Limited does not accept orders from clients to trade in such securities. This material may not be distributed to the public media or used by the public media without prior written consent of Barclays.

This material is distributed in South Korea by Barclays Capital Securities Limited, Seoul Branch.

All equity research material is distributed in India by Barclays Securities (India) Private Limited (SEBI Registration No: INB/INF 231292732 (NSE), INB/INF 011292738 (BSE) | Corporate Identification Number: U67120MH2006PTC161063 | Registered Office: 208 | Ceejay House | Dr. Annie Besant Road | Shivsagar Estate | Worli | Mumbai - 400 018 | India, Phone: + 91 22 67196363). Other research reports are distributed in India by Barclays Bank PLC, India Branch.

Barclays Bank PLC Frankfurt Branch distributes this material in Germany under the supervision of Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin).

This material is distributed in Malaysia by Barclays Capital Markets Malaysia Sdn Bhd.

This material is distributed in Brazil by Banco Barclays S.A.

This material is distributed in Mexico by Barclays Bank Mexico, S.A.

Barclays Bank PLC in the Dubai International Financial Centre (Registered No. 0060) is regulated by the Dubai Financial Services Authority (DFSA). Principal place of business in the Dubai International Financial Centre: The Gate Village, Building 4, Level 4, PO Box 506504, Dubai, United Arab Emirates. Barclays Bank PLC-DIFC Branch, may only undertake the financial services activities that fall within the scope of its existing DFSA licence. Related financial products or services are only available to Professional Clients, as defined by the Dubai Financial Services Authority.

Barclays Bank PLC in the UAE is regulated by the Central Bank of the UAE and is licensed to conduct business activities as a branch of a commercial bank incorporated outside the UAE in Dubai (Licence No.: 13/1844/2008, Registered Office: Building No. 6, Burj Dubai Business Hub, Sheikh Zayed Road, Dubai City) and Abu Dhabi (Licence No.: 13/952/2008, Registered Office: Al Jazira Towers, Hamdan Street, PO Box 2734, Abu Dhabi).

Barclays Bank PLC in the Qatar Financial Centre (Registered No. 00018) is authorised by the Qatar Financial Centre Regulatory Authority (QFCRA). Barclays Bank PLC-QFC Branch may only undertake the regulated activities that fall within the scope of its existing QFCRA licence. Principal place of business in Qatar: Qatar Financial Centre, Office 1002, 10th Floor, QFC Tower, Diplomatic Area, West Bay, PO Box 15891, Doha, Qatar. Related financial products or services are only available to Business Customers as defined by the Qatar Financial Centre Regulatory Authority.

This material is distributed in the UAE (including the Dubai International Financial Centre) and Qatar by Barclays Bank PLC.

This material is distributed in Saudi Arabia by Barclays Saudi Arabia ('BSA'). It is not the intention of the publication to be used or deemed as recommendation, option or advice for any action(s) that may take place in future. Barclays Saudi Arabia is a Closed Joint Stock Company, (CMA License No. 09141-37). Registered office Al Faisaliah Tower, Level 18, Riyadh 11311, Kingdom of Saudi Arabia. Authorised and regulated by the Capital Market Authority, Commercial Registration Number: 1010283024.

This material is distributed in Russia by OOO Barclays Capital, affiliated company of Barclays Bank PLC, registered and regulated in Russia by the FSFM. Broker License #177-11850-100000; Dealer License #177-11855-010000. Registered address in Russia: 125047 Moscow, 1st Tverskaya-Yamskaya str. 21.

This material is distributed in Singapore by the Singapore branch of Barclays Bank PLC, a bank licensed in Singapore by the Monetary Authority of Singapore. For matters in connection with this report, recipients in Singapore may contact the Singapore branch of Barclays Bank PLC, whose registered address is One Raffles Quay Level 28, South Tower, Singapore 048583.

Barclays Bank PLC, Australia Branch (ARBN 062 449 585, AFSL 246617) is distributing this material in Australia. It is directed at 'wholesale clients' as defined by Australian Corporations Act 2001.

IRS Circular 230 Prepared Materials Disclaimer: Barclays does not provide tax advice and nothing contained herein should be construed to be tax advice. Please be advised that any discussion of U.S. tax matters contained herein (including any attachments) (i) is not intended or written to be used, and cannot be used, by you for the purpose of avoiding U.S. tax-related penalties; and (ii) was written to support the promotion or marketing of the transactions or other matters addressed herein. Accordingly, you should seek advice based on your particular circumstances from an independent tax advisor.

© Copyright Barclays Bank PLC (2014). All rights reserved. No part of this publication may be reproduced or redistributed in any manner without the prior written permission of Barclays. Barclays Bank PLC is registered in England No. 1026167. Registered office 1 Churchill Place, London, E14 5HP. Additional information regarding this publication will be furnished upon request.

