MOODY'S ANALYTICS

METHODOLOGY

Stressed Scenarios and Linkages to Market Risk Instruments

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Introduction

The purpose of this paper is to demonstrate a two-step methodology for forecasting and stress-testing market risk instruments with explicit links to stressed macro scenarios. Examples of conditional forecasts of market risk variables are presented and econometrics behind the financial models are discussed. The proposed methodology can be leveraged to perform scenario-conditional stress-testing exercises.

Introduction

The demand placed on the forecasting and stress-testing of market risk instruments by regulators and financial institutions has grown tremendously in recent years. The concept of market risk refers to the risk of losses due to changes in financial variables such as interest rates, foreign exchange rates, and asset prices and volatilities, whose values are set in public markets. An extensive list of market risk variables represents a next layer of risk indicators built upon core macroeconomic and financial drivers used by financial institutions for regulatory compliance, business planning, and investment strategy development.

Modern stress-testing exercises, including regulatory, customized, and Moody's Analytics alternative scenarios,[1] are designed to anticipate a broad spectrum of shocks to create a forward-looking insight for financial institutions to prepare for changing economic and market conditions. For deep and integrated risk management, stress-testing is carried across many layers of macro and financial variables that often extend beyond regulatory requirements to support strategic growth objectives. The methodology presented in this article is designed to map the initial assumptions of alternative scenarios on the core drivers into an extensive set of market risk variables.

This methodology is a two-stage process generating forecasts that ensure cross-consistency between projections for core macroeconomic and financial series and the market risk variables. The first stage consists of generating the forecasts of core drivers, either provided directly by a regulator or a client or generated in Moody's Analytics macro-econometric country models. At the second stage, satellite models are used to generate market risk variables forecasts conditional on assumptions on the core variables. This allows us to produce reasonable in-sample fit and generate consistent, sensible, out-of-sample forecasts for stressed scenarios. Satellite model selection is based on a combination of economic theory, regulatory assumptions, and the statistical properties of the estimated model. This paper describes general satellite modeling framework and shows some applied examples, using most the recent econometric techniques.

To set up the satellite models, we build upon extensive academic literature that has developed a large number of financial models adopted by practitioners. These models could be divided into groups depending on the type of market risk variables, underlying core macro determinants, and econometric techniques. Both time series and cross-sectional methodologies play an important role in empirical investigation of financial series. Many of the market risk variables represent a whole term or rating structure rather than a univariate time series. There are numerous examples in the literature that focus on the reduction of the dimension of cross-section to a smaller number of unobserved factors. The principal component analysis is performed on interest rates, equities, and foreign exchange rates with different setups and focuses. In addition, PCA has been applied to not only levels but also the derivative features of interest rates, such as option-implied volatilities (Cont and Fonseca, 2002).

Recently, empirical financial models have greatly evolved in direct response to new features found in the data coming from financial markets. Stochastic variance models and their extensions have become increasingly popular, while newer developments incorporate breaking trends and dependence between distant observations. The autogressive conditional heteroskedasticity process proposed by Engle (1982) and generalized ARCH by Bollerslev (1986) became the benchmark for modeling and forecasting asset returns and volatilities.[2] There is evidence that these models provide reliable estimates and forecasts of financial time series, since they are able to reproduce the periods of volatility clustering, particularly at high frequencies. This is especially true for returns on financial assets such as stocks, exchange rates, and various interest rates.[3]

[1]The supervisory scenarios are provided by regulators such as the U.S. Federal Reserve for the annual Comprehensive Capital Analysis and Review, the U.K. Prudential Regulation Authority (a part of the Bank of England) for the biannual scenario, and the European Banking Authority for irregular stress tests. For custom scenarios, the targets are usually specified by the clients in terms of severity metrics. Moody's Analytics also produces baseline forecasts and alterative scenarios (S1 through S6 and S8) for 49 countries, representing more than 90% of global GDP. These forecasts and alternative scenarios are updated monthly, reflecting the latest economic data, conditions and expectations.

[2]Their extensions and modifications include TARCH and EGARCH models that allow negative shocks to behave differently than positive shocks, while IGARCH allows volatility shocks to be permanent. Another powerful model is GARCH in mean that allows volatility to directly influence asset market mean returns.

[3]Other examples include commodities, swaptions, and cap and floor volatilities.

Despite the extensive coverage of most popular financial instruments and their models, the academic literature on corporate and sovereign credit default swaps and mortgage-backed securities is relatively young, yet rapidly growing. Although there have been several treatments of the corporate CDS markets, there is less attention devoted to its sovereign analogue. With the outbreak of the sovereign debt crisis, SCDS have become important tools in the management of credit risk. There is consensus in the academic literature that there exists a common factor driving SCDS for different countries. Some studies argue for the leading role of global factors, while others emphasize local drivers (see Ang and Longstaff, 2013).

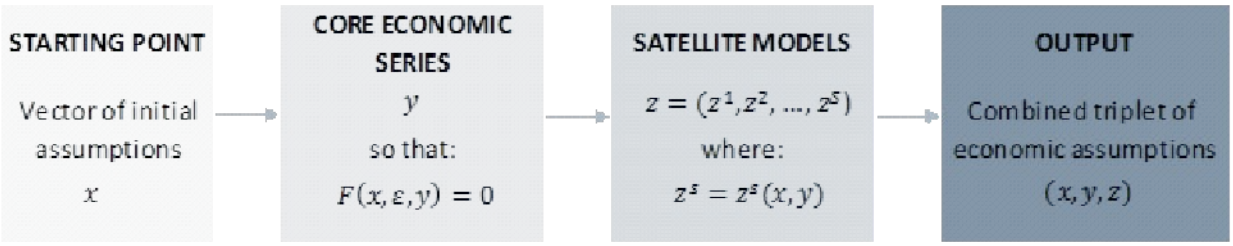
The literature is similarly scarce regarding the modeling and forecasting of MBS. Existing empirical studies mostly focus on finding candidate drivers for agency MBS spreads such as Freddie Mac and Fannie Mae (Hancock, 2011; Boyarchenko et al. 2015). To the best of our knowledge, there are no comprehensive studies that forecast or stress-test these instruments in a dynamic environment over a long forecast horizon relevant for business planning (two, three or even five years).

Our two-stage modeling framework is capable of generating forecasts over long horizons for a wide range of market risk variables. The extent of quantitative projections of specific macroeconomic and financial series provided by regulators varies widely, from just a handful of key factors to a fairly comprehensive list of financial and macroeconomic drivers. The practical challenge of satellite models is to map the given initial core assumptions onto a larger set of market risk variables. The starting point is expanding the initial assumptions to other core macro and financial series where applicable in Moody's Analytics macro-econometric models. The country models aim at reasonable baseline projections under standard economic conditions as well as generate forecasts under alternative assumptions provided either by regulators, clients or Moody's Analytics scenarios. In the second stage, we design satellite models for each group of market risk variables that input the core drivers for the purpose of stress-testing. This paper describes the application of such methodology using the examples of stock market returns, implied volatilities, asset-backed securities, and sovereign credit default swaps.

General satellite modeling framework

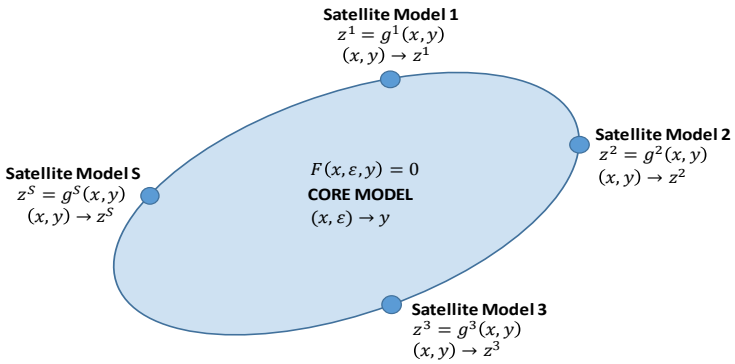
To map the stress scenario assumptions to market risk variables, we define satellite models that have an explicit and transparent connection to the core drivers in a multivariate, parametric and semi-structural framework. The forecasts of the core drivers generated at the first stage are fed into the satellite models, mapping the effects of shocks onto a large set of the market risk variables. This approach allows us to produce reasonable in-sample fit and generate consistent, sensible, out-of-sample forecasts for stressed scenarios.

The process of forecast generation starts with a set of initial assumptions, captured in a vector x. These could be regulatory, custom or Moody's Analytics scenario assumptions. The next step consists of translating these shocks into a group of core macroeconomic and financial series, collected in a vector y. With the information from the pair (x,y), we populate values for a long list of parameters, grouped into what we refer to as the vector of satellite models: $z = (z^1, z^2, \dots, z^S)$. The final output of the scenario phase gets summarized in the triplet (x,y,z). This combined vector is a starting point for the modeling of credit, market, liquidity and operational risk parameters.



Each satellite model is defined such that there is no feedback between satellite variables and core drivers, since the stress-test exercise is unidirectional, that is, modeling a risk metric as a function of core macroeconomic and financial variables. These

satellite equations contain core variables or their combination. The figure below illustrates the satellite equations centered on a core macroeconomic model. Consider a group of S satellite models, labeled $s \in \{1,2,3,\ldots,S\}$. Each of these equations is such that the endogenous variables $\mathbf{z^s}$ can be obtained as an explicit mapping of the core economic variables, $\mathbf{z^s = g^s(x,y)}$.



To illustrate the concept of satellite models, we show a time-series example of the behavior of z_t^s, with lags of (x,y,z) and a residual term, μ_t^s, as potential explanatory variables:

$$z_t^s = f(x_t, x_{t-1}, x_{t-2}, \ldots, x_{t-L}, y_t, y_{t-1}, y_{t-2}, \ldots, y_{t-L}, z_{t-1}^s, z_{t-2}^s, \ldots, z_{t-T}^s, \mu_t^s)$$

With z_t^s as the only variable on the left-hand side of the equation, the relationship is unidirectional: from (x,y) to z. This simple time-series satellite model allows for no interactions with other satellite variables nor any feedback between z_t^s and the core regulatory assumptions in (x,y).

Standard time-series models such as autoregressive moving average models are good examples of satellite models. This representation may include autoregressive lags and/or moving average components. A standard Box-Jenkins methodology is followed to find the most parsimonious model of the data-generating process for a given risk metric Z_t

$$Z_t = c + \sum_{l=0}^{N} \beta_l X_{t-l} + \sum_{l=0}^{P} \rho_l Y_{t-l} + \sum_{l=1}^{L} \partial_l Z_{t-l} + \sum_{k=0}^{K} \theta_k \varepsilon_{t-k}, \quad (1)$$

where Z_t is a satellite variable, X_t is a row vector of initial exogenous core variables provided by the regulator, Y_t is a row vector of the next layer of core macroeconomic and financial series produced in Moody's Analytics country models, and ε is the value of the stochastic error term. The parameters c, β, ρ, ∂ are unknown and are to be estimated.

However, including autoregressive terms in the model often results in a muted impact of core drivers on a target supplementary variable. Thus, it is a common practice and recommended by regulators to exclude autoregressive terms in the supplementary variable equations.

Model selection procedure

A key aspect of satellite model development is variable selection to identify which core drivers best explain the dynamic behavior of the market risk variable in question. Aligned with principles of modern econometrics, our approach toward variable selection is based on a combination of economic theory or intuition, regulatory assumptions, and a consideration of the statistical properties of the estimated model. Models built using pure data-mining techniques or principles such as machine learning, though they may fit the existing data well, are more likely to fail in a changing external environment because they lack theoretical underpinnings. The best prediction models employ a combination of statistical rigor with a healthy dose of economic principle. Hence, our models combine expert judgment with statistical optimization. Models built this way enjoy the additional benefit of ease of interpretation.

The satellite model development process consists of selecting optimal exogenous drivers X_t, Y_t in equation (1) from a pool of potential drivers. Once the final model is selected and estimated, the conditional dynamic forecasts of Z_t are generated given the sets of final parameter estimates and the forecasts of the core variables from the first stage. The next step is to validate the final model in and out of sample.

The procedure of selecting optimal drivers is the following. First, potential drivers are identified based on relevant economic theory and ensuring consistency with regulatory or custom assumptions. Second, these potential drivers undergo the exhaustive search process, whereby all possible combinations of variables are tested, including all lag combinations up to two quarters. This ensures that we obtain the most robust and predictive model available from the tested variables. To avoid model over-fitting, up to three uncorrelated core drivers are typically selected. The selected drivers should be significant at a conventional level and have the expected sign of the coefficient estimate.[4] The final models selected by the exhaustive search procedure are always reviewed for consistency with regulatory assumptions.

The in-sample validation of the final model helps us identify sensitivities, stability issues, and other potential problems. A wide range of diagnostic methods is available to verify regression model assumptions and detect other potential problems such as outliers.[5] Of note, there is a trade-off between not adding lags of dependent variables, thus allowing potential autocorrelation in residuals, and obtaining a reasonable spread between the forecasts of alternative scenarios. In such cases, we correct for this by applying robust standard errors using the Newey-West variance estimator to produce consistent estimates when there is autocorrelation in addition to possible heteroskedasticity.

Concerning the out-of-sample validation, a typical analysis includes back-testing and sensitivity. For back-testing, parts of the sample data are removed from the model estimation and the model is used to generate forecasts for the resulting validation sample to assess the model's accuracy and to determine whether the errors are similar to those for the entire sample. For sensitivity, we look at impulse responses to each of the drivers included in the final model and at the beta elasticity of dependent variables to each of its right-hand-side drivers. For impulse response analysis, a shock occurs only in one driver at a time, since the shocks in different drivers are independent. For example, a shock of one-standard-deviation size is applied to one driver at a time, and the model is used to forecast the dependent variable. The beta elasticity quantifies the response of the dependent variable to a one-standard-deviation shock on each driver. This standardizes each driver's coefficient estimate such that they become identical to estimates from a regression on standardized variables.

To maximize the informative content of core macro and financial drivers, the global factors are often used. They reduce the dimensional space of the explanatory variables, thus achieving more parsimony and flexibility. The principle component analysis is used to extract relevant business cycle information from the sets of macroeconomic variables. The key global factors include the global growth factor, the global equity factor, and the global equity volatility factor. Each of these factors represents the variance of a wide range of constituent macro and financial variables as well as geographical territories.

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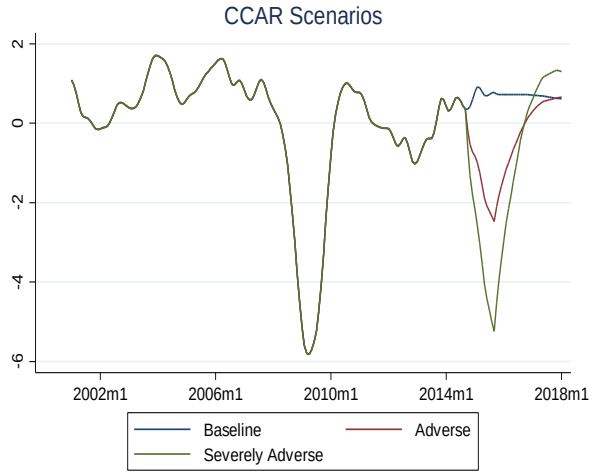
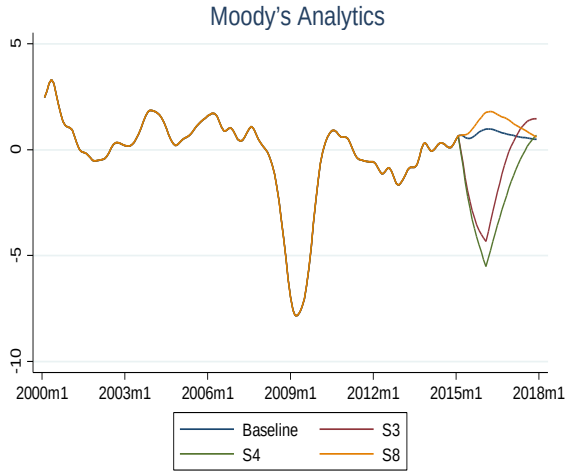
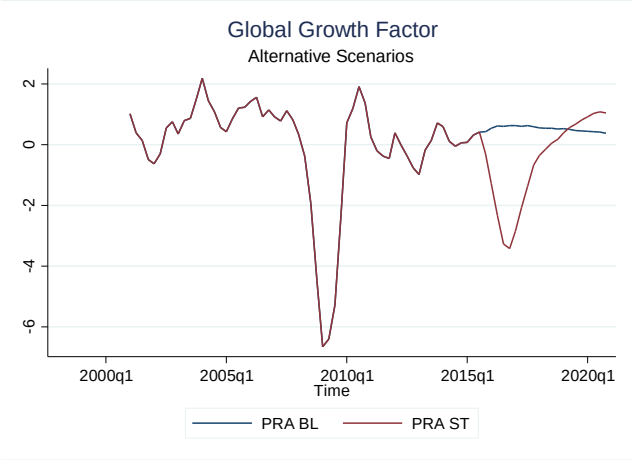
[4] From the models that pass these criteria we select the best model by maximizing the ratio $\frac{Adj.R^2}{RMSE}$, where $Adj.R^2 = 1 - (1 - R^2)\frac{n-1}{n-m-1}$, $R^2 = \frac{\sum_1^n (y_i - \hat{y}_i)^2}{\sum_1^n (y_i - \bar{y})^2}$, $RMSE = \sqrt{\frac{1}{n}\sum_1^n (y_i - \widehat{y_i})^2}$, n denotes the number of variables and m the number of parameters to be estimated (excluding a constant). While the adjusted R^2 measures the share of total variation explained by the driver(s) considering the degrees of freedom of the regression equation, the RMSE captures the average deviation of estimates from observed values. We also restrict a threshold variation on $\frac{Adj.R^2}{RMSE}$ when adding an extra driver.

[5] If a single observation or small group of observations can make a large difference in the results of regression output, it is important to identify them and investigate further. An observation can be unusual if it is an outlier, has high leverage, or exerts strong influence. While outliers are observations with large residuals, leverage is a measure of how far an observation deviates from its mean. Influential points combine features of outliers and high leverage; removing influential observations substantially changes the estimates of coefficients. There are two key methods for assessing unusual observations: statistics that assess the overall impact of an observation on the regression results such as residuals, leverage and Cook's D, and statistics that assess the specific impact of an observation on the regression coefficients such as DFBETA.

The global growth factor captures the dynamics of global economic activity and is an aggregate measure of the real GDP growth of the key world economies. The charts below depict the GGF based on the GDP growth rates of the U.S., U.K. and euro zone for a number of alternative scenarios. CCAR scenarios represent the U.S. Federal Reserve for the annual Comprehensive Capital Analysis and Review.[6] Moody's Analytics standard scenarios: Baseline, Moderate Recession (S3), Protracted Slump (S4), and Low Oil Price (S8). The PRA scenarios are baseline and stress scenarios under assumptions provided by the Prudential Regulatory Authority. The first PCA component, named the GGF, accounts for more than 85% of the total variation. It is therefore possible to reduce the dimensionality of the problem by focusing only on one factor instead of the three original series.[7] Additionally, the PCA addresses the issue of multicollinearity coming from a high degree of correlation between series.





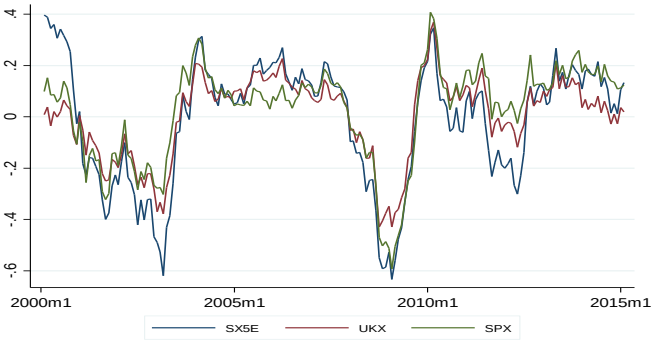


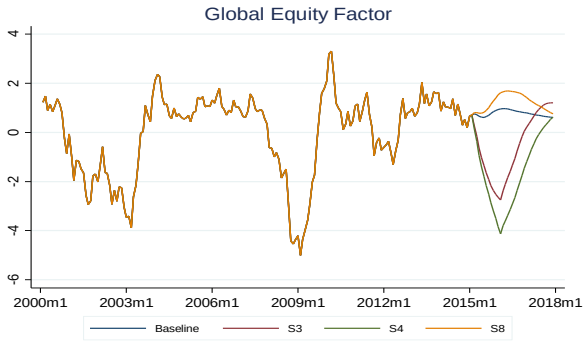
The global equity factor is an aggregate measure of global equity returns. The example presented below includes the Standard & Poor's 500, the STOXX 50 Blue Chip Price Index, and the FTSE 100 for Moody's Analytics and PRA scenarios. The GEF accounts for more than 94% of total variation in the equity indexes. The co-movement in the equities can be explained by the tight integration of financial services in developed markets; the presence of large, international investors; and the limited differences in regulatory

[6] For CCAR 2015 see http://www.federalreserve.gov/bankinforeg.

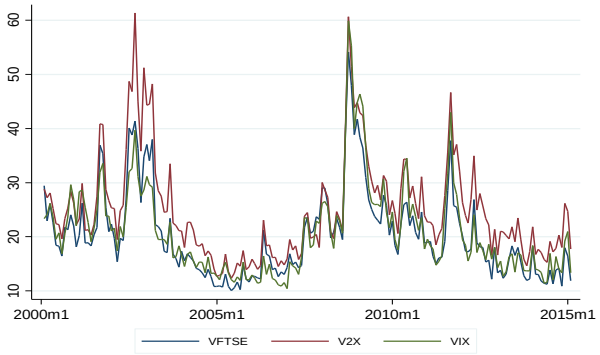
[7] When more variables are included in the PCA, the dimensionality issue grows in importance. Many different techniques can be used to choose the optimal number of components. One of the rules widely acknowledged in the statistical literature is to keep all components whose eigenvalues exceed one.

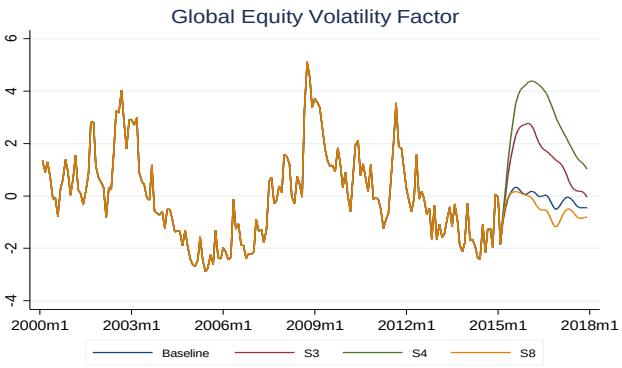
and infrastructural frameworks, which minimize the room for arbitrages and favor liquidity spillovers. The forecast of the GEF is driven by the GGF, since stock returns tend to be procyclical and anticipate the dynamics of the business cycle a few months ahead.



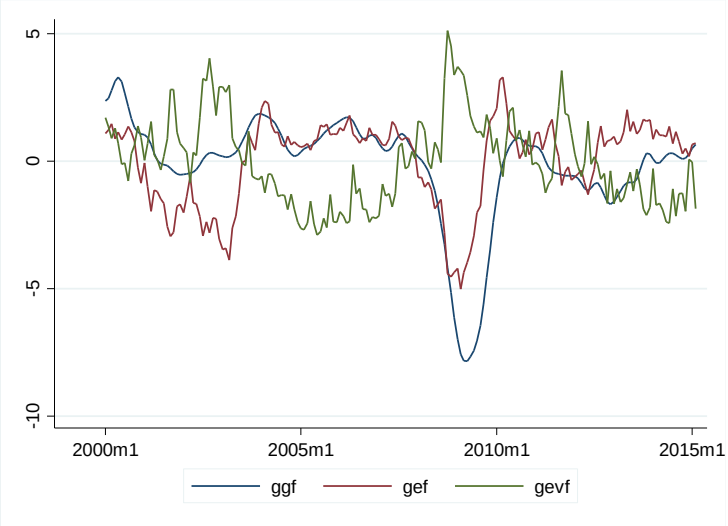


Finally, the global equity volatility factor is constructed as the first principal component from implied volatility indexes. The GEVF presented below is based on VIX, V2X and VFTSE 30-day implied volatilities. Similar to equity returns, equity volatilities share much in common because uncertainty easily transcends across stock markets. We find that the GEVF accounts for more than 95% of total variation in the volatility indexes.

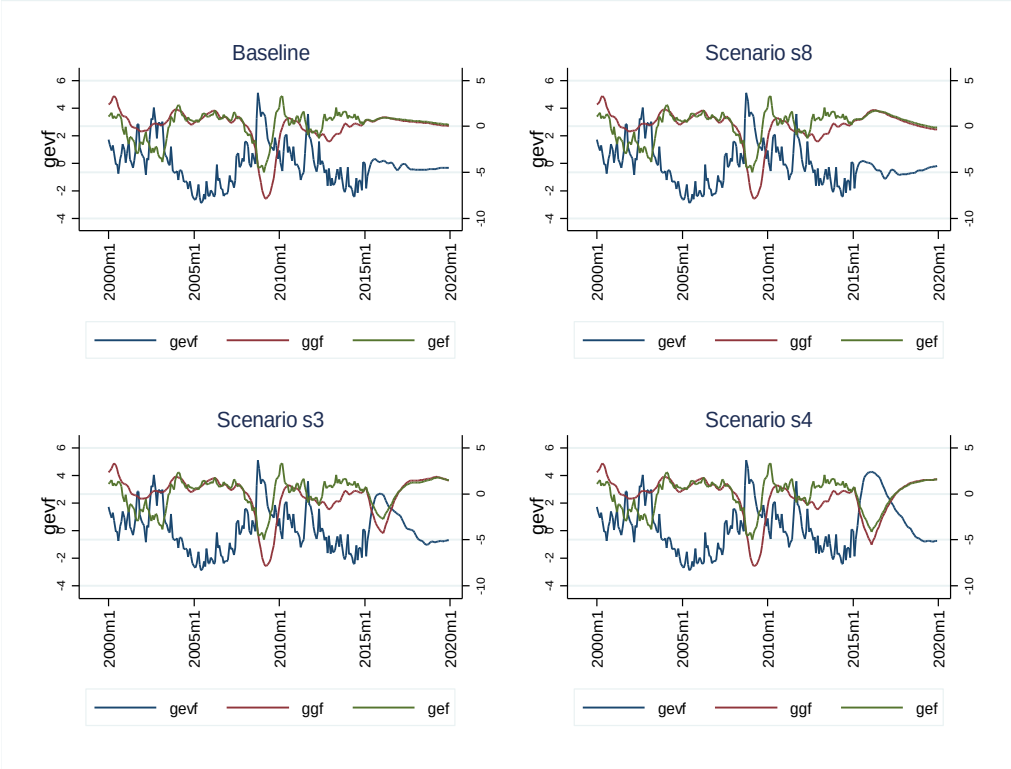




The chart below compares the in-sample fit of the three global factors. There is a positive association between the GGF and the GEV with the correlation coefficient 0.58. Intuitively, better stock market performance is positively related with higher economic growth. In turn, this is associated with lower volatility as measured by the GEVF, with the correlation coefficient between GEV and GEVF being
-0.72.



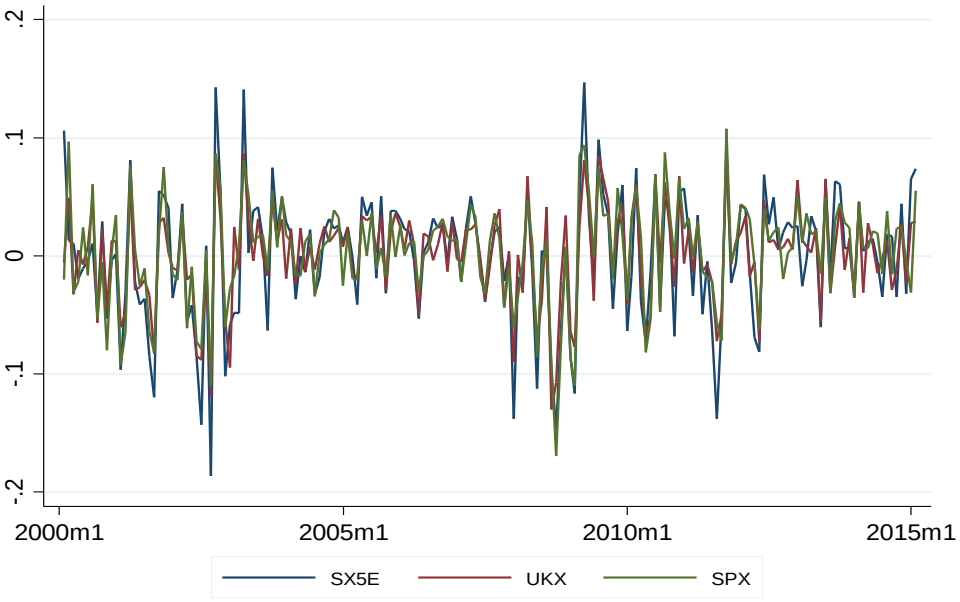
This relationship between the global factors also persists in the forecasts across scenarios. Under the baseline and S8 scenarios, the GDP growth rates are positive and stock markets rise, while volatility declines and remains relatively constant. In the adverse S3 and S4 scenarios, GDP contracts, stocks decline and volatility spikes.



Asset returns and volatility modeling

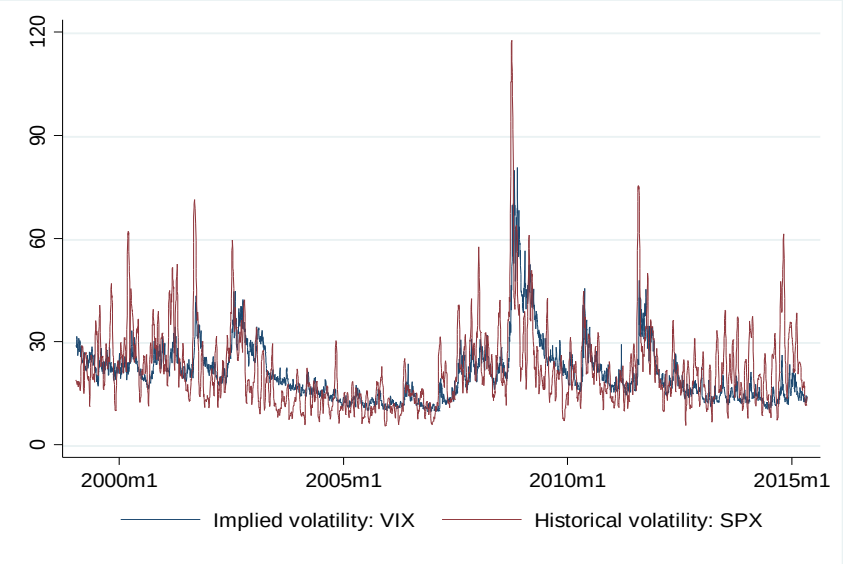
In this section we present a unified modeling framework for the asset returns and volatilities with some applications. This approach relies on the factor analysis and employs autoregressive conditional heteroskedastic models and their extensions. From a statistical point of view, ARCH models have similar properties to autoregressive models except that these properties relate to the volatility of the series.

We illustrate the process of fitting an ARMA-GARCH model to financial data using an example of stock returns and corresponding option-implied volatilities. The time series consist of monthly SX5E, UKX and SPX indexes and their corresponding implied volatilities VIX, VFTSE and V2X from January 2000 through February 2015. As can be seen in the figure below, the series are good candidates to be (G)ARCH processes since the stock market exhibits periods of large volatility followed by periods of relative tranquility.[8]



The chart below illustrates two volatility measures of the SPX Index: the historical volatility and implied volatility. Both volatilities consist of daily observations; the historical volatility is computed over the rolling window of 21 consecutive trading days. The implied volatility index is calculated using the price of near-term options on the S&P 500 index. This clearly illustrates the stylized fact that implied volatility fluctuates less than the historical series. The implied volatility is interpreted in terms of expected future fluctuations, whereas historical volatility constitutes past realization. Thus, it is preferable to model equities and volatilities in a unified framework.

[8]Statistical tests confirm the presence of conditional heteroskedasticity in each monthly index returns. The tests include inspection of the sample autocorrelation function and partial autocorrelation function for squared residuals, Ljung-Box Q-test, and LM test for the presence of ARCH.



We jointly estimate the model of the mean and the conditional volatility using the ARMA-GARCH model with exogenous drivers. First, the order of the appropriate process is selected for each index using an analogue of standard Box-Jenkins methodology to select the most parsimonious model. Once the model is selected, it is estimated using the method of maximum likelihood.[9] The exogenous drivers are global factors and local measures such as respective GDP growth rates.

The dependent variable is a stock index return (R_t), while conditional heteroskedasticity relates to the variance (or volatility) of the error term h_t.

MEAN EQUATION, ARMA (P, Q):

$$R_t = a_0 + \sum_{j=1}^{P} a_i R_{t-i} + \sum_{j=l}^{L} b_j GF_{t-j} + \sum_{j=k}^{K} c_j GDP_{t-j} + \sum_{j=0}^{Q} \gamma_j \varepsilon_{t-j} \ ,$$

VARIANCE EQUATION, GARCH(P, Q):

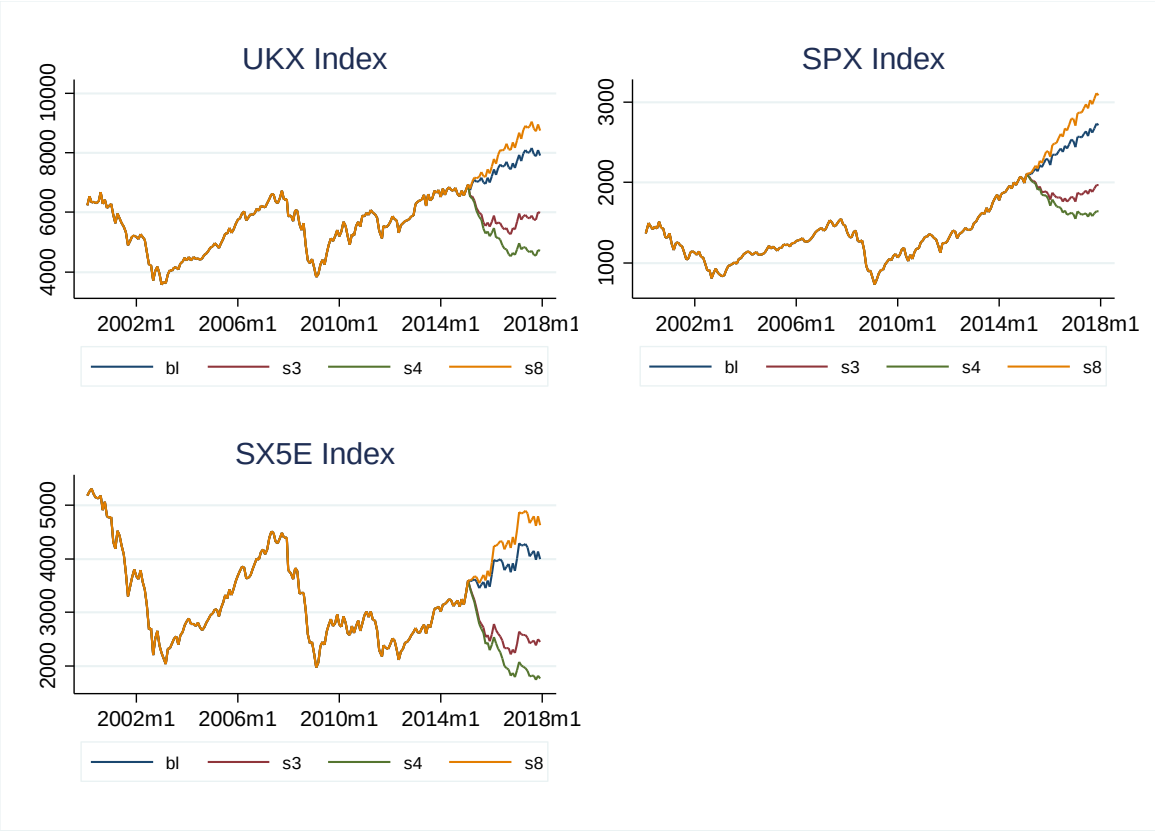
$$h_t = \omega_0 + \sum_{i=1}^{p} \alpha_i {\varepsilon^2}_{t-i} + \sum_{i=1}^{q} \beta_i h_{t-i} + \sum_{i=k}^{K} c_i GF_{t-i} \ .$$

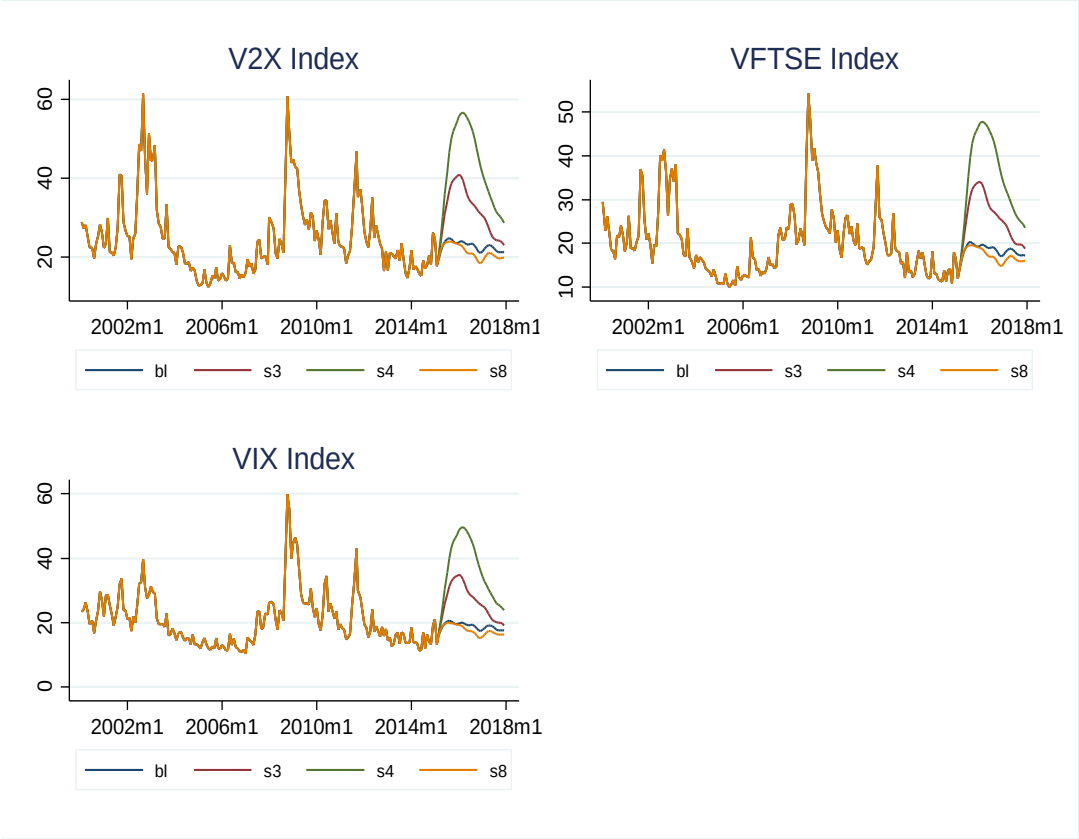
The mean equation can include lags of the GEF to capture the persistence in stock returns. The coefficients b_j are positively significant, consistent with the stylized fact that returns tend to cluster in the short term. As to the volatility equation, most models are ARCH(1) or GARCH(1,1) (p=1 while $\beta_j = 0$, or p=1 and q=1, respectively). The ARCH term $\alpha_1 {\varepsilon^2}_{t-1}$ reflects the impact of "news" or "surprises" from previous periods that affect volatility of equity returns. The coefficient α_1 is significant, positive, and less than unity, depicting the extent of the shocks' effect on volatility that is not destabilizing. The GARCH term $\beta_1 h_{t-1}$ measures the impact of the forecast variance from previous periods on the current conditional variance, or volatility. Significant and positive coefficient β_1 shows a high degree of persistence in exchange rate volatility. The sum of coefficients also tells us about the speed of convergence of the forecast of the conditional volatility to a steady state: Values closer to unity indicate slower convergence.

Leads on the GGF (or on the country's own GDP) for some indexes are included in the volatility equation to capture expectations about future corporate profitability that influences volatility, which measures risk. We found that the coefficient c_1 is negative.

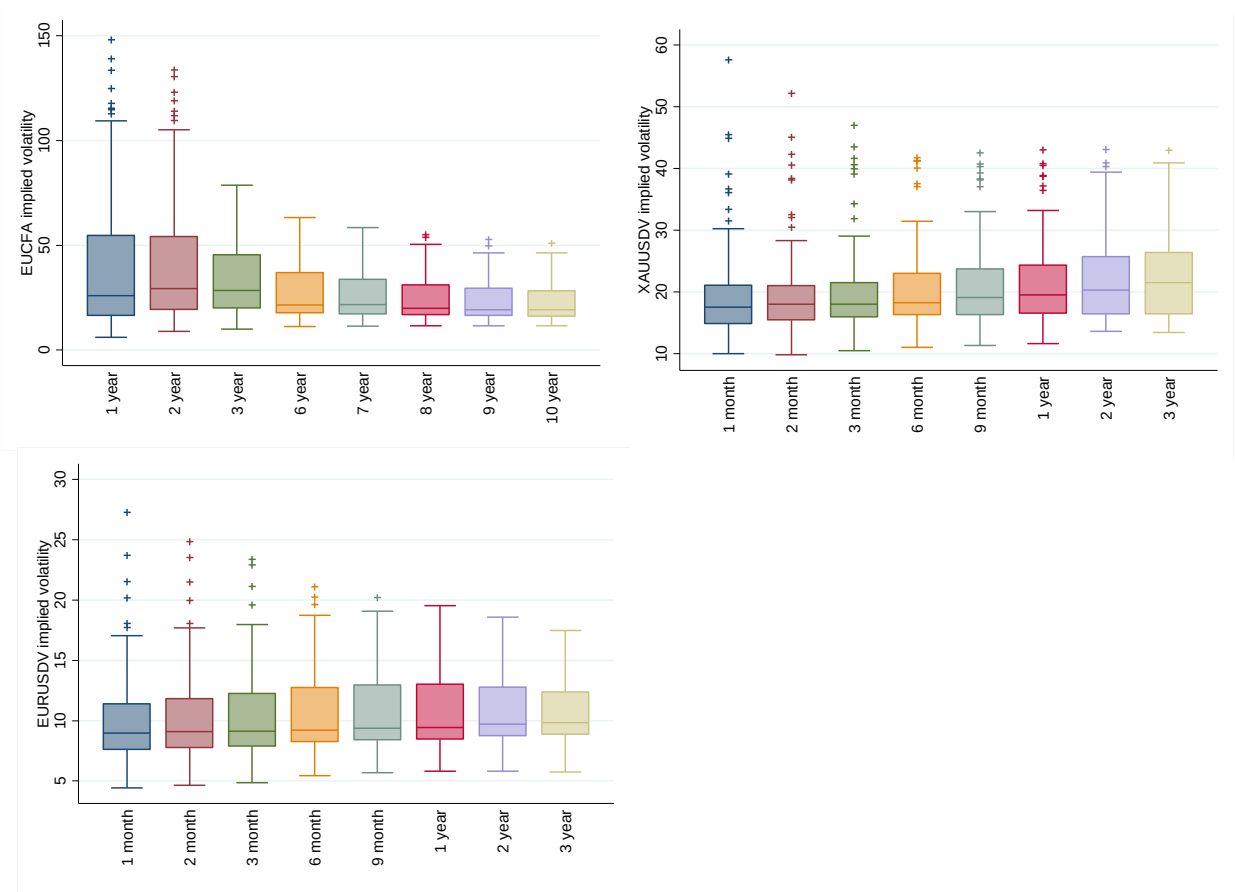
[9]The utilized estimation procedure calculates standard errors robust to departures from normality, since the distribution of the data has fat tails.

This is consistent with the fact that higher expected returns calm down markets, thus reducing volatility. Sample conditional forecasts for the Moody's Analytics scenarios of both stock indexes and volatility indexes are depicted in charts below.





Other examples of implied volatilities include cap-and-floor volatilities, foreign exchange volatilities, gold volatilities, and swaptions volatilities. The charts below present the corresponding term structures: cap-and-floor, designated as EUCFA; gold volatility, XAUUSDV; and Forex volatility, EURUSDV. There is a clear ranking of mean and median values within term structure. For example, long EUCFA tenors have smaller mean and median values than short tenors. This index displays inverted term structure most of the time. In contrast, XAUUSDV and EURUSDV indexes have higher mean and median values for longer tenors. Meanwhile, volatility values for the tenors on the short end display more dispersion around their means than the tenors on the long end. Hence, the short tenors are more sensitive to economic fluctuations than the long curves. This observation is also supported by the fact that attained maximum values decline for higher tenors for most curves.



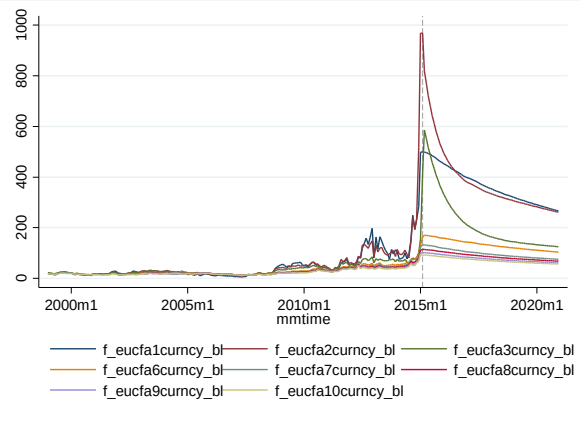
Since the historical data across the tenors display a high degree of collinearity, it makes sense to model them in unified framework. For this, a state-space model is employed, which can be formalized with the two equations below.

$$V_t = A + LF_t + \varepsilon_t$$

$$F_t = \alpha + \sum_{k=1}^{K} \beta_k F_{t-k} + v_t$$

The first equation models the volatility tenors as a function of *N* factors, which are collected in vector $\mathbf{F_t}$, while the second equation models the dynamics of the term structure through *K* lags of the factors. $V_t = [\mathrm{v_t}(1), \ldots, \mathrm{v_t}(\mathrm{M})]^T$ denotes a $(M \times 1)$ vector of volatilities observed at time *t* for *M* different maturities; F_t denotes a $(N \times 1)$ vector of factors obtained from the data with *N*<*M*. *A* and *L* are matrixes of unknown parameters to be estimated on the data. *A* is a matrix of intercept coefficients that set the level of V_t if $F_t = 0$. *L* is a matrix that defines how volatility tenors in V_t respond to changes in F_t factors. ε_t is a vector of approximation errors, and $\mathbf{v_t}$ are standard stochastic regression errors. ε_t and v_t are mutually orthogonal.

For the example of C&F volatilities, the first component accounts for more than 97% of the variation. We model the level component as a function of the global growth factor and the global equity factor. The historical data and sample forecasts for Moody's Analytics baseline and S4 scenarios are displayed in the figures below.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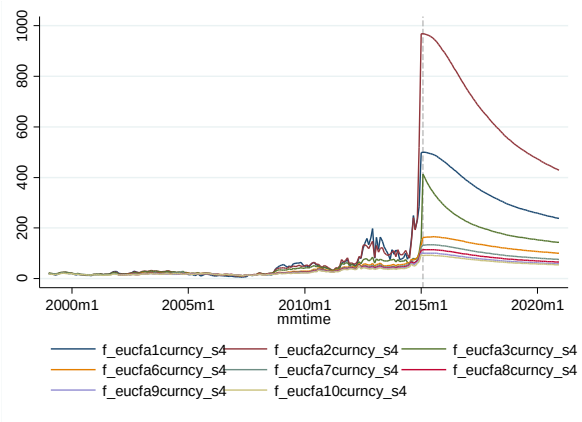
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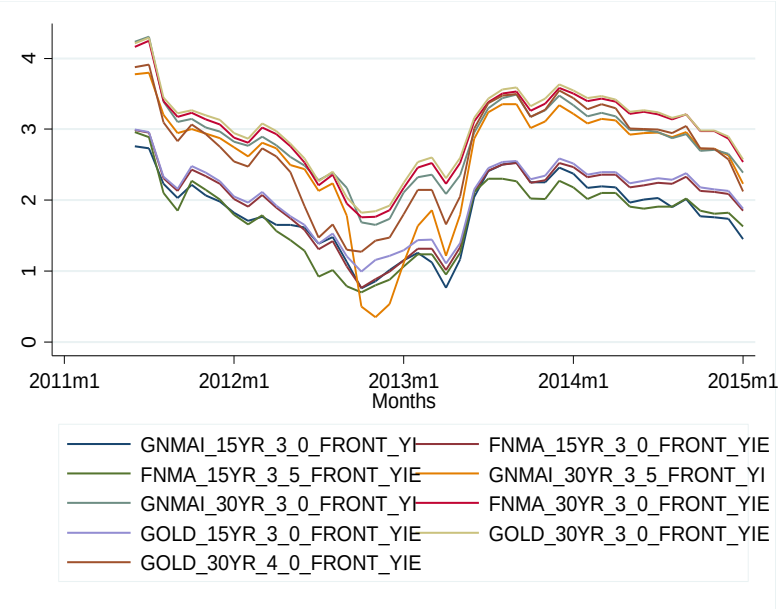
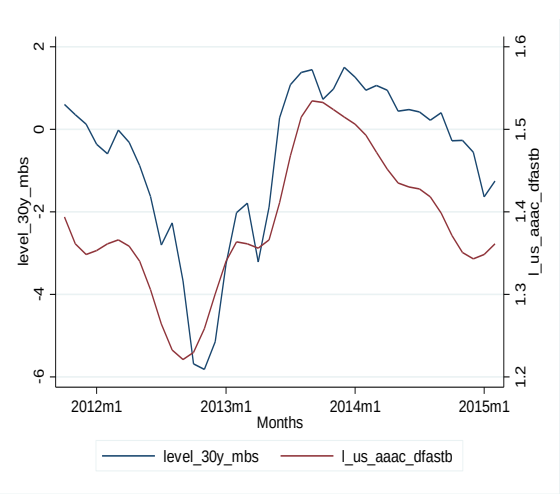
Asset-backed securities modeling

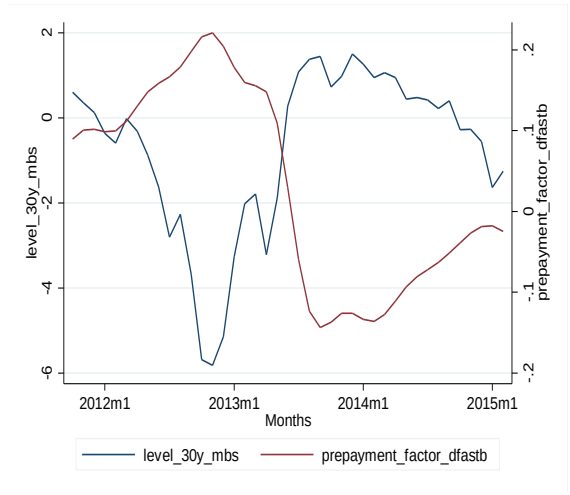
The term structure framework can be used for other types of market risk variables. An example of a satellite model for agency mortgage-backed securities is presented in this section. The historical data include 15- and 30-year MBS issued by Ginnie Mae, designated as GNMAI; Fannie Mae, FNMAI; and Freddie Mac Gold Participation Certificate, or GOLD, securities with coupon rates of 3%, 3.5% and 4%. Historical data displays clear co-movement across different types, coupons and maturities. It is also evident that the spread between the 15- and 30-year MBS is persistent and mostly stable.

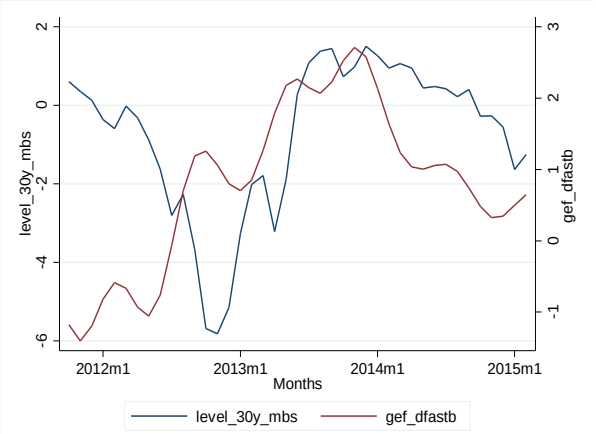


In line with the recent empirical literature, the model for the level component includes the measures of the prepayment risk and the rollover risk as exogenous drivers. The former is computed as the difference between two-year moving average of the mortgage rate on conventional term mortgages and its current value. The rollover risk in a mortgage life cycle that reflects financial market disruptions, credit downgrades, and other unanticipated events is approximated by the GEF. Additionally, the Moody's AAA corporate bond yield is included as one of macro exogenous drivers.

The charts below demonstrate in-sample correlation between the level component and drivers. The level component is positively correlated with AAA corporate bond yield and negatively with the GEF. It is also evident that the level component is inversely related to the prepayment factor. A mortgage whose fixation period is ending soon is less likely to be prepaid when the current mortgage rate declines relative to its two-year moving average. Households are more likely to negotiate lower contract rates after the end of the fixation period. As the prepayment factor increases as a result of a decline in the current rate, the level factor falls with reduced prepayment risk.



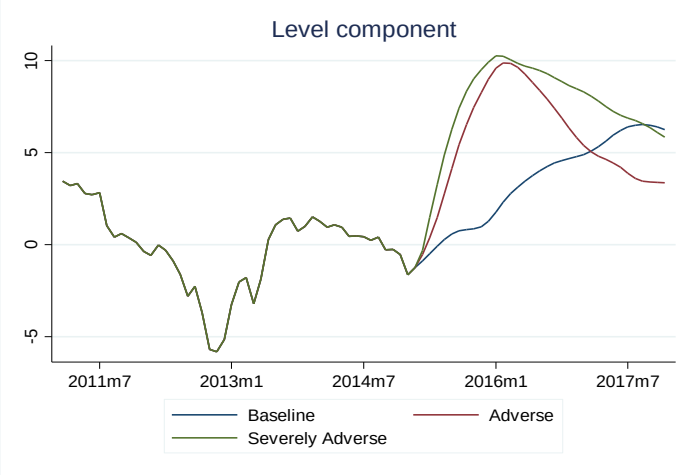




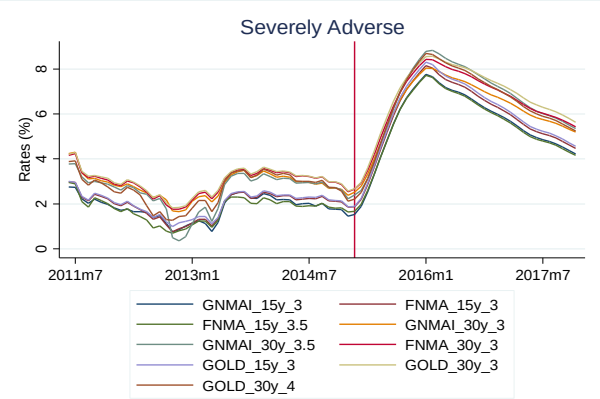
The regression equation for the level component has the following ARMA(1,0) structure with the exogenous drivers:

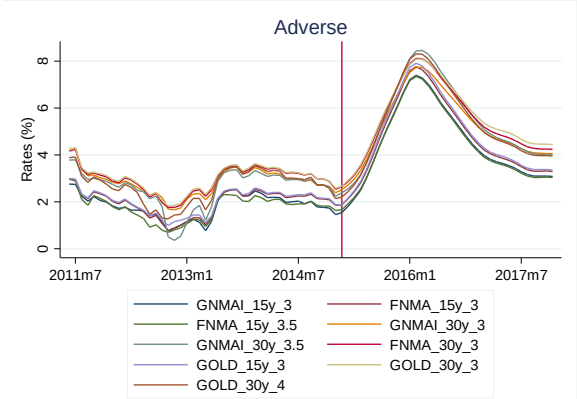
$$L_t = \beta_0 + \beta_1 L_{t-1} + \beta_2 GEF_{t+2} + \beta_3 \ln\_US\_AAAC_t + \beta_4 PF_t + \varepsilon_t,$$

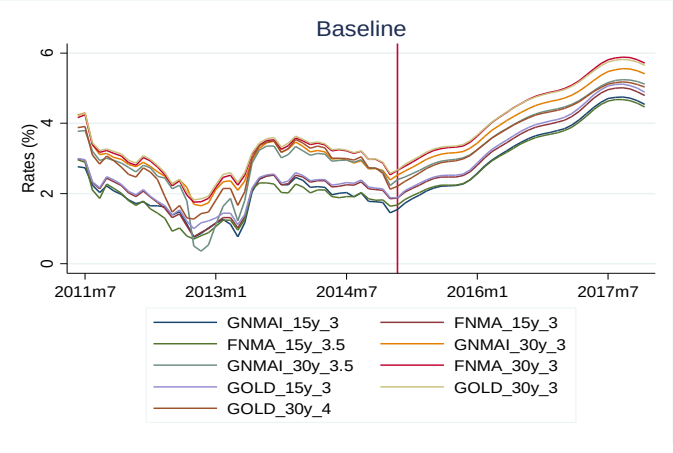
where $Level_t$ is the level component at time t, GEF_t is the global equity facto at t, $ln\_US\_AAAC_t$ is the natural logarithm of Moody's AAA corporate bond yield obtained from the U.S. country model, PF_t is the prepayment factor at t, and ε_t is a stochastic error term. The forecasts of the level component under the CCAR scenarios are depicted below.



Under the CCAR scenarios, the aligment of the curves is preserved, and historical sensitivity of bigger coupons (3.5% and 4%) to stress is also reproduced in the forecast period.

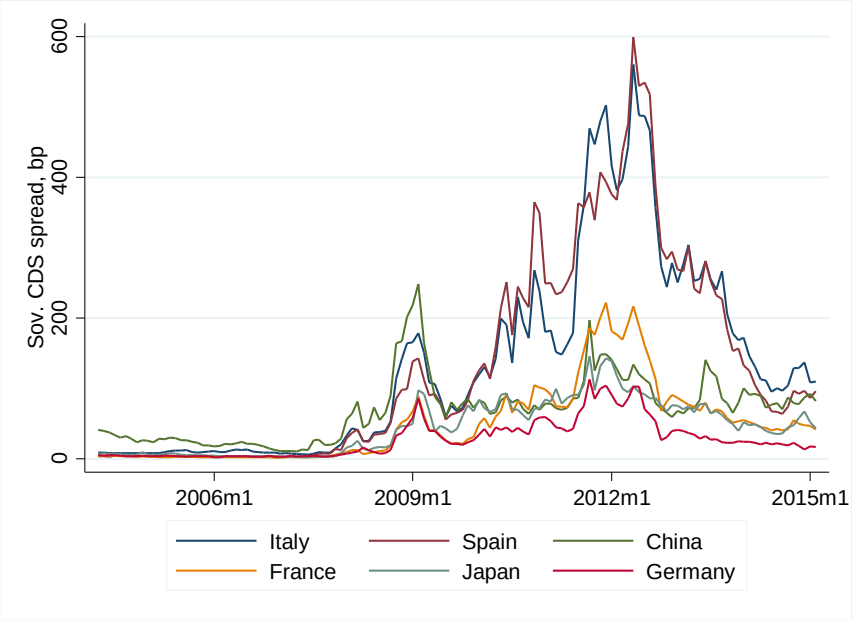






Sovereign CDS modeling

In this section we present an example satellite model of sovereign CDS spreads. The sovereign crisis, which exploded in late 2009, has had a large impact on the statistical properties of SCDS spreads time series. Prior to August 2007, the CDS spreads are broadly stable; however, with the start of the credit crunch they fluctuate considerably and the spreads increase sharply.



To model sovereign CDS spreads, we employ an autoregressive fractionally integrated moving average model with long memory. Long-memory time series are characterized by the presence of dependence between observations separated by a long time interval. Sovereigns are exposed to the financial crisis and uncertainty of financial markets for not only a short period but also over a persistent horizon.[10]

The creditworthiness of a sovereign can be described in terms of the stochastic process with some order of integration. ARMA models are applicable for integrated of order zero I(0) series with short memory. Negative shocks to the creditworthiness of the borrower are temporary and eventually—depending on the persistence of the shock itself—die out. On the other hand, ARIMA models handle integrated of order one I(1) series. Negative shocks to such series are permanent and memory never fades, or they are even explosive (order of integration greater than one) and eventually drive the probability of default implied by the CDS contract to one. This is equivalent to saying that the stochastic process contains one or more unit roots.

Meanwhile, ARFIMA provides a middle ground in the length of the process memory. ARFIMA handles processes that are neither pure I(0) nor I(1) and models long-run effects that die out only at longer horizons. Technically, a long memory process can be characterized by a fractionally integrated process (that is, the degree of integration is less than one but greater than zero). Formally, a fractionally integrated ARFIMA process is a generalization of ARIMA process

$$y_t = \rho(L)^{-1}(1-L)^{-d}\theta(L)\varepsilon_t,\ \varepsilon_t \sim iid\ (0, \sigma^2),$$

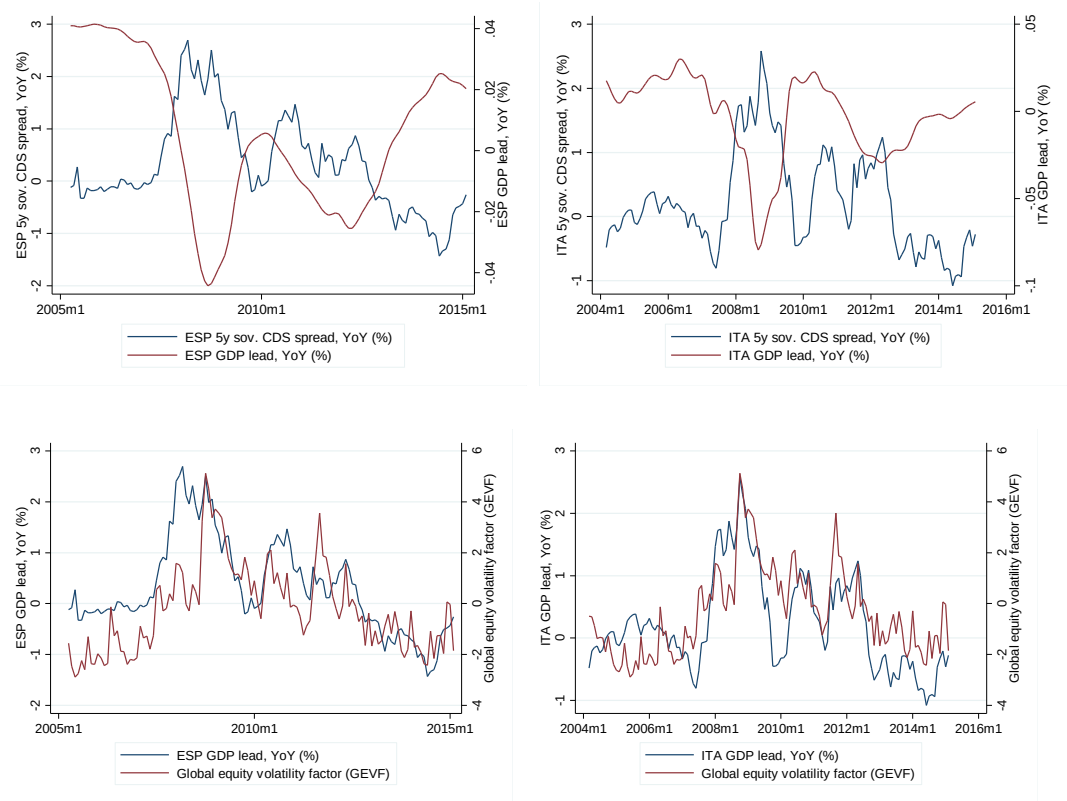
where $\rho(L) = (1 - \rho_1 L - \rho_2 L^2 - \cdots - \rho_p L^p)$ and $\theta(L) = (1 + \theta_1 L + \theta_2 L^2 + \cdots + \theta_p L^p)$ are AR and MA lag polynomial, respectively, where L denotes a lag operator, $Ly_t = y_{t-1}$. While AR and MA terms capture short-run dependence, the fractional differencing parameter d captures long-run effects with $-0.5 < d < 0.5$ for stationary series with long memory. The

[10] Formal statistical tests are employed to avoid spurious short or long memory evidence.

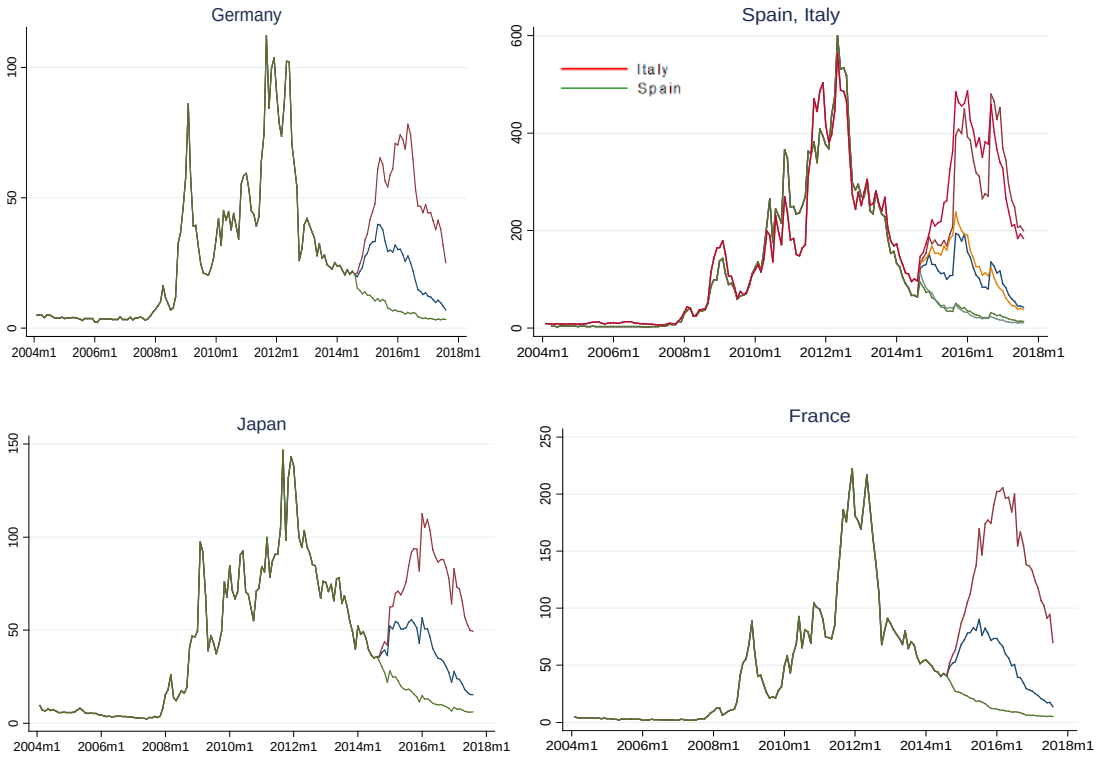
main advantage of the ARFIMA over the ARIMA model for stationary series with long memory is its relative parsimony, since it allows avoiding over-fitting with too many AR and MA terms.

$$SCDS_t = F(local_t, global_t).$$

We model SCDS changes as a long memory process with exogenous variables related to the local and global economy. For country-specific measures, the real GDP annual growth rate can be used as a proxy for the overall state of the economy. In addition, SCDS spreads react to investors' global changing risk aversion even if underlying local macro fundamentals are unchanged.



Taking Italian and Spanish five-year SCDS spreads as examples, we plot the in-sample fit of the annual growth rates of SCDS, GDP and GEVF. There is a clear negative correlation between the growth rates of SCDS spreads and GDP. Higher economic growth implies that a country can meet its financial obligations, thus decreasing its probability of default, and this reduces premium as insurance against default. However, the SCDS spreads and the global equity volatility factor are positively correlated. The following figures show the forecasts for the baseline, S3 and S4 scenarios.



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Appendix: Examples of Market Risk Instruments

This appendix provides a list of examples of supplementary variables that were modeled and forecast using our proposed methodology.

Variable/Instrument Name	Source
United States: Swap and Money Market Rates*	
Federal funds effective rate	Moody's Analytics
Overnight rate – U.S.	Moody's Analytics
Libor on USD – Overnight	Moody's Analytics
USD tomorrow next deposit	Bloomberg
1-wk ICE Libor – U.S.	Bloomberg
Interest rates: Libor on USD – 1 wk	Moody's Analytics
1-mo ICE Libor – U.S.	Bloomberg
2-mo ICE Libor – U.S.	Bloomberg
Libor on USD – 2 mo	Moody's Analytics
3-mo ICE Libor – U.S.	Bloomberg
4-mo swap rate – U.S.	Bloomberg
5-mo swap rate – U.S.	Bloomberg
6-mo swap rate – U.S.	Bloomberg
6-mo ICE Libor – U.S.	Bloomberg
7-mo swap rate – U.S.	Bloomberg
8-mo swap rate – U.S.	Bloomberg
9-mo swap rate – U.S.	Bloomberg
10-mo swap rate – U.S.	Bloomberg
11-mo swap rate – U.S.	Bloomberg
1-yr swap rate – U.S.	Bloomberg
2-yr swap rate – U.S.	Bloomberg
3-yr swap rate – U.S.	Bloomberg
4-yr swap rate – U.S.	Bloomberg
5-yr swap rate – U.S.	Bloomberg
6-yr swap rate – U.S.	Bloomberg
7-yr swap rate – U.S.	Bloomberg
8-yr swap rate – U.S.	Bloomberg
9-yr swap rate – U.S.	Bloomberg
10-yr swap rate – U.S.	Bloomberg
12-yr swap rate – U.S.	Bloomberg
15-yr swap rate – U.S.	Bloomberg
20-yr swap rate – U.S.	Bloomberg
25-yr swap rate – U.S.	Bloomberg
30-yr swap rate – U.S.	Bloomberg
40-yr swap rate – U.S.	Bloomberg
50-yr swap rate – U.S.	Bloomberg
60-yr swap rate – U.S.	Bloomberg
Australia: Swap and Money Market Rates	
RBA cash rate overnight – Australia	Bloomberg
Overnight deposit rate – Australia	Bloomberg
1-mo Australian Dollar Bank Bills rate – Australia	Bloomberg

2-mo Australian Dollar Bank Bills rate – Australia	Bloomberg
3-mo Australian Dollar Bank Bills rate – Australia	Bloomberg
4-mo Australian Dollar Bank Bills rate – Australia	Bloomberg
5-mo Australian Dollar Bank Bills rate – Australia	Bloomberg
6-mo Australian Dollar Bank Bills rate – Australia	Bloomberg
1-yr swap rate – Australia	Bloomberg
2-yr swap rate – Australia	Bloomberg
3-yr swap rate – Australia	Bloomberg
4-yr swap rate – Australia	Bloomberg
5-yr swap rate – Australia	Bloomberg
6-yr swap rate – Australia	Bloomberg
7-yr swap rate – Australia	Bloomberg
8-yr swap rate – Australia	Bloomberg
9-yr swap rate – Australia	Bloomberg
10-yr swap rate – Australia	Bloomberg
12-yr swap rate – Australia	Bloomberg
15-yr swap rate – Australia	Bloomberg
20-yr swap rate – Australia	Bloomberg
25-yr swap rate – Australia	Bloomberg
30-yr swap rate – Australia	Bloomberg
60-yr swap rate – Australia	Bloomberg
Canada: Swap and Money Market Rates	
Overnight swap rate – Canada	Bloomberg
1-mo Bankers Acceptances rate – Canada	Bloomberg
2-mo Bankers Acceptances rate- Canada	Bloomberg
3-mo Bankers Acceptances rate – Canada	Bloomberg
6-mo Bankers Acceptances rate Canada	Bloomberg
1-yr swap rate – Canada	Bloomberg
2-yr swap rate – Canada	Bloomberg
3-yr swap rate – Canada	Bloomberg
4-yr swap rate – Canada	Bloomberg
5-yr swap rate – Canada	Bloomberg
7-yr swap rate – Canada	Bloomberg
10-yr swap rate – Canada	Bloomberg
15-yr swap rate – Canada	Bloomberg
20-yr swap rate – Canada	Bloomberg
30-yr swap rate – Canada	Bloomberg
60-yr swap rate – Canada	Bloomberg
Switzerland: Swap and Money Market Rates	
ICE Libor Spot Next	Bloomberg
1-mo ICE Libor – Switzerland	Bloomberg
3-mo ICE Libor – Switzerland	Bloomberg
6-mo ICE Libor – Switzerland	Bloomberg

1-yr swap rate – Switzerland	Bloomberg
2-yr swap rate – Switzerland	Bloomberg
3-yr swap rate – Switzerland	Bloomberg
3-yr swap rate – Switzerland	Bloomberg
5-yr swap rate – Switzerland	Bloomberg
7-yr swap rate – Switzerland	Bloomberg
10-yr swap rate – Switzerland	Bloomberg
15-yr swap rate – Switzerland	Bloomberg
20-yr swap rate – Switzerland	Bloomberg
30-yr swap rate – Switzerland	Bloomberg
Denmark: Swap and Money Market Rates	
1-mo ICE Libor – Denmark	Bloomberg
3-mo ICE Libor – Denmark	Bloomberg
6-mo ICE Libor – Denmark	Bloomberg
1-yr swap rate – Denmark	Bloomberg
2-yr swap rate – Denmark	Bloomberg
3-yr swap rate – Denmark	Bloomberg
5-yr swap rate – Denmark	Bloomberg
10-yr swap rate – Denmark	Bloomberg
15-yr swap rate – Denmark	Bloomberg
30-yr swap rate – Denmark	Bloomberg
Euro: Swap and Money Market Rates	
Euro Overnight Index Average	Bloomberg
1-wk Euribor – euro zone	Bloomberg
1-mo Euribor – euro zone	Bloomberg
2-mo Euribor – euro zone	Bloomberg
3-mo Euribor – euro zone	Bloomberg
6-mo Euribor – euro zone	Bloomberg
7-mo swap rate – euro zone	Bloomberg
8-mo swap rate – euro zone	Bloomberg
9-mo Euribor – euro zone	Bloomberg
9-mo swap rate – euro zone	Bloomberg
10-mo swap rate – euro zone	Bloomberg
11-mo swap rate – euro zone	Bloomberg
12-mo Euribor – euro zone	Bloomberg
1-yr swap rate – euro zone	Bloomberg
2-yr swap rate – euro zone	Bloomberg
3-yr swap rate – euro zone	Bloomberg
4-yr swap rate – euro zone	Bloomberg
5-yr swap rate – euro zone	Bloomberg
6-yr swap rate – euro zone	Bloomberg
7-yr swap rate – euro zone	Bloomberg
8-yr swap rate – euro zone	Bloomberg

9-yr swap rate – euro zone	Bloomberg
10-yr swap rate – euro zone	Bloomberg
11-yr swap rate – euro zone	Bloomberg
12-yr swap rate – euro zone	Bloomberg
15-yr swap rate – euro zone	Bloomberg
20-yr swap rate – euro zone	Bloomberg
25-yr swap rate – euro zone	Bloomberg
30-yr swap rate – euro zone	Bloomberg
35-yr swap rate – euro zone	Bloomberg
40-yr swap rate – euro zone	Bloomberg
45-yr swap rate – euro zone	Bloomberg
50-yr swap rate – euro zone	Bloomberg
60-yr swap rate – euro zone	Bloomberg
United Kingdom: Swap and Money Market Rates	
Sterling Overnight Index Average	Bloomberg
ICE Libor overnight rate – U.K.	Bloomberg
1-wk ICE Libor – U.K.	Bloomberg
1-mo ICE Libor – U.K.	Bloomberg
2-mo ICE Libor – U.K.	Bloomberg
3-mo ICE Libor – U.K.	Bloomberg
6-mo ICE Libor – U.K.	Bloomberg
12-mo ICE Libor – U.K.	Bloomberg
1-yr swap rate – U.K.	Bloomberg
2-yr swap rate – U.K.	Bloomberg
3-yr swap rate – U.K.	Bloomberg
5-yr swap rate – U.K.	Bloomberg
7-yr swap rate – U.K.	Bloomberg
8-yr swap rate – U.K.	Bloomberg
9-yr swap rate – U.K.	Bloomberg
10-yr swap rate – U.K.	Bloomberg
12-yr swap rate – U.K.	Bloomberg
15-yr swap rate – U.K.	Bloomberg
20-yr swap rate – U.K.	Bloomberg
25-yr swap rate – U.K.	Bloomberg
30-yr swap rate – U.K.	Bloomberg
35-yr swap rate – U.K.	Bloomberg
40-yr swap rate – U.K.	Bloomberg
45-yr swap rate – U.K.	Bloomberg
50-yr swap rate – U.K.	Bloomberg
60-yr swap rate – U.K.	Bloomberg
Hong Kong: Swap and Money Market Rates	
1-mo Hong Kong Dollar Hibor Fixings rate – Hong Kong	Bloomberg
3-mo Hong Kong Dollar Hibor Fixings rate – Hong Kong	Bloomberg

6-mo Hong Kong Dollar Hibor Fixings rate – Hong Kong	Bloomberg
1-yr swap rate – Hong Kong	Bloomberg
2-yr swap rate – Hong Kong	Bloomberg
3-yr swap rate – Hong Kong	Bloomberg
5-yr swap rate – Hong Kong	Bloomberg
10-yr swap rate – Hong Kong	Bloomberg
15-yr swap rate – Hong Kong	Bloomberg
30-yr swap rate – Hong Kong	Bloomberg
Hungary: Swap and Money Market Rates	
Overnight Deposit rate – Hungary	Bloomberg
1-mo Interbank Offered rate – Hungary	Bloomberg
2-mo Interbank Offered rate – Hungary	Bloomberg
3-mo Interbank Offered rate – Hungary	Bloomberg
6-mo Interbank Offered rate – Hungary	Bloomberg
9-mo Interbank HUFONIA swap rate	Bloomberg
1-yr swap rate – Hungary	Bloomberg
2-yr swap rate – Hungary	Bloomberg
3-yr swap rate – Hungary	Bloomberg
4-yr swap rate – Hungary	Bloomberg
5-yr swap rate – Hungary	Bloomberg
6-yr swap rate – Hungary	Bloomberg
7-yr swap rate – Hungary	Bloomberg
8-yr swap rate – Hungary	Bloomberg
9-yr swap rate – Hungary	Bloomberg
10-yr swap rate – Hungary	Bloomberg
15-yr swap rate – Hungary	Bloomberg
20-yr swap rate – Hungary	Bloomberg
30-yr swap rate – Hungary	Bloomberg
Japan: Swap and Money Market Rates	
ICE Libor Spot next – Japan	Bloomberg
1-mo ICE Libor – Japan	Bloomberg
3-mo ICE Libor – Japan	Bloomberg
6-mo ICE Libor – Japan	Bloomberg
1-yr swap rate – Japan	Bloomberg
2-yr swap rate – Japan	Bloomberg
3-yr swap rate – Japan	Bloomberg
4-yr swap rate – Japan	Bloomberg
5-yr swap rate – Japan	Bloomberg
7-yr swap rate – Japan	Bloomberg
10-yr swap rate – Japan	Bloomberg
15-yr swap rate – Japan	Bloomberg
20-yr swap rate – Japan	Bloomberg
30-yr swap rate – Japan	Bloomberg

60-yr swap rate – Japan	Bloomberg
Mexico: Swap and Money Market Rates	
Bank of Mexico Overnight rate – Mexico	Bloomberg
1-mo Mexico Interbank TIIE rate – Mexico	Bloomberg
3-mo swap rate – Mexico	Bloomberg
6-mo swap rate – Mexico	Bloomberg
1-yr swap rate – Mexico	Bloomberg
2-yr swap rate – Mexico	Bloomberg
3-yr swap rate – Mexico	Bloomberg
4-yr swap rate – Mexico	Bloomberg
5-yr swap rate – Mexico	Bloomberg
7-yr swap rate – Mexico	Bloomberg
10-yr swap rate – Mexico	Bloomberg
15-yr swap rate – Mexico	Bloomberg
20-yr swap rate – Mexico	Bloomberg
30-yr swap rate – Mexico	Bloomberg
New Zealand: Swap and Money Market Rates	
New Zealand Dollar Overnight Deposit rate – New Zealand	Bloomberg
3-mo New Zealand Dollar Bank Bills rate – New Zealand	Bloomberg
6-mo New Zealand Dollar Bank Bills rate – New Zealand	Bloomberg
9-mo swap rate – New Zealand	Bloomberg
1-yr swap rate – New Zealand	Bloomberg
2-yr swap rate – New Zealand	Bloomberg
3-yr swap rate – New Zealand	Bloomberg
4-yr swap rate – New Zealand	Bloomberg
5-yr swap rate – New Zealand	Bloomberg
6-yr swap rate – New Zealand	Bloomberg
7-yr swap rate – New Zealand	Bloomberg
8-yr swap rate – New Zealand	Bloomberg
9-yr swap rate – New Zealand	Bloomberg
10-yr swap rate – New Zealand	Bloomberg
15-yr swap rate – New Zealand	Bloomberg
20-yr swap rate – New Zealand	Bloomberg
Norway: Swap and Money Market Rates	
1-mo Interbank Offered rate – Norway	Bloomberg
3-mo Interbank Offered rate – Norway	Bloomberg
6-mo Interbank Offered rate – Norway	Bloomberg
1-yr swap rate – Norway	Bloomberg
2-yr swap rate – Norway	Bloomberg
3-yr swap rate – Norway	Bloomberg
4-yr swap rate – Norway	Bloomberg
5-yr swap rate – Norway	Bloomberg
7-yr swap rate – Norway	Bloomberg

10-yr swap rate – Norway	Bloomberg
15-yr swap rate – Norway	Bloomberg
20-yr swap rate – Norway	Bloomberg
30-yr swap rate – Norway	Bloomberg
60-yr swap rate – Norway	Bloomberg
Poland: Swap and Money Market Rates	
Overnight Deposit rate – Poland	Bloomberg
1-mo Warsaw Interbank Offer/Bid rate – Poland	Bloomberg
3-mo Warsaw Interbank Offer/Bid rate – Poland	Bloomberg
6-mo Warsaw Interbank Offer/Bid rate – Poland	Bloomberg
1-yr swap rate – Poland	Bloomberg
2-yr swap rate – Poland	Bloomberg
3-yr swap rate – Poland	Bloomberg
4-yr swap rate – Poland	Bloomberg
5-yr swap rate – Poland	Bloomberg
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8-yr swap rate – Poland	Bloomberg
9-yr swap rate – Poland	Bloomberg
10-yr swap rate – Poland	Bloomberg
15-yr swap rate – Poland	Bloomberg
20-yr swap rate – Poland	Bloomberg
30-yr swap rate – Poland	Bloomberg
Czech Republic: Swap and Money Market Rates	
Overnight Deposit rate – Czech Republic	Bloomberg
1-mo Interbank Offer rate – Czech Republic	Bloomberg
2-mo Interbank Offer rate – Czech Republic	Bloomberg
3-mo Interbank Offer rate – Czech Republic	Bloomberg
6-mo Interbank Offer rate – Czech Republic	Bloomberg
9-mo Interbank Offer rate – Czech Republic	Bloomberg
1-yr swap rate – Czech Republic	Bloomberg
2-yr swap rate – Czech Republic	Bloomberg
3-yr swap rate – Czech Republic	Bloomberg
4-yr swap rate – Czech Republic	Bloomberg
5-yr swap rate – Czech Republic	Bloomberg
6-yr swap rate – Czech Republic	Bloomberg
7-yr swap rate – Czech Republic	Bloomberg
8-yr swap rate – Czech Republic	Bloomberg
9-yr swap rate – Czech Republic	Bloomberg
10-yr swap rate – Czech Republic	Bloomberg
15-yr swap rate – Czech Republic	Bloomberg
20-yr swap rate – Czech Republic	Bloomberg
30-yr swap rate – Czech Republic	Bloomberg

Sweden: Swap and Money Market Rates	
Stockholm Interbank Offered rate T/N	Bloomberg
1-mo Stockholm Interbank Offered rate – Sweden	Bloomberg
2-mo Stockholm Interbank Offered rate – Sweden	Bloomberg
3-mo Stockholm Interbank Offered rate – Sweden	Bloomberg
6-mo Stockholm Interbank Offered rate – Sweden	Bloomberg
1-yr swap rate – Sweden	Bloomberg
2-yr swap rate – Sweden	Bloomberg
3-yr swap rate – Sweden	Bloomberg
4-yr swap rate – Sweden	Bloomberg
5-yr swap rate – Sweden	Bloomberg
7-yr swap rate – Sweden	Bloomberg
10-yr swap rate – Sweden	Bloomberg
15-yr swap rate – Sweden	Bloomberg
20-yr swap rate – Sweden	Bloomberg
30-yr swap rate – Sweden	Bloomberg
60-yr swap rate – Sweden	Bloomberg
Singapore: Swap and Money Market Rates	
1-mo Swap Offer Rate Fixing – Singapore	Bloomberg
3-mo Swap Offer Rate Fixing – Singapore	Bloomberg
6-mo Swap Offer Rate Fixing – Singapore	Bloomberg
1-yr swap rate – Singapore	Bloomberg
2-yr swap rate – Singapore	Bloomberg
3-yr swap rate – Singapore	Bloomberg
5-yr swap rate – Singapore	Bloomberg
10-yr swap rate – Singapore	Bloomberg
15-yr swap rate – Singapore	Bloomberg
30-yr swap rate – Singapore	Bloomberg
South Africa: Swap and Money Market Rates	
1-mo Johannesburg Interbank Agreed rate – South Africa	Bloomberg
3-mo Johannesburg Interbank Agreed rate – South Africa	Bloomberg
6-mo Johannesburg Interbank Agreed rate – South Africa	Bloomberg
1-yr swap rate – South Africa	Bloomberg
2-yr swap rate – South Africa	Bloomberg
3-yr swap rate – South Africa	Bloomberg
4-yr swap rate – South Africa	Bloomberg
5-yr swap rate – South Africa	Bloomberg
7-yr swap rate – South Africa	Bloomberg
10-yr swap rate – South Africa	Bloomberg
15-yr swap rate – South Africa	Bloomberg
20-yr swap rate – South Africa	Bloomberg
30-yr swap rate – South Africa	Bloomberg
60-yr swap rate – South Africa	Bloomberg

Turkey: Swap and Money Market Rates	
1-mo swap rate – Turkey	Bloomberg
3-mo swap rate – Turkey	Bloomberg
6-mo swap rate – Turkey	Bloomberg
1-yr swap rate – Turkey	Bloomberg
2-yr swap rate – Turkey	Bloomberg
3-yr swap rate – Turkey	Bloomberg
4-yr swap rate – Turkey	Bloomberg
5-yr swap rate – Turkey	Bloomberg
7-yr swap rate – Turkey	Bloomberg
10-yr swap rate – Turkey	Bloomberg
15-yr swap rate – Turkey	Bloomberg
20-yr swap rate – Turkey	Bloomberg
30-yr swap rate – Turkey	Bloomberg
60-yr swap rate – Turkey	Bloomberg
Canada: Libor Rates	
Libor CAD (1M)	Bloomberg
Libor CAD (3M)	Bloomberg
Libor CAD (6M)	Bloomberg
Libor CAD (1Y)	Bloomberg
Libor CAD (2Y)	Bloomberg
Libor CAD (3Y)	Bloomberg
Libor CAD (4Y)	Bloomberg
Libor CAD (5Y)	Bloomberg
Libor CAD (6Y)	Bloomberg
Libor CAD (7Y)	Bloomberg
Libor CAD (8Y)	Bloomberg
Libor CAD (9Y)	Bloomberg
Libor CAD (10Y)	Bloomberg
Libor CAD (12Y)	Bloomberg
Libor CAD (14Y)	Bloomberg
Libor CAD (16Y)	Bloomberg
Libor CAD (18Y)	Bloomberg
Libor CAD (20Y)	Bloomberg
Libor CAD (25Y)	Bloomberg
Libor CAD (30Y)	Bloomberg
Euro: Libor Rates	
Libor EUR (1M)	Bloomberg
Libor EUR (3M)	Bloomberg
Libor EUR (6M)	Bloomberg
Libor EUR (1Y)	Bloomberg
Libor EUR (2Y)	Bloomberg
Libor EUR (3Y)	Bloomberg

Libor EUR (4Y)	Bloomberg
Libor EUR (5Y)	Bloomberg
Libor EUR (6Y)	Bloomberg
Libor EUR (7Y)	Bloomberg
Libor EUR (8Y)	Bloomberg
Libor EUR (9Y)	Bloomberg
Libor EUR (10Y)	Bloomberg
Libor EUR (12Y)	Bloomberg
Libor EUR (14Y)	Bloomberg
Libor EUR (16Y)	Bloomberg
Libor EUR (18Y)	Bloomberg
Libor EUR (20Y)	Bloomberg
Libor EUR (25Y)	Bloomberg
Libor EUR (30Y)	Bloomberg
United Kingdom: Libor Rates	
Libor GBP (1M)	Bloomberg
Libor GBP (3M)	Bloomberg
Libor GBP (6M)	Bloomberg
Libor GBP (1Y)	Bloomberg
Libor GBP (2Y)	Bloomberg
Libor GBP (3Y)	Bloomberg
Libor GBP (4Y)	Bloomberg
Libor GBP (5Y)	Bloomberg
Libor GBP (6Y)	Bloomberg
Libor GBP (7Y)	Bloomberg
Libor GBP (8Y)	Bloomberg
Libor GBP (9Y)	Bloomberg
Libor GBP (10Y)	Bloomberg
Libor GBP (12Y)	Bloomberg
Libor GBP (14Y)	Bloomberg
Libor GBP (16Y)	Bloomberg
Libor GBP (18Y)	Bloomberg
Libor GBP (20Y)	Bloomberg
Libor GBP (25Y)	Bloomberg
Libor GBP (30Y)	Bloomberg
Japan: Libor Rates	
Libor JPY (1M)	Bloomberg
Libor JPY (3M)	Bloomberg
Libor JPY (6M)	Bloomberg
Libor JPY (1Y)	Bloomberg
Libor JPY (2Y)	Bloomberg
Libor JPY (3Y)	Bloomberg
Libor JPY (4Y)	Bloomberg

Libor JPY (5Y)	Bloomberg
Libor JPY (6Y)	Bloomberg
Libor JPY (7Y)	Bloomberg
Libor JPY (8Y)	Bloomberg
Libor JPY (9Y)	Bloomberg
Libor JPY (10Y)	Bloomberg
Libor JPY (12Y)	Bloomberg
Libor JPY (14Y)	Bloomberg
Libor JPY (16Y)	Bloomberg
Libor JPY (18Y)	Bloomberg
Libor JPY (20Y)	Bloomberg
Libor JPY (25Y)	Bloomberg
Libor JPY (30Y)	Bloomberg
SIFMA Swaps	
SIFMA SWAP 10Y	Bloomberg
SIFMA SWAP 5Y	Bloomberg
SIFMA SWAP 1Y	Bloomberg
SIFMA SWAP 30Y	Bloomberg
SIFMA SWAP 7D	Bloomberg
United States: Bond Yields	
1-mo T-Bill rate (%)	
3-mo T-Bill rate (%)	
6-mo T-Bill rate (%)	
1-yr T-Bill rate (%)	
18-mo T-Bill rate (%)	
1-mo T-Bill – BEY (%)	
3-mo T-Bill – BEY (%)	
6-mo T-Bill – BEY (%)	
2-yr Treasury yield (%)	
2.5-yr Treasury yield (%)	
3-yr Treasury yield (%)	
3.5-yr Treasury yield (%)	
4.5-yr Treasury yield (%)	
5-yr Treasury yield (%)	
5.5-yr Treasury yield (%)	
6.5-yr Treasury yield (%)	
7-yr Treasury yield (%)	
7.5-yr Treasury yield (%)	
8.5-yr Treasury yield (%)	
9.5-yr Treasury yield (%)	
10-yr Treasury yield (%)	
10.5-yr Treasury yield (%)	
11.5-yr Treasury yield (%)	

12.5-yr Treasury yield (%)	
13.5-yr Treasury yield (%)	
14.5-yr Treasury yield (%)	
15.5-yr Treasury yield (%)	
16.5-yr Treasury yield (%)	
17.5-yr Treasury yield (%)	
18.5-yr Treasury yield (%)	
19.5-yr Treasury yield (%)	
20.5-yr Treasury yield (%)	
21.5-yrTreasury yield (%)	
22.5-yr Treasury yield (%)	
23.5-yr Treasury yield (%)	
24.5-yr Treasury yield (%)	
25.5-yr Treasury yield (%)	
26.5-yr Treasury yield (%)	
27.5-yr Treasury yield (%)	
28.5-yr Treasury yield (%)	
29.5-yr Treasury yield (%)	
30-yr Treasury yield (%)	
Euro zone: Bond Yields, aggregates	
Overnight rate – euro zone	Bloomberg
1-mo Bond yield – euro zone	Bloomberg
3-mo Bond yield – euro zone	Bloomberg
6-mo Bond yield – euro zone	Bloomberg
1-yr Bond yield – euro zone	Bloomberg
2-yr Bond yield – euro zone	Bloomberg
3-yr Bond yield – euro zone	Bloomberg
4-yr Bond yield – euro zone	Bloomberg
5-yr Bond yield – euro zone	Bloomberg
7-yr Bond yield – euro zone	Bloomberg
10-yr Bond yield – euro zone	Bloomberg
15-yr Bond yield – euro zone	Bloomberg
20-yr Bond yield – euro zone	Bloomberg
30-yr Bond yield – euro zone	Bloomberg
60-yr Bond yield – euro zone	Bloomberg
Japan: Bond Yields	
Overnight rate – Japan	Bloomberg
1-mo Bond yield – Japan	Bloomberg
3-mo Bond yield – Japan	Bloomberg
6-mo Bond yield – Japan	Bloomberg
1-yr Bond yield – Japan	Bloomberg
2-yr Bond yield – Japan	Bloomberg
3-yr Bond yield – Japan	Bloomberg

4-yr Bond yield – Japan	Bloomberg
5-yr Bond yield – Japan	Bloomberg
7-yr Bond yield – Japan	Bloomberg
10-yr Bond yield – Japan	Bloomberg
15-yr Bond yield – Japan	Bloomberg
20-yr Bond yield – Japan	Bloomberg
30-yr Bond yield – Japan	Bloomberg
60-yr Bond yield – Japan	Bloomberg
United Kingdom: Bond Yields	
Overnight rate – U.K.	Bloomberg
1-mo Bond yield – U.K.	Bloomberg
3-mo Bond yield – U.K.	Bloomberg
6-mo Bond yield – U.K.	Bloomberg
1-yr Bond yield – U.K.	Bloomberg
2-yr Bond yield – U.K.	Bloomberg
3-yr Bond yield – U.K.	Bloomberg
4-yr Bond yield – U.K.	Bloomberg
5-yr Bond yield – U.K.	Bloomberg
7-yr Bond yield – U.K.	Bloomberg
10-yr Bond yield – U.K.	Bloomberg
15-yr Bond yield – U.K.	Bloomberg
20-yr Bond yield – U.K.	Bloomberg
30-yr Bond yield – U.K.	Bloomberg
60-yr Bond yield – U.K.	Bloomberg
1-yr Nominal Spot rate	Bank of England
5-yr Nominal Spot rate	Bank of England
15-yr Nominal Spot rate	Bank of England
20-yr Nominal Spot rate	Bank of England
25-yr Nominal Spot rate	Bank of England
Real short yield	Bloomberg
2.5-yr Real Spot rate	Bank of England
5-yr Real Spot rate	Bank of England
10-yr Real Spot rate	Bank of England
15-yr Real Spot rate	Bank of England
20-yr Real Spot rate	Bank of England
25-yr Real Spot rate	Bank of England
Developing Asia: Bond Yields	
3-mo Bond yield – Developing Asia	Moody's Analytics
2-yr Bond yield – Developing Asia	Moody's Analytics
5-yr Bond yield – Developing Asia	Moody's Analytics
30-yr Bond yield – Developing Asia	Moody's Analytics
Australia: Bond Yields	
Overnight rate – Australia	Bloomberg

1-mo Bond yield – Australia	Bloomberg
3-mo Bond yield – Australia	Bloomberg
6-mo Bond yield – Australia	Bloomberg
1-yr Bond yield – Australia	Bloomberg
2-yr Bond yield – Australia	Bloomberg
3-yr Bond yield – Australia	Bloomberg
4-yr Bond yield – Australia	Bloomberg
5-yr Bond yield – Australia	Bloomberg
7-yr Bond yield – Australia	Bloomberg
10-yr Bond yield – Australia	Bloomberg
15-yr Bond yield – Australia	Bloomberg
20-yr Bond yield – Australia	Bloomberg
30-yr Bond yield – Australia	Bloomberg
60-yr Bond yield – Australia	Bloomberg
Germany: Bond Yields	
Overnight rate – Germany	Bloomberg
1-mo Bond yield – Germany	Bloomberg
3-mo Bond yield – Germany	Bloomberg
6-mo Bond yield – Germany	Bloomberg
1-yr Bond yield – Germany	Bloomberg
2-yr Bond yield – Germany	Bloomberg
3-yr Bond yield – Germany	Bloomberg
4-yr Bond yield – Germany	Bloomberg
5-yr Bond yield – Germany	Bloomberg
7-yr Bond yield – Germany	Bloomberg
10-yr Bond yield – Germany	Bloomberg
15-yr Bond yield – Germany	Bloomberg
20-yr Bond yield – Germany	Bloomberg
30-yr Bond yield – Germany	Bloomberg
60-yr Bond yield – Germany	Bloomberg
France: Bond Yields	
Overnight rate – France	Bloomberg
1-mo Bond yield – France	Bloomberg
3-mo Bond yield – France	Bloomberg
6-mo Bond yield – France	Bloomberg
1-yr Bond yield – France	Bloomberg
2-yr Bond yield – France	Bloomberg
3-yr Bond yield – France	Bloomberg
4-yr Bond yield – France	Bloomberg
5-yr Bond yield – France	Bloomberg
7-yr Bond yield – France	Bloomberg
10-yr Bond yield – France	Bloomberg
15-yr Bond yield – France	Bloomberg

20-yr Bond yield – France	Bloomberg
30-yr Bond yield – France	Bloomberg
60-yr Bond yield – France	Bloomberg
Norway: Bond Yields	
Overnight rate – Norway	Bloomberg
1-mo Bond yield – Norway	Bloomberg
3-mo Bond yield – Norway	Bloomberg
6-mo Bond yield – Norway	Bloomberg
1-yr Bond yield – Norway	Bloomberg
2-yr Bond yield – Norway	Bloomberg
3-yr Bond yield – Norway	Bloomberg
4-yr Bond yield – Norway	Bloomberg
5-yr Bond yield – Norway	Bloomberg
7-yr Bond yield – Norway	Bloomberg
10-yr Bond yield – Norway	Bloomberg
15-yr Bond yield – Norway	Bloomberg
20-yr Bond yield – Norway	Bloomberg
30-yr Bond yield – Norway	Bloomberg
60-yr Bond yield – Norway	Bloomberg
Canada: Bond Yields	
Overnight rate – Canada	Bloomberg
1-mo Bond yield – Canada	Bloomberg
3-mo Bond yield – Canada	Bloomberg
6-mo Bond yield – Canada	Bloomberg
1-yr Bond yield – Canada	Bloomberg
2-yr Bond yield – Canada	Bloomberg
3-yr Bond yield – Canada	Bloomberg
4-yr Bond yield – Canada	Bloomberg
5-yr Bond yield – Canada	Bloomberg
7-yr Bond yield – Canada	Bloomberg
10-yr Bond yield – Canada	Bloomberg
15-yr Bond yield – Canada	Bloomberg
20-yr Bond yield – Canada	Bloomberg
30-yr Bond yield – Canada	Bloomberg
60-yr Bond yield – Canada	Bloomberg
Sweden: Bond Yields	
Overnight Rate – Sweden	Bloomberg
1-mo Bond yield – Sweden	Bloomberg
3-mo Bond yield – Sweden	Bloomberg
6-mo Bond yield – Sweden	Bloomberg
1-yr Bond yield – Sweden	Bloomberg
2-yr Bond yield – Sweden	Bloomberg
3-yr Bond yield – Sweden	Bloomberg

4-yr Bond yield – Sweden	Bloomberg
5-yr Bond yield – Sweden	Bloomberg
7-yr Bond yield – Sweden	Bloomberg
10-yr Bond yield – Sweden	Bloomberg
15-yr Bond yield – Sweden	Bloomberg
20-yr Bond yield – Sweden	Bloomberg
30-yr Bond yield – Sweden	Bloomberg
60-yr Bond yield – Sweden	Bloomberg
South Africa: Bond Yields	
Overnight rate – South Africa	Bloomberg
1-mo Bond yield – South Africa	Bloomberg
3-mo Bond yield – South Africa	Bloomberg
6-mo Bond yield – South Africa	Bloomberg
1-yr Bond yield – South Africa	Bloomberg
2-yr Bond yield – South Africa	Bloomberg
3-yr Bond yield – South Africa	Bloomberg
4-yr Bond yield – South Africa	Bloomberg
5-yr Bond yield – South Africa	Bloomberg
7-yr Bond yield – South Africa	Bloomberg
10-yr Bond yield – South Africa	Bloomberg
15-yr Bond yield – South Africa	Bloomberg
20-yr Bond yield – South Africa	Bloomberg
30-yr Bond yield – South Africa	Bloomberg
60-yr Bond yield – South Africa	Bloomberg
Switzerland: Bond Yields	
2-yr Bond yield – Switzerland	Bloomberg
3-yr Bond yield – Switzerland	Bloomberg
5-yr Bond yield – Switzerland	Bloomberg
7-yr Bond yield – Switzerland	Bloomberg
10-yr Bond yield – Switzerland	Bloomberg
15-yr Bond yield – Switzerland	Bloomberg
30-yr Bond yield – Switzerland	Bloomberg
Corporate Credit Curve	
2-yr Composite BVAL AA Curve – U.S.	Bloomberg
10-yr Composite BVAL AA Curve – U.S.	Bloomberg
2-yr Composite BVAL A Curve – U.S.	Bloomberg
10-yr Composite BVAL A Curve – U.S.	Bloomberg
2-yr Composite BVAL BBB Curve – U.S.	Bloomberg
10-yr Composite BVAL BBB Curve – U.S.	Bloomberg
2-yr Composite BVAL BB Curve – U.S.	Bloomberg
10-yr Composite BVAL BB Curve – U.S.	Bloomberg
2-yr Composite BVAL B Curve – U.S.	Bloomberg
10-yr Composite BVAL B Curve – U.S.	Bloomberg

2-yr Composite BVAL AA Curve – euro zone	Moody's Analytics
10-yr Composite BVAL AA Curve – euro zone	Moody's Analytics
2-yr Composite BVAL A Curve – euro zone	Moody's Analytics
10-yr Composite BVAL A Curve – euro zone	Moody's Analytics
2-yr Composite BVAL BBB Curve – euro zone	Moody's Analytics
10-yr Composite BVAL BBB Curve – euro zone	Moody's Analytics
2-yr Composite BVAL AA Curve – U.K.	Moody's Analytics
10-yr Composite BVAL AA Curve – U.K.	Moody's Analytics
2-yr Composite BVAL A Curve – U.K.	Moody's Analytics
10-yr Composite BVAL A Curve – U.K.	Moody's Analytics
2-yr Composite BVAL BBB Curve – U.K.	Moody's Analytics
10-yr Composite BVAL BBB Curve – U.K.	Moody's Analytics
BBB Corporate and Merrill Lynch	
10-yr BBB Corporate Bond yield for U.S.	Bloomberg
10-yr BBB Corporate Bond yield for U.K.	Moody's Analytics
10-yr BBB Corporate Bond yield for euro zone	Moody's Analytics
10-yr BBB Corporate Bond yield for Japan	Moody's Analytics
10-yr BBB Corporate Bond yield for Dev. Asia	Moody's Analytics
BofA ML 15+ yr BBB sterling corporate index	BofA Merrill Lynch
BofA ML BBB sterling utilities index	BofA Merrill Lynch
BofA Merrill Lynch U.S. High-Yield Master II OAS	BofA Merrill Lynch
BofA Merrill Lynch U.S. Corporate BBB OAS	BofA Merrill Lynch
BofA Merrill Lynch U.S. Corporate Master OAS	BofA Merrill Lynch
BofA ML 10- to 15-yr maturity AA Sterling Corporate (spread)	BofA Merrill Lynch
BofA ML 15+-yr maturity AA Sterling Corporate (spread)	BofA Merrill Lynch
BofA ML 10-15 yr AA Sterling Corporate	BofA Merrill Lynch
AA 10-yr Corporate Bond Yields	Bloomberg
Corporate Credit Default Swaps (CDS)	
Markit CDX North America Investment Grade Index	Bloomberg
Markit CDX North America High-Yield Index	Bloomberg
Markit iTraxx Europe Senior Financial Index	Bloomberg
Markit iTraxx Europe Subordinated Financial Index	Bloomberg
Markit iTraxx Europe Crossover (sub-investment grade) Index	Bloomberg
Markit iTraxx Europe Index	Bloomberg
Moody's Intermediate-Term Bond Yield Average: Corporate – Rated Aa	Moody's Analytics
Corporate Credit Spreads	
Financial AAA	
Financial AA	
Financial A	
Financial BBB	
Financial BB	
Financial B	
Nonfinancial AAA	

Nonfinancial AA	
Nonfinancial A	
Nonfinancial BBB	
Nonfinancial BB	
Nonfinancial B	
Corporate Yields: Australia	
3-mo BFV AUD Australia Domestic A	Bloomberg
6-mo BFV AUD Australia Domestic A	Bloomberg
1-yr BFV AUD Australia Domestic A	Bloomberg
2-yr BFV AUD Australia Domestic A	Bloomberg
3-yr BFV AUD Australia Domestic A	Bloomberg
4-yr BFV AUD Australia Domestic A	Bloomberg
5-yr BFV AUD Australia Domestic A	Bloomberg
7-yr BFV AUD Australia Domestic A	Bloomberg
3-mo BFV AUD Australia Domestic AA	Bloomberg
6-mo BFV AUD Australia Domestic AA	Bloomberg
1-yr BFV AUD Australia Domestic AA	Bloomberg
2-yr BFV AUD Australia Domestic AA	Bloomberg
3-yr BFV AUD Australia Domestic AA	Bloomberg
4-yr BFV AUD Australia Domestic AA	Bloomberg
5-yr BFV AUD Australia Domestic AA	Bloomberg
7-yr BFV AUD Australia Domestic AA	Bloomberg
3-mo BFV AUD Australia Domestic AAA	Bloomberg
6-mo BFV AUD Australia Domestic AAA	Bloomberg
1-yr BFV AUD Australia Domestic AAA	Bloomberg
2-yr BFV AUD Australia Domestic AAA	Bloomberg
3-yr BFV AUD Australia Domestic AAA	Bloomberg
4-yr BFV AUD Australia Domestic AAA	Bloomberg
3-mo BFV AUD Australia Domestic BB	Bloomberg
6-mo BFV AUD Australia Domestic BB	Bloomberg
1-yr BFV AUD Australia Domestic BB	Bloomberg
2-yr BFV AUD Australia Domestic BB	Bloomberg
3-yr BFV AUD Australia Domestic BB	Bloomberg
4-yr BFV AUD Australia Domestic BB	Bloomberg
5-yr BFV AUD Australia Domestic BB	Bloomberg
7-yr BFV AUD Australia Domestic BB	Bloomberg
Corporate Yields: Euro	
3-mo BFV EUR Composite AA	Bloomberg
6-mo BFV EUR Composite AA	Bloomberg
1-yr BFV EUR Composite AA	Bloomberg
2-yr BFV EUR Composite AA	Bloomberg
3-yr BFV EUR Composite AA	Bloomberg
4-yr BFV EUR Composite AA	Bloomberg

5-yr BFV EUR Composite AA	Bloomberg
7-yr BFV EUR Composite AA	Bloomberg
8-yr BFV EUR Composite AA	Bloomberg
9-yr BFV EUR Composite AA	Bloomberg
10-yr BFV EUR Composite AA	Bloomberg
15-yr BFV EUR Composite AA	Bloomberg
3-mo BFV EUR Composite A	Bloomberg
6-mo BFV EUR Composite A	Bloomberg
1-yr BFV EUR Composite A	Bloomberg
2-yr BFV EUR Composite A	Bloomberg
3-yr BFV EUR Composite A	Bloomberg
4-yr BFV EUR Composite A	Bloomberg
5-yr BFV EUR Composite A	Bloomberg
7-yr BFV EUR Composite A	Bloomberg
8-yr BFV EUR Composite A	Bloomberg
9-yr BFV EUR Composite A	Bloomberg
10-yr BFV EUR Composite A	Bloomberg
15-yr BFV EUR Composite A	Bloomberg
20-yr BFV EUR Composite A	Bloomberg
25-yr BFV EUR Composite A	Bloomberg
30-yr BFV EUR Composite A	Bloomberg
3-mo BFV EUR Composite BBB	Bloomberg
6-mo BFV EUR Composite BBB	Bloomberg
1-yr BFV EUR Composite BBB	Bloomberg
2-yr BFV EUR Composite BBB	Bloomberg
3-yr BFV EUR Composite BBB	Bloomberg
4-yr BFV EUR Composite BBB	Bloomberg
5-yr BFV EUR Composite BBB	Bloomberg
7-yr BFV EUR Composite BBB	Bloomberg
8-yr BFV EUR Composite BBB	Bloomberg
9-yr BFV EUR Composite BBB	Bloomberg
10-yr BFV EUR Composite BBB	Bloomberg
15-yr BFV EUR Composite BBB	Bloomberg
Corporate Yields: USD	
3-mo BFV USD Composite A	Bloomberg
6-mo BFV USD Composite A	Bloomberg
1-yr BFV USD Composite A	Bloomberg
2-yr BFV USD Composite A	Bloomberg
3-yr BFV USD Composite A	Bloomberg
4-yr BFV USD Composite A	Bloomberg
5-yr BFV USD Composite A	Bloomberg
7-yr BFV USD Composite A	Bloomberg
8-yr BFV USD Composite A	Bloomberg

9-yr BFV USD Composite A	Bloomberg
10-yr BFV USD Composite A	Bloomberg
15-yr BFV USD Composite A	Bloomberg
20-yr BFV USD Composite A	Bloomberg
25-yr BFV USD Composite A	Bloomberg
30-yr BFV USD Composite A	Bloomberg
3-mo BFV USD Composite BBB	Bloomberg
6-mo BFV USD Composite BBB	Bloomberg
1-yr BFV USD Composite BBB	Bloomberg
2-yr BFV USD Composite BBB	Bloomberg
3-yr BFV USD Composite BBB	Bloomberg
4-yr BFV USD Composite BBB	Bloomberg
5-yr BFV USD Composite BBB	Bloomberg
7-yr BFV USD Composite BBB	Bloomberg
8-yr BFV USD Composite BBB	Bloomberg
9-yr BFV USD Composite BBB	Bloomberg
10-yr BFV USD Composite BBB	Bloomberg
15-yr BFV USD Composite BBB	Bloomberg
20-yr BFV USD Composite BBB	Bloomberg
25-yr BFV USD Composite BBB	Bloomberg
30-yr BFV USD Composite BBB	Bloomberg
3-mo BFV USD Composite BB	Bloomberg
6-mo BFV USD Composite BB	Bloomberg
1-yr BFV USD Composite BB	Bloomberg
2-yr BFV USD Composite BB	Bloomberg
3-yr BFV USD Composite BB	Bloomberg
4-yr BFV USD Composite BB	Bloomberg
5-yr BFV USD Composite BB	Bloomberg
7-yr BFV USD Composite BB	Bloomberg
8-yr BFV USD Composite BB	Bloomberg
9-yr BFV USD Composite BB	Bloomberg
10-yr BFV USD Composite BB	Bloomberg
15-yr BFV USD Composite BB	Bloomberg
20-yr BFV USD Composite BB	Bloomberg
25-yr BFV USD Composite BB	Bloomberg
Corporate Yields: GBP	
3-mo BFV GBP Euro AAA	Bloomberg
6-mo BFV GBP Euro AAA	Bloomberg
1-yr BFV GBP Euro AAA	Bloomberg
2-yr BFV GBP Euro AAA	Bloomberg
3-yr BFV GBP Euro AAA	Bloomberg
4-yr BFV GBP Euro AAA	Bloomberg
5-yr BFV GBP Euro AAA	Bloomberg

7-yr BFV GBP Euro AAA	Bloomberg
8-yr BFV GBP Euro AAA	Bloomberg
9-yr BFV GBP Euro AAA	Bloomberg
10-yr BFV GBP Euro AAA	Bloomberg
15-yr BFV GBP Euro AAA	Bloomberg
20-yr BFV GBP Euro AAA	Bloomberg
25-yr BFV GBP Euro AAA	Bloomberg
30-yr BFV GBP Euro AAA	Bloomberg
3-mo BFV GBP Euro AA	Bloomberg
6-mo BFV GBP Euro AA	Bloomberg
1-yr BFV GBP Euro AA	Bloomberg
2-yr BFV GBP Euro AA	Bloomberg
3-yr BFV GBP Euro AA	Bloomberg
4-yr BFV GBP Euro AA	Bloomberg
5-yr BFV GBP Euro AA	Bloomberg
7-yr BFV GBP Euro AA	Bloomberg
8-yr BFV GBP Euro AA	Bloomberg
9-yr BFV GBP Euro AA	Bloomberg
10-yr BFV GBP Euro AA	Bloomberg
15-yr BFV GBP Euro AA	Bloomberg
20-yr BFV GBP Euro AA	Bloomberg
25-yr BFV GBP Euro AA	Bloomberg
30-yr BFV GBP Euro AA	Bloomberg
3-mo BFV GBP Euro A	Bloomberg
6-mo BFV GBP Euro A	Bloomberg
1-yr BFV GBP Euro A	Bloomberg
2-yr BFV GBP Euro A	Bloomberg
3-yr BFV GBP Euro A	Bloomberg
4-yr BFV GBP Euro A	Bloomberg
5-yr BFV GBP Euro A	Bloomberg
7-yr BFV GBP Euro A	Bloomberg
8-yr BFV GBP Euro A	Bloomberg
9-yr BFV GBP Euro A	Bloomberg
10-yr BFV GBP Euro A	Bloomberg
15-yr BFV GBP Euro A	Bloomberg
20-yr BFV GBP Euro A	Bloomberg
25-yr BFV GBP Euro A	Bloomberg
30-yr BFV GBP Euro A	Bloomberg
3-mo BFV GBP Euro BBB	Bloomberg
6-mo BFV GBP Euro BBB	Bloomberg
1-yr BFV GBP Euro BBB	Bloomberg
2-yr BFV GBP Euro BBB	Bloomberg
3-yr BFV GBP Euro BBB	Bloomberg

4-yr BFV GBP Euro BBB	Bloomberg
5-yr BFV GBP Euro BBB	Bloomberg
7-yr BFV GBP Euro BBB	Bloomberg
8-yr BFV GBP Euro BBB	Bloomberg
9-yr BFV GBP Euro BBB	Bloomberg
10-yr BFV GBP Euro BBB	Bloomberg
15-yr BFV GBP Euro BBB	Bloomberg
20-yr BFV GBP Euro BBB	Bloomberg
25-yr BFV GBP Euro BBB	Bloomberg
30-yr BFV GBP Euro BBB	Bloomberg
3-mo BFV GBP Euro Bank AAA	Bloomberg
6-mo BFV GBP Euro Bank AAA	Bloomberg
1-yr BFV GBP Euro Bank AAA	Bloomberg
2-yr BFV GBP Euro Bank AAA	Bloomberg
3-yr BFV GBP Euro Bank AAA	Bloomberg
4-yr BFV GBP Euro Bank AAA	Bloomberg
5-yr BFV GBP Euro Bank AAA	Bloomberg
7-yr BFV GBP Euro Bank AAA	Bloomberg
8-yr BFV GBP Euro Bank AAA	Bloomberg
9-yr BFV GBP Euro Bank AAA	Bloomberg
10-yr BFV GBP Euro Bank AAA	Bloomberg
15-yr BFV GBP Euro Bank AAA	Bloomberg
20-yr BFV GBP Euro Bank AAA	Bloomberg
25-yr BFV GBP Euro Bank AAA	Bloomberg
30-yr BFV GBP Euro Bank AAA	Bloomberg
3-mo BFV GBP Euro Bank AA	Bloomberg
6-mo BFV GBP Euro Bank AA	Bloomberg
1-yr BFV GBP Euro Bank AA	Bloomberg
2-yr BFV GBP Euro Bank AA	Bloomberg
3-yr BFV GBP Euro Bank AA	Bloomberg
4-yr BFV GBP Euro Bank AA	Bloomberg
5-yr BFV GBP Euro Bank AA	Bloomberg
7-yr BFV GBP Euro Bank AA	Bloomberg
8-yr BFV GBP Euro Bank AA	Bloomberg
9-yr BFV GBP Euro Bank AA	Bloomberg
10-yr BFV GBP Euro Bank AA	Bloomberg
15-yr BFV GBP Euro Bank AA	Bloomberg
20-yr BFV GBP Euro Bank AA	Bloomberg
25-yr BFV GBP Euro Bank AA	Bloomberg
30-yr BFV GBP Euro Bank AA	Bloomberg
3-mo BFV GBP Euro Bank A	Bloomberg
6-mo BFV GBP Euro Bank A	Bloomberg
1-yr BFV GBP Euro Bank A	Bloomberg

2-yr BFV GBP Euro Bank A	Bloomberg
3-yr BFV GBP Euro Bank A	Bloomberg
4-yr BFV GBP Euro Bank A	Bloomberg
5-yr BFV GBP Euro Bank A	Bloomberg
7-yr BFV GBP Euro Bank A	Bloomberg
8-yr BFV GBP Euro Bank A	Bloomberg
9-yr BFV GBP Euro Bank A	Bloomberg
10-yr BFV GBP Euro Bank A	Bloomberg
15-yr BFV GBP Euro Bank A	Bloomberg
20-yr BFV GBP Euro Bank A	Bloomberg
25-yr BFV GBP Euro Bank A	Bloomberg
30-yr BFV GBP Euro Bank A	Bloomberg
3-mo BFV GBP Euro Finance A	Bloomberg
6-mo BFV GBP Euro Finance A	Bloomberg
1-yr BFV GBP Euro Finance A	Bloomberg
2-yr BFV GBP Euro Finance A	Bloomberg
3-yr BFV GBP Euro Finance A	Bloomberg
4-yr BFV GBP Euro Finance A	Bloomberg
5-yr BFV GBP Euro Finance A	Bloomberg
7-yr BFV GBP Euro Finance A	Bloomberg
8-yr BFV GBP Euro Finance A	Bloomberg
9-yr BFV GBP Euro Finance A	Bloomberg
10-yr BFV GBP Euro Finance A	Bloomberg
15-yr BFV GBP Euro Finance A	Bloomberg
20-yr BFV GBP Euro Finance A	Bloomberg
25-yr BFV GBP Euro Finance A	Bloomberg
30-yr BFV GBP Euro Finance A	Bloomberg
3-mo BFV GBP Euro Finance BBB	Bloomberg
6-mo BFV GBP Euro Finance BBB	Bloomberg
1-yr BFV GBP Euro Finance BBB	Bloomberg
2-yr BFV GBP Euro Finance BBB	Bloomberg
3-yr BFV GBP Euro Finance BBB	Bloomberg
4-yr BFV GBP Euro Finance BBB	Bloomberg
5-yr BFV GBP Euro Finance BBB	Bloomberg
7-yr BFV GBP Euro Finance BBB	Bloomberg
8-yr BFV GBP Euro Finance BBB	Bloomberg
9-yr BFV GBP Euro Finance BBB	Bloomberg
10-yr BFV GBP Euro Finance BBB	Bloomberg
15-yr BFV GBP Euro Finance BBB	Bloomberg
20-yr BFV GBP Euro Finance BBB	Bloomberg
25-yr BFV GBP Euro Finance BBB	Bloomberg
30-yr BFV GBP Euro Finance BBB	Bloomberg

Other	
Company Insolvencies in England and Wales (#, SA)	Moody's Analytics
U.K. Corporate Gearing Ratio	Bank of England
U.K. Claimant Count	ONS
U.K. Savings Ratio	ONS
Ireland Business Investment	CSO
Sovereign CDS	
Brazil 5-yr USD Sovereign CDS Spreads	Bloomberg
China 5-yr USD Sovereign CDS Spreads	Bloomberg
France 5-yr USD Sovereign CDS Spreads	Bloomberg
Germany 5-yr USD Sovereign CDS Spreads	Bloomberg
Italy 5-yr USD Sovereign CDS Spreads	Bloomberg
Japan 5-yr USD Sovereign CDS Spreads	Bloomberg
Spain 5-yr USD Sovereign CDS Spreads	Bloomberg
U.S. 5-yr Euro Sovereign CDS Spreads	Bloomberg
Switzerland 5-yr USD Sovereign CDS Spreads	Bloomberg
Municipals	
1-yr AAA U.S. GO Municipal Curve Level	Bloomberg
2-yr AAA U.S. GO Municipal Curve Level	Bloomberg
5-yr AAA U.S. GO Municipal Curve Level	Bloomberg
10-yr AAA U.S. GO Municipal Curve Level	Bloomberg
30-yr AAA U.S. GO Municipal Curve Level	Bloomberg
3-mo AA U.S. GO Municipal Curve Yield	Bloomberg
1-yr AA U.S. GO Municipal Curve Yield	Bloomberg
2-yr AA U.S. GO Municipal Curve Yield	Bloomberg
5-yr AA U.S. GO Municipal Curve Yield	Bloomberg
10-yr AA U.S. GO Municipal Curve Yield	Bloomberg
30-yr AA U.S. GO Municipal Curve Yield	Bloomberg
3-mo A U.S. GP Municipal Curve Yield	Bloomberg
1-yr A U.S. GP Municipal Curve Yield	Bloomberg
2-yr A U.S. GP Municipal Curve Yield	Bloomberg
5-yr A U.S. GP Municipal Curve Yield	Bloomberg
10-yr A U.S. GP Municipal Curve Yield	Bloomberg
30-yr A U.S. GP Municipal Curve Yield	Bloomberg
3-mo BBB U.S. GO Municipal Curve Yield	Bloomberg
1-yr BBB U.S. GO Municipal Curve Yield	Bloomberg
2-yr BBB U.S. GO Municipal Curve Yield	Bloomberg
5-yr BBB U.S. GO Municipal Curve Yield	Bloomberg
10-yr BBB U.S. GO Municipal Curve Yield	Bloomberg
30-yr BBB U.S. GO Municipal Curve Yield	Bloomberg
3-mo BFV U.S. Taxable AA	Bloomberg
6-mo BFV U.S. Taxable AA	Bloomberg
1-yr BFV U.S. Taxable AA	Bloomberg

2-yr BFV U.S. Taxable AA	Bloomberg
3-yr BFV U.S. Taxable AA	Bloomberg
4-yr BFV U.S. Taxable AA	Bloomberg
5-yr BFV U.S. Taxable AA	Bloomberg
7-yr BFV U.S. Taxable AA	Bloomberg
9-yr BFV U.S. Taxable AA	Bloomberg
10-yr BFV U.S. Taxable AA	Bloomberg
12-yr BFV U.S. Taxable AA	Bloomberg
14-yr BFV U.S. Taxable AA	Bloomberg
15-yr BFV U.S. Taxable AA	Bloomberg
17-yr BFV U.S. Taxable AA	Bloomberg
19-yr BFV U.S. Taxable AA	Bloomberg
20-yr BFV U.S. Taxable AA	Bloomberg
25-yr BFV U.S. Taxable AA	Bloomberg
30-yr BFV U.S. Taxable AA	Bloomberg
1-yr Municipal Market Advisors AAA GO Consensus	Bloomberg
2-yr Municipal Market Advisors AAA GO Consensus	Bloomberg
5-yr Municipal Market Advisors AAA GO Consensus	Bloomberg
10-yr Municipal Market Advisors AAA GO Consensus	Bloomberg
30-yr Municipal Market Advisors AAA GO Consensus	Bloomberg
1-yr U.S. General Obligation AA Muni BVAL Yield Curve	Bloomberg
2-yr U.S. General Obligation AA Muni BVAL Yield Curve	Bloomberg
5-yr U.S. General Obligation AA Muni BVAL Yield Curve	Bloomberg
10-yr U.S. General Obligation AA Muni BVAL Yield Curve	Bloomberg
30-yr U.S. General Obligation AA Muni BVAL Yield Curve	Bloomberg
1-yr U.S. General Obligation A Muni BVAL Yield Curve	Bloomberg
2-yr U.S. General Obligation A Muni BVAL Yield Curve	Bloomberg
5-yr U.S. General Obligation A Muni BVAL Yield Curve	Bloomberg
10-yr U.S. General Obligation A Muni BVAL Yield Curve	Bloomberg
20-yr U.S. General Obligation A Muni BVAL Yield Curve	Bloomberg
1-yr U.S. Revenue BBB Muni BVAL Yield Curve	Bloomberg
2-yr U.S. Revenue BBB Muni BVAL Yield Curve	Bloomberg
5-yr U.S. Revenue BBB Muni BVAL Yield Curve	Bloomberg
10-yr U.S. Revenue BBB Muni BVAL Yield Curve	Bloomberg
30-yr U.S. Revenue BBB Muni BVAL Yield Curve	Bloomberg
Sovereigns	
2-yr Treasury Benchmark: Swap Spread – Yield	Barclays Live
3-yr Treasury Benchmark: Swap Spread – Yield	Barclays Live
3-yr Germany Benchmark: Swap Spread – Yield	Barclays Live
4-yr Germany Benchmark: Swap Spread – Yield	Barclays Live
3-yr France Benchmark: Swap Spread – Yield	Barclays Live
4-yr France Benchmark: Swap Spread – Yield	Barclays Live
3-yr Belgium Benchmark: Swap Spread – Yield	Barclays Live

4-yr Belgium Benchmark: Swap Spread – Yield	Barclays Live
3-yr Holland Benchmark: Swap Spread – Yield	Barclays Live
4-yr Holland Benchmark: Swap Spread – Yield	Barclays Live
3-yr Italy Benchmark: Swap Spread – Yield	Barclays Live
4-yr Italy Benchmark: Swap Spread – Yield	Barclays Live
3-yr Spain Benchmark: Swap Spread – Yield	Barclays Live
4-yr Spain Benchmark: Swap Spread – Yield	Barclays Live
3-yr GILTS Benchmark: Swap Spread – Yield	Barclays Live
4-yr GILTS Benchmark: Swap Spread – Yield	Barclays Live
Supranational Curve Kreditanstalt für Wiederaufbau (KfW, German development agency)	
KFW Development Bank overnight credit default swap	Bloomberg
KFW Development Bank 1-mo credit default swap	Bloomberg
KFW Development Bank 3-mo credit default swap	Bloomberg
KFW Development Bank 6-mo credit default swap	Bloomberg
KFW Development Bank 1-yr credit default swap	Bloomberg
KFW Development Bank 2-yr credit default swap	Bloomberg
KFW Development Bank 3-yr credit default swap	Bloomberg
KFW Development Bank 4-yr credit default swap	Bloomberg
KFW Development Bank 5-yr credit default swap	Bloomberg
KFW Development Bank 7-yr credit default swap	Bloomberg
KFW Development Bank 10-yr credit default swap	Bloomberg
KFW Development Bank 15-yr credit default swap	Bloomberg
KFW Development Bank 20-yr credit default swap	Bloomberg
KFW Development Bank 30-yr credit default swap	Bloomberg
KFW Development Bank 0-yr credit default swap	Bloomberg
Supranational Curve European Investment Bank (EIB)	
European Investment Bank overnight credit default swap	Bloomberg
European Investment Bank 1-mo credit default swap	Bloomberg
European Investment Bank 3-mo credit default swap	Bloomberg
European Investment Bank 6-mo credit default swap	Bloomberg
European Investment Bank 1-yr credit default swap	Bloomberg
European Investment Bank 2-yr credit default swap	Bloomberg
European Investment Bank 3-yr credit default swap	Bloomberg
European Investment Bank 4-yr credit default swap	Bloomberg
European Investment Bank 5-yr credit default swap	Bloomberg
European Investment Bank 7-yr credit default swap	Bloomberg
European Investment Bank 10-yr credit default swap	Bloomberg
European Investment Bank 15-yr credit default swap	Bloomberg
European Investment Bank 20-yr credit default swap	Bloomberg
European Investment Bank 30-yr credit default swap	Bloomberg
European Investment Bank 60-yr credit default swap	Bloomberg
CLO	
Seas. USD (04-05 vint) – CLO AA Spread to 3M Libor	Morgan Markets

Bench. USD (06-07 vint) – CLO AA Spread to 3M Libor	Morgan Markets
Seas. USD (04-05 vint) – CLO AAA Spread to 3M Libor	Morgan Markets
Bench. USD (06-07 vint) – CLO AAA Spread to 3M Libor	Morgan Markets
CLO Total AAA Coupon	Morgan Markets
MBS	
BBB All 3-yr/40% Fitted Par Spread Libor	Morgan Markets
BBB All 5-yr/40% Fitted Par Spread Libor	Morgan Markets
BBB All 7-yr/40% Fitted Par Spread Libor	Morgan Markets
CMBS 3.0 AA 10-yr	Barclays Live
CMBS 3.0 A 10-yr	Barclays Live
CMBS 3.0 BBB 10-yr	Barclays Live
CMBS FHMS 10-yr A-2	Barclays Live
Floaters Conventional Strips 7 Cap,:DM	Barclays Live
Floaters GNMA PAC/SEQ 7 Cap,:DM	Barclays Live
Floaters GNMA Strips 7 Cap,:DM	Barclays Live
MBS CCOAS USD	Barclays Live
FNMA 30-yr 3% Front Yield Default Model(2014)	Morgan Markets
FNMA 15-yr 3% Front Yield Default Model(2014)	Morgan Markets
FNMA 15-yr 3.5% Front Yield Default Model(2014)	Morgan Markets
GOLD 30-yr 3% Front Yield Default Model(2014)	Morgan Markets
GOLD 30-yr 4% Front Yield Default Model(2014)	Morgan Markets
GOLD 15-yr 3% Front Yield Default Model(2014)	Morgan Markets
GNMA 3.5-yr Spread	JP Morgan Markets
GNMA 12-yr Spread	JP Morgan Markets
GNMAI 30-yr 3.0% Front Yield Default Model(2014)	Morgan Markets
GNMAI 30-yr 3.5% Front Yield Default Model(2014)	Morgan Markets
GNMAI 15-yr 3.0% Front Yield Default Model(2014)	Morgan Markets
GNMAI 15-yr 3.5% Front Yield Default Model(2014)	Morgan Markets
FNMA DUS 5- to 10-yr Spread	JP Morgan Markets
FHLMC 10-yr A2 Spread	JP Morgan Markets
AUTO Fixed BBB 3-yr	Morgan Markets
15-yr FNMA CC; Libor OAS (BarCap)	Barclays Live
15-yr FNMA 3.5%; Libor OAS (BarCap)	Barclays Live
15-yr FNMA 4.0%; Libor OAS (BarCap)	Barclays Live
15-yr FNMA 4.5%; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC CC; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 3.5%; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 4.0%; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 4.5%; Libor OAS (BarCap)	Barclays Live
15-yr GNMA CC; Libor OAS (BarCap)	Barclays Live
30-yr FNMA CC; Libor OAS (BarCap)	Barclays Live
30-yr FNMA 4.5%; Libor OAS (BarCap)	Barclays Live
30-yr FHLMC CC; Libor OAS (BarCap)	Barclays Live

30-yr GNMA CC; Libor OAS (BarCap)	Barclays Live
FNMA, 5/1, 3.0,:Libor OAS (BarCap)	Barclays Live
FHLM, 5/1, 3.0,:Libor OAS (BarCap)	Barclays Live
CMO PAC – 2-yr WAL, Tsy OAS (JPM)	JP Morgan Markets
CMO PAC – 10-yr WAL, Tsy OAS (JPM)	JP Morgan Markets
CMO SEQ – 2-yr WAL, Tsy OAS (JPM)	JP Morgan Markets
CMO SEQ – 10-yr WAL, Tsy OAS (JPM)	JP Morgan Markets
CMO Floaters Strips – 6.5 Cap DM (BarCap)	JP Morgan Markets
Floaters Conventional Strips 6.5 Cap,:DM	JP Morgan Markets
Floaters Conventional Strips 7 Cap,:DM	JP Morgan Markets
15-yr FNMA 5.5% 2005; Libor OAS (BarCap)	Barclays Live
15-yr FNMA 3.5% 2011; Libor OAS (BarCap)	Barclays Live
15-yr FNMA 4.0% 2011; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 4.5% 2005; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 5.0% 2005; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 5.0% 2008; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 4.5% 2009; Libor OAS (BarCap)	Barclays Live
15-yr FHLMC 4.0% 2010; Libor OAS (BarCap)	Barclays Live
15-yr GNMA CC; Libor OAS (BarCap)	Barclays Live
30-yr FNMA CC; Libor OAS (BarCap)	Barclays Live
International MBS	
EUR Floating Coupon: Irish RMBS: A::Spread	Barclays Live
EUR Floating Coupon: German RMBS: A::Spread	Barclays Live
EUR Floating Coupon: French RMBS: A::Spread	Barclays Live
EUR Floating Coupon: Spanish RMBS: A::Spread	Barclays Live
EUR Floating Coupon: Italian RMBS: A::Spread	Barclays Live
EUR Floating Coupon: Portuguese RMBS: A::Spread	Barclays Live
EUR Floating Coupon: Portuguese RMBS: A::Spread	Barclays Live
GBP Floating Coupon: U.K. Prime RMBS: AAA 0-3::Spread	Barclays Live
GBP Floating Coupon: U.K. Prime RMBS: AAA 3-5::Spread	Barclays Live
GBP: U.K. Prime RMBS: AAA 5-10 Flt Spread	Barclays Live
EUR: Dutch RMBS: AAA 5-10yr Flt Spread	Barclays Live
EUR: Dutch RMBS: AA Flt Spread	Barclays Live
EUR: Irish RMBS: BBB – Flt. Spread	Barclays Live
Non-Agency RMBS	
ABX.HE.Chained BBB, Price	Barclays Live
ABX.HE.Chained BBB-, Price	Barclays Live
Non-Agency RMBS Prime AAA	IDC
Non-Agency RMBS Alt-A AAA	IDC
Non-Agency RMBS Alt-A AA	IDC
Non-Agency RMBS Subprime AAA	IDC
Non-Agency CMBS	
CMBX.NA 6 AAA Mid Spread	Morgan Markets

CMBX.NA 6 BBB- Mid Spread	Morgan Markets
CMBS 2005 A	Barclays Live
CMBS 2005 AM	Barclays Live
CMBS 2005 AJ	Barclays Live
CMBS AJ AA (2011-Current) Spread	JP Morgan Markets
CMBS 10yr Mezz AA (2011-Current) Spread	JP Morgan Markets
CMBS 10yr Mezz A (2011-Current) Spread	JP Morgan Markets
CMBS 10yr BBB+ (2012-Current) Spread (Junior)	JP Morgan Markets
ABS	
Credit Cards Fixed BBB 3-yr	Morgan Markets
Student Loans Libor (FFELP) AA 6-yr spread to Libor	Morgan Markets
Auto (Subprime) Fixed BBB – 3-yr spread to Swap	Morgan Markets
AUTO Fixed AAA 1-yr	JP Morgan Markets
ABS-Student Loans AAA 1-yr	JP Morgan Markets
ABS-Student Loans AAA 5-yr	JP Morgan Markets
Auto Fixed AAA to Swap 3-yr	JP Morgan Markets
Credit Card Floating AAA 3-yr	JP Morgan Markets
Credit Card Floating AAA 7-yr	JP Morgan Markets
ABCP	**Barclays Live**
BACR/6M SENIOR/SPREAD/NYCLOSE	
Housing	**Bloomberg**
Housing Turnover	Bloomberg
Mortgage Bankers Association Refinancing Index	Bloomberg
Other Credit-Related Variables	**Bank of England**
Mortgage approvals	Bank of England
M4 holdings of PNFCs	Bank of England
M4 lending to PNFCs	Bank of England
M4 lending	Bloomberg
20-yr break-evens	Bank of England
UKPA (APACS) credit card delinquencies	Bank of England
Write-off rate on credit cards	Bank of England
Personal sector deposits with U.K. MFIs	Bank of England
Gross mortgage lending	Moody's Analytics
Net mortgage lending	Bank of England
Gross credit card lending	Bank of England
Gross other unsecured lending	Bank of England
Net credit card lending	Bank of England
Net other unsecured lending	
Covered Bonds	
EUR 3-yr	Bloomberg
USD Covered 1-3 BBG YTW	Bloomberg
iBoxx $ Canada Covered	JP Morgan Markets
iBoxx EUR Canada	JP Morgan Markets

iBoxx EUR GB	JP Morgan Markets
iBoxx EUR Netherlands	JP Morgan Markets
iBoxx EUR Scandinavia	JP Morgan Markets
Consumer ABS	
Total ABS Index Price	Morgan Markets
Total Credit Card Index Price	Morgan Markets
Total Auto Index Price	Morgan Markets
Total Student Loan Index Price	Morgan Markets
Corporates	
LCDX 100 On the run (5-yr) UN JPMorgan Dirty Price Mid	
Agency Debentures	
Agency Debentures Short	IDC
Agency Debentures Intermediate	IDC
Agency Debentures Long	IDC
Stock Market Indices	
MSCI Global Equity index	Bloomberg
MSCI Emerging Market Equity Index	Bloomberg
FT STOXX 50 Blue Chip Price Index	Bloomberg
FTSE 100	Bloomberg
FTSE Low Volatility	Bloomberg
S&P 500	Bloomberg
LPX Listed Private Equity Index	Bloomberg
Total returns on UKX Index FTSE 100	Bloomberg
Total returns on ASX Index FTSE All-share	Bloomberg
Total returns on S&P 500	Bloomberg
Total returns on MSCI World Equity	Bloomberg
IPDMPROP Index U.K. Property Total Returns	Bloomberg
Dow Jones Euro STOXX 50 Index, (Index, NSA)	Moody's Analytics
Nikkei 225 Index, (Index, NSA) for Japan	Moody's Analytics
S&P 500 Composite, (Index 1941-43=10, Average, NSA)	Moody's Analytics
Oslo Stock Exchange Index	Bloomberg
OMX Stockholm 30 Index	Bloomberg
NIKKEI 225 Index	Bloomberg
Swiss Market Index	Bloomberg
Top 40 Index FTSE/JSE Africa Top 40 Tradable Index	Bloomberg
Eurekahedge NA HF Index	Bloomberg
MSCI WORLD Index	Bloomberg
NASDAQ Composite	Moody's Analytics
NASDAQ 100	Moody's Analytics
Dow Jones Global Indices	Moody's Analytics
Dow Jones: Composite Average	Moody's Analytics
JPM Global EM TR	Morningstar
EURONEXT 100	Yahoo Finance

iShares MSCI World (URTH)	Yahoo Finance
MSCI Emerging	Yahoo Finance
MSCI EAFE	Yahoo Finance
S&P Global 1200	Bloomberg
MCX Index – FTSE 250 Index	Bloomberg
S&P MidCap 400	Bloomberg
SDJMID:GR Index – STOXX Europe Mid 200 UCITS ETF	Bloomberg
SMI Index – Swiss Market Index	Bloomberg
SX5E Index – Euro Stoxx 50 price EUR	Bloomberg
Stock Volatilities	
S&P 500 30day Implied Equity ATM Options Vol.	Bloomberg
S&P 500 6-mo Implied Equity ATM Options Vol.	Bloomberg
S&P 500 1-yr Implied Equity ATM Options Vol.	Bloomberg
S&P 500 2-yr Implied Equity ATM Options Vol.	Bloomberg
STOXX 50 30-day Implied Equity ATM Options Vol.	Bloomberg
STOXX 50 6-moImplied Equity ATM Options Vol.	Bloomberg
STOXX 50 1-yr Implied Equity ATM Options Vol.	Bloomberg
STOXX 50 2-yr Implied Equity ATM Options Vol.	Bloomberg
FTSE 100 30-day Implied Equity ATM Options Vol.	Bloomberg
FTSE 100 6-mo Implied Equity ATM Options Vol.	Bloomberg
FTSE 100 1-yr Implied Equity ATM Options Vol.	Bloomberg
FTSE 100 2-yr Implied Equity ATM Options Vol.	Bloomberg
NIKKEI 225 30-day Implied Equity ATM Options Vol.	Bloomberg
NIKKEI 225 6-mo Implied Equity ATM Options Vol.	Bloomberg
NIKKEI 225 1-yr Implied Equity ATM Options Vol.	Bloomberg
NIKKEI 225 2-yr Implied Equity ATM Options Vol.	Bloomberg
Deutsche Bank Currency Volatility Index	Moody's Analytics
Volatility Indexes for Developing Asia	
Euro Stoxx Volatility Index	Bloomberg
FTSE 100 Volatility Index	Bloomberg
CBOE Volatility SP100	Moody's Analytics
CBOE NASDAQ	Moody's Analytics
CBOE DJIA	Moody's Analytics
CBOE Volatility SP500	Moody's Analytics
NASDAQ Share Vol	Moody's Analytics
NASDAQ Trades	Moody's Analytics
Swaption Volatilities	
EUR European Swaption Black Vol at the Money Libor Discount vs .EUR006M Index 3Mox10Yr	Bloomberg
EUR European Swaption Black Vol at the Money Libor Discount vs. EUR006M Index 6Mox10Yr	Bloomberg
EUR European Swaption Black Vol at the Money Libor Discount vs. EUR006M Index 1Yrx10Yr	Bloomberg
EUR European Swaption Black Vol at the Money Libor Discount vs. EUR006M Index 2Yrx10Yr	Bloomberg
EUR European Swaption Black Vol at the Money Libor Discount vs. EUR006M Index 3Yrx10Yr	Bloomberg
USD European Swaption Black Vol at the Money OIS Libor Discount vs. US003M Index 3Mox2Yr	Bloomberg

USD European Swaption Black Vol at the Money OIS Libor Discount vs. US003M Index 3Mox5Yr	Bloomberg
USD European Swaption Black Vol at the Money OIS Libor Discount vs. US003M Index 3Mox10Yr	Bloomberg
USD European Swaption Black Vol at the Money OIS Libor Discount vs. US003M Index 1Yrx2Yr	Bloomberg
USD European Swaption Black Vol at the Money OIS Libor Discount vs. US003M Index 1Yrx5Yr	Bloomberg
USD European Swaption Black Vol at the Money OIS Libor Discount vs. US003M Index 1Yrx10Yr	Bloomberg
Gold Volatilities	
Gold/USD 1-mo at the Money Option Volatility	Bloomberg
Gold/USD 2-mo at the Money Option Volatility	Bloomberg
Gold/USD 3-mo at the Money Option Volatility	Bloomberg
Gold/USD 6-mo at the Money Option Volatility	Bloomberg
Gold/USD 9-mo at the Money Option Volatility	Bloomberg
Gold/USD 1-yr at the Money Option Volatility	Bloomberg
Gold/USD 2-yr at the Money Option Volatility	Bloomberg
Gold/USD 3-yr at the Money Option Volatility	Bloomberg
Cap & Floor Volatilities	
EUR 1-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 2-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 3-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 4-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 5-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 6-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 7-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 8-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 9-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
EUR 10-yr Cap & Floor at the Money Option Implied Volatility	Bloomberg
Forex Volatilities	
EUR/USD 1-mo at the Money Implied Volatility	Bloomberg
EUR/USD 2-mo at the Money Implied Volatility	Bloomberg
EUR/USD 3-mo at the Money Implied Volatility	Bloomberg
EUR/USD 6-mo at the Money Implied Volatility	Bloomberg
EUR/USD 9-mo at the Money Implied Volatility	Bloomberg
EUR/USD 1-yr at the Money Implied Volatility	Bloomberg
EUR/USD 2-yr at the Money Implied Volatility	Bloomberg
EUR/USD 3-yr at the Money Implied Volatility	Bloomberg
Currency Volatility Index	Bloomberg
JP Morgan Volatility Index	Bloomberg
FX Forwards	
GBP/EUR 3m forward point	Bloomberg
GBP/USD 3m forward point	Bloomberg
Other Investment-Related Variables	
S&P GLOBAL TIMBER & FORESTRY	Bloomberg
UBS GLOBAL INFRASTRUCTURE & UTILITIES 50-50	Bloomberg
HFRX GLOBAL HEDGE FUND INDEX	Bloomberg

FTSE Actuaries Govt. Securities U.K. Gilts TR over 15-yr	Bloomberg
FTSE Actuaries Govt. Securities U.K. Index Linked TR over 15-yr	Bloomberg
KBW Bank Index	Bloomberg
Mutual Funds: Total net assets – All fund types	Moody's Analytics
Mutual Funds: Total net assets – Stock funds	Moody's Analytics
Mutual Funds: Total net assets – Taxable and muni bonds	Moody's Analytics
Mutual Funds: Total net assets – Taxable money market funds	Moody's Analytics
3- to 5-yr aggregate TR	Morningstar
BofaML High-Yield TR	Morningstar
BarclaysGCTR.M	Morningstar

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