An MSCI Brand

Barra Stochastic Factor Models

Frequently Asked Questions

April 2013

General FAQs

1. What are the major highlights of Barra Stochastic Factor Models?

The major highlights of Barra Stochastic Factor Models are:

- Innovative modeling approach incorporating techniques from machine learning and signal processing.
- Wavelet-based asset volatility modeling to provide more accurate and smooth risk forecasts.
- Factors are learned from historical returns data, thus, no fundamental data is needed for the estimation process. This works as a great advantage if this fundamental data is not available for a certain company as in the case of recent IPOs.
- No prior assumptions on how the factors are structured, thus allowing models to adapt to changing market conditions and uncover dynamic drivers of risk and return.
- Dynamic nature overcomes common statistical model shortcomings to generate stable and interpretable factors. Models closely capture the true nature of fast-changing financial markets and therefore, avoid the common pitfalls of applying static estimation methods, such as principal components analysis (PCA) to time series.
- Separation of volatility and correlation estimation provides more stable correlation estimates, which are not dominated by high volatility market regimes.
- Models for North America (NAMS1) and Europe (EURS1) have a broad coverage of local securities. The European model covers over 12000 assets traded in Europe, while the North American model covers over 26000 US and Canadian listings including American Depository Receipts and foreign listings of US and Canadian companies.
- Complementary hybrid structural model allows the inclusion of stocks with short return history, such as IPOs or illiquid stocks. A unique blending methodology allows a smooth transition from this auxiliary process to a normal estimation, once more data becomes available.
- 6 model versions: Daily, Weekly, and Monthly return horizons, each available with fast and slow responsiveness to cater to differing investment horizons and strategies.
- Currency factor model allows insight into drivers and movements in select FX markets. Currencies are modeled as separate assets by stochastic currency factors. For a list of covered currencies, refer to the model Datasheets.

2. What are the advantages of adding Barra Stochastic Factor Models to the investment process, compared to solely relying on Barra Fundamental Factor Models?

Using Barra Stochastic Factor Models in parallel with Barra Fundamental Factor Models has the following advantages:

- Barra Stochastic Factor Models have lower data requirements than Barra Fundamental Factor Models. Since fundamental data is only released occasionally, Barra Stochastic Factor Models have a faster response to structural market changes or during existing market turmoil conditions.

- Barra Fundamental Factor Models deterministically calculate the exposure to a set of fundamental factors. While particular care is given to a selection that economically makes sense, it is not guaranteed that they lead to optimal factor estimation. In contrast, Barra Stochastic Factor Models derive factor exposures directly from the data and therefore are not subject to misspecification.
- Barra Stochastic Factor Models let you use multiple volatility forecast speeds, which enable you to analyze the responsiveness and dynamics of an assets' portfolio with different levels of responsiveness over the same forecast horizon.
- Barra Stochastic Factor Models are better suited for short-term investors, who require that the dynamics of the model fit to short-term evolution of their managed portfolios.

As a result, Barra Stochastic Factor Models do not replace fundamental models but rather extend them and provide the user with another insight on how portfolio risk can be decomposed. Barra Stochastic Factor Models overcome the limitation of sparse fundamental data and can provide insights about short-term market turmoil, which fundamental models are not able to capture. Fundamental models, on the other hand, are more interpretable, as they are based upon our economic intuition. A good combination can be a very powerful tool for traders and risk managers.

3. What are the advantages of Barra Stochastic Factor Models over traditional principal component analysis (PCA) models?

NAMS1 employs measures to ensure the smooth evolution of factor exposures, addressing a well-known shortcoming of standard PCA models (For detailed information, see Ward (2012)).

These measures are:

- Iterative estimation of factor exposures is initialized with the previous day's estimate
- Estimated factor exposures are blended with the previous day's estimated exposures

A naive statistical model will always be incapable of generating stable exposures, which is a pre-requisite for performing risk and return attribution. Stability of exposures is also necessary for meaningful attribution of statistical factors in terms of fundamental characteristics.

Despite the evident advantages of having stable exposures, introducing this restriction into the model estimation can affect explanatory power, which can be quantified.

For a detailed study, see The Barra North America Stochastic Factor Model (NAMS1) Research Notes.

4. What daily data is delivered with Barra Stochastic Factor Models?

Barra Stochastic Factor Models deliver the following daily updated data:

- Asset exposures to 20 stochastic equity factors
- Exposures of currencies to a number of stochastic currency factors (4 for Europe and 2 for North America)
- Asset-level total volatility and specific volatility forecasts
- Predicted betas against estimation universe
- Factor covariance matrices with equity and currency blocks
- Linked specific risk estimates for asset pairs that are linked to the same issuer
- Daily factor returns provided for attribution purposes
- Daily factor scores

Stochastic factors, numbered with one to two digits, are stochastic equity factors (for example, Factor 15) and those numbered with four digits are stochastic currency factors (for example, Factor 1001).

5. Which regions are currently covered? Will MSCI develop Barra Stochastic Factor Models for other countries or regions?

MSCI released the Barra Europe Stochastic Factor Model (EURS1) in September 2012 and the North America Stochastic Factor Model (NAMS1) in April 2013. In future, we may release models for other regions including a global model. For the latest roadmap, contact your MSCI support representative.

6. How many versions or horizons are available?

Barra Stochastic Factor Models are available in three horizons, M=Monthly, W=Weekly, and D=Daily, with two different volatility forecast speeds in each horizon, 1=FAST and 2=SLOW.

7. What is the difference between volatility forecast speed 1=FAST and 2=SLOW?

The volatility forecast speed determines the level of responsiveness of your model. This effect is achieved through different decay factors in the temporal weighting of the factor learning. The fast version puts more emphasis on recent data, whereas the slow version is less dominated by the most recent observations. Higher weight on recent data makes the model more responsive, but also more subject to unwanted noise. Your investment horizon will mainly determine the appropriate version.

8. What is the difference between the horizon (Daily, Weekly, and Monthly) and speed (Fast and Slow)?

Models use a single, Daily volatility forecast horizon and scale the results to provide Weekly and Monthly volatility forecasts (adjusted for serial correlation). The speed measures the responsiveness of the model for a given horizon. Two different speeds, Fast and Slow, are provided for the three different investment horizons for you to use different levels of responsiveness while performing your analysis.

9. Which versions of the Barra Fundamental Factor Models can be compared with the Stochastic Model versions?

The Long and Short horizon models use a Monthly forecast horizon and the new Daily versions of USE4 and EUE4 use a Daily forecast horizon. The Daily Fast version of the model can be compared with the Daily horizon model for either USE4 or EUE4. The Monthly Slow version of the model can be mostly compared to the Long horizon version.

10. Which MSCI products support Barra Stochastic Factor Models? Are the models available on Factset?

Barra Stochastic Factor Models are available in:

- Barra Portfolio Manager
- Models Direct (GM Format)

The models will be made available on other platforms, such as Factset, in the future.

11. How much model history is available?

The history for the European version of the model starts in January 1997 and the North American version starts in July 1995.

12. How many assets are covered?

The European model covers over 12000 assets traded in Europe, whereas the North American model covers over 26000 US and Canadian listings including American Depository Receipts (ADRs) and foreign listings of US and Canadian companies.

13. What asset types are covered?

The following assets are covered:

- Equity assets trading in any country covered by the model

  This includes Depositary Receipts (DRs) and cross-listed securities. The European model limits coverage to assets where the underlying issuer has a country of exposure covered by the model.
- Synthetic assets with Country of Exposure (COE) equal to any country covered by the model
- Exchange Traded Funds (ETFs) with close to 100% of underlying assets covered by the model
- Equity Index Futures (EIFs)[1]

Refer to the Datasheets for each model for more information.

[1] Only in Barra Portfolio Manager

14. Which countries and currencies are covered?

The European model covers Western European countries and G-7 currencies. For the complete list of countries and currencies, refer to the model Datasheet. The North American model covers US and Canada. It covers the US Dollar and Canadian Dollar.

15. Why is the EURS1 coverage less than the Barra Europe Equity Model (EUE3 or EUE4)?

EURS1 covers Western Europe only because the model requires a continuous time series of good quality daily asset returns.

16. How many risk factors are present in Barra Stochastic Factor Models? What is the difference between factors numbered with 1 and 2 digit numbers and factors numbered with 4 digit numbers?

The European model contains 20 stochastic equity factors (Factors 1-20) and 4 stochastic currency factors (Factors 1001-1004). The North American model contains 20 stochastic equity factors (Factors 1-20) and 2 stochastic currency factors (Factors 1015-16).

17. Is any stochastic factor, included in EURS1, similar to the EUE3 market factor?

Yes, the first stochastic equity factor, EUR Factor 1, is similar to the market factor of the fundamental Barra Europe Equity Model (EUE3BAS).

18. Will Barra Stochastic Factor Models be available in the Barra Integrated Model (BIM)?

No, the Barra Integrated Model (BIM) will continue to use the Barra Fundamental Factor Models.

Methodology FAQs

19. How are Barra Stochastic Factor Models estimated?

As in the Fundamental Factor Models, a forecast of the asset's covariance matrix $\mathbf{C}_A$ is used to calculate portfolio risk. It can be expressed as a linear combination of the diagonal matrix $\mathbf{V}_A$, containing variance estimates and the factor correlation (standardized z-scores) matrix $\mathbf{C}_\mathbf{F}^\mathbf{Z}$. The covariance matrix of all assets is then defined as:

$$\mathbf{C_A} = (\mathbf{V_A} \cdot \mathbf{X}^Z) \cdot \mathbf{C_F^Z} \cdot (\mathbf{X}^{Z^t} \cdot \mathbf{V_A}) + \mathbf{V_A} \cdot \mathbf{S^Z} \cdot \mathbf{V_A}$$

This enables us to estimate the following values:

1. **Estimation of univariate Asset Variances ($\mathbf{V}_A$)**

   It begins with the estimation from historical data, using exponential moving averages (EMA) of the univariate absolute returns. The idea is to put more weight on recent observation. The decay factor is an important parameter as it determines how much smoothing is applied. A short-term EMA is accurate but noisy and a long-term EMA overstates volatility after market shocks. Therefore, SFM applies a responsive estimator, whose half life is determined by the ratio of a fast and slow EMA. Concretely, during times of market shocks, a faster EMA provides smoother results by using this methodology. To filter unwanted noise, wavelet decomposition is performed. These additional measures have shown better out-of-sample results in tests as compared to a simple EMA.

2. **Estimation of correlation structure ($\mathbf{C_F^Z}$) and exposure matrix ($\mathbf{X}^Z$)**

   First, the return data needs to be standardized to obtain the z-scores for further estimation. A non-parametric kernel smoother is applied to the data, which provides a time-varying volatility estimate that adapts to market conditions and to the fact that volatility is a time-varying process. The z-scores are then calculated and they serve as the input data for the factor model. In the second step, the data is weighted, applying hyperbolic secant weighting, to put more emphasis on recent data (fast and slow decay version available).

Finally, the following state space model for the description of z-score returns $\mathbf{z}_t$ is defined:

$$\underset{(m\times 1)}{\mathbf{z}_t} = \underset{(m\times k)}{\mathbf{X}^{\mathbf{z}}} \cdot \underset{(k\times 1)}{\mathbf{f}_t^{\mathbf{z}}} + \underset{(m\times 1)}{\mathbf{u}_t^{\mathbf{z}}} \qquad \mathbf{u}_t^{\mathbf{z}} \sim N(0,\mathbf{S});\;\; \mathbf{S}\, diag$$

$$\underset{(k\times 1)}{\mathbf{f}_t^{\mathbf{z}}} = \underset{(k\times k)}{\mathbf{A}} \cdot \underset{(k\times 1)}{\mathbf{f}_{t-1}^{\mathbf{z}}} + \underset{(k\times 1)}{\mathbf{q}_t^{\mathbf{z}}} \qquad \mathbf{q}_t^{\mathbf{z}} \sim N(0,\mathbf{Q});\;\; \mathbf{Q} = \mathbf{1}_k$$

The first equation describes the evolution of the asset z-scores $\mathbf{z}_t$ as a linear combination of factor exposures $\mathbf{X}^{\mathbf{z}}$ and factor scores $\mathbf{f}_t^{\mathbf{z}}$, and white noise. In the second equation, the hidden factor scores are autoregressively modeled through the confounding matrix $\mathbf{A}$.

As in the case of Fundamental Factor Models, we explain the returns through common factors. It is important to note though, that in this case, the factor scores are unobservable and are treated as hidden states. Therefore, the standard optimization method for the likelihood function is not available and the model is estimated using the iterative Expectation-Maximization (EM) algorithm. We mainly aim to estimate the parameter space that comprises the exposure matrix $\mathbf{X}^{\mathbf{z}}$ and specific z-score variance $\mathbf{S}$. Furthermore, we obtain the hidden factor scores $\mathbf{f}_t^{\mathbf{z}}$. Iteratively, for every point in time **t**, the following steps are applied (for the sake of simplicity, learning of $\mathbf{S}$ and other parameters are excluded):

1. Iterate for **i=1.**
2. Initialize $\mathbf{X}_i^{\mathbf{z},t}$ from the previously obtained solution $\mathbf{X}_i^{\mathbf{z},t-1}$ at time **t-1**.
3. Determine the expectation of the log-likelihood function $\ln \mathrm{P}\left[\mathbf{z},\mathbf{f}\,\middle|\,\mathbf{X}^{\mathbf{Z}}\right]$, with respect to $\mathbf{f}$ and conditional on $\mathbf{z}_t$ and $\mathbf{X}_i^{\mathbf{z},t}$ (Expectation Step).
4. Maximize the expectation term from the step 3 (Maximization Step). Hence, calculate $$\mathbf{X}_{i+1}^{Z,t} = \arg\max_{\mathbf{X}^{\mathbf{Z}}} E_{f|z,X_i^{z,t}} \left\{ \ln \mathrm{P}\left[\mathbf{z},\mathbf{f}\,\middle|\,\mathbf{X}^{\mathbf{Z}}\right] \right\}$$
5. Iterate **i** until change in log-likelihood becomes sufficiently small.

It can be shown that at each iteration, the likelihood of the model is increased and therefore, the algorithm is guaranteed to converge. However, it may be captured in local optimums or saddle points. However, the aim is not to reach the global optimum but rather obtain a robust model for out-of –sample data.

Having obtained the exposure matrices $\mathbf{X}^{\mathbf{Z},t}$, the factor scores $\mathbf{f}_t^{\mathbf{z},regressed}$ may then be obtained by regressing the z-scores against the exposures at every point in time. Using the factor scores, the factor correlation matrix $\mathbf{C}_{\mathbf{F}}^{\mathbf{Z}}$ finally can be estimated.

3. **Estimation of specific variance**

   In Barra Stochastic Factor Models, the asset-specific variance is expressed through the random variable $\mathbf{u}_t^{\mathbf{z}}$, whose covariance matrix $\mathbf{S}$ is diagonal. It is estimated as part of the parameter space in step 2. It may be interpreted as the specific variance of the asset's z-score. Hence, we can calculate the asset's specific variance by multiplying $\mathbf{S}$ with the asset volatility estimates $\mathbf{V_A}$.

4. **Combination of estimation results**

   As explained earlier, the total asset covariance matrix $\mathbf{C_A}$ combines the estimates of step 1 to 3. We finally can rewrite the expression as:

$$\mathbf{C_A} = \underbrace{(\mathbf{X}^Z \cdot \mathbf{V_A} \cdot \mathbf{C_F^{Z1/2}})}_{\mathbf{X}} \cdot \mathbf{F}_{Period} \cdot \underbrace{(\mathbf{C_F^{Z1/2}} \cdot \mathbf{V_A} \cdot \mathbf{X}^{Z^t})}_{\mathbf{X}} + \underbrace{(\mathbf{V_A} \cdot \mathbf{S^Z} \cdot \mathbf{V_A})}_{\Delta}$$

   Finally, the model delivers $\mathbf{X}$ and Δ, which contain all relevant information. $\mathbf{F}_{Days}$ is a diagonal scaling matrix which simply contains the number of trading days in order to scale risk numbers. The Variance information is stored in the exposure matrix $\mathbf{X}$ which is a major difference to the fundamental factor problems.

20. What are the conceptual differences between Barra Stochastic Factor Models and Fundamental Factor Models?

The following table lists and describes the differences between Barra Stochastic Factor Models and Fundamental Factor Models:

Fundamental Factor Models	Stochastic Factor Models
• Decompose asset returns using pre-specified exposures.	• Decompose asset z-scores (standardized returns) and estimate exposures from the data.
• Factors are defined, using economic reasoning (Industry, Country & Style Factors) and remain stable over a long period. Manual interaction only needed to adjust factors.	• Factors are solely derived from the data (unsupervised learning) and thus do not offer an intuitive interpretation. They may change over time and adjust automatically to the data, without requiring manual interaction.
• Specific volatility is estimated using a separate structural model.	• Specific variance matrix estimation is part of the same algorithm (EM) and is estimated together with the factor exposure matrix.
• Estimation of factor covariance matrix containing asset variance and correlations.	• Two separate estimations of univariate asset volatilities and standardized factor score correlations (decomposition of the covariance matrix into diagonal variance and correlation matrix).

21. How are illiquid assets for which market information is not readily available, such as IPOs, treated?

The time series regression, which is applied in Barra Stochastic Factor Models relies on the quality of data. If the return data of assets is poor, the model output will be inaccurate. Therefore, illiquid assets must be treated accordingly. In the SFM framework, a structural model constructs auxiliary estimates of the parameters mentioned in Question 19, using regression methodology against well-established fundamental descriptors for the assets. The following structural models are estimated:

- Factor exposures and residual variances on z-score level
- Linked specific risk on z-score level
- Daily, weekly, and monthly asset volatility

Because time series information of a certain quality is always available (few data points after IPO), the structural model is blended with the standard time series model, outlined in Question 19. The weighting of both the models is determined by a liquidity and autocorrelation indicator, which assesses the level of data quality. As an asset's liquidity and data quality improves, the emphasis is shifted from the structural model towards the standard time series estimation procedure. This guarantees a smooth transition from the auxiliary to the final estimation method.

22. What is the estimation universe for each model?

Barra Stochastic Factor Models are based on the MSCI Investable Market Indices (IMI) for the region covered by the model. Illiquid securities or multiple securities from the same issuer are filtered out.

23. What are the minimum requirements for an asset to be included in Barra Stochastic Factor Models?

Assets need at least 21 days of returns to be included in the models based on the standard methodology. However, the models can also pick up new asset additions such as IPOs with use of auxiliary structural models (see Question 21).

24. What happens when an asset is delisted?

If an asset is delisted, it will automatically be dropped from the model coverage and/or the estimation universe.

25. Is there a way to link stochastic factors to fundamental model factors?

Yes, in a later release, we will provide additional files and guidelines for mapping stochastic factors to fundamental model factors. This will give traditional fundamental factor model users a familiar way of interpreting numbers from stochastic factors.

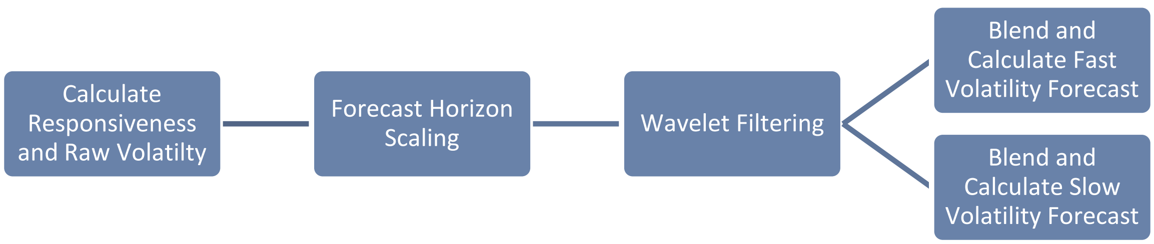
26. How do Barra Stochastic Factor Models treat public holidays?

A model holiday is determined by two different parameters. The first parameter is the holiday calendar of the different stock exchanges in a market and the second one, added recently to Barra models, is the trading volume of shares in a particular market. If the trading volume is particularly low for a specific market, it is treated as a pseudo-holiday to avoid skewness in the model estimation. No model data is delivered for a market on a holiday.

We provide a static list of past model holidays based upon the above mentioned parameters and future holidays for the upcoming year, based on the official calendar of the relevant exchanges.

27. What is the process to calculate asset volatility forecasts?

As stated in Question 19, Barra Stochastic Factor Models use a multiple step process to calculate the volatility forecast. This methodology is summarized in the following flowchart:



The first step in the process is to calculate a raw daily forecast of asset volatility:

$$\sigma^2_{d,n,t} = a_{n,t}\sigma^2_{d,n,t-1} + (1 - \alpha_{n,t})r^2_{d,n,t},$$

where, $a_{n,t}$ represents a variable parameter that controls the responsiveness of the raw volatility forecast. The volatility forecast estimate is based on one-day returns, and subsequently, they are scaled to give the respective weekly and monthly forecast. To provide a good estimator, the model uses an estimator similar to the Newey West Estimator, using a maximum of 4 and 20 lags for the weekly and monthly forecast to correct serial correlation (autocorrelation). In the second step, a wavelet filter is applied to decompose the volatility forecast signal into high frequency to low frequency components. The resulting signal components are processed separately based on their appropriateness of providing accurate volatility forecasts. This methodology allows improving the construction of volatility forecasts for different horizons with different levels of responsiveness.

Then, the components are grouped into three buckets based on the types of signals:

- High-frequency signals that typically include asymmetric bursts of volatility noise
- Signals containing more persistent signals
- Low frequency signals

Finally, we use an algorithm that blends all different signals together. In this algorithm, we use unchanged low frequency signals as the underlying components; then, we provide consistent signals with a linear model build by the frequency component and its cross-sectional average, and high frequency signals with an Exponential Weighted Moving Average Algorithm (EWMA). Blending algorithms are available for both fast and slow speeds for each one of the three volatility forecast horizons. For more information, see The Barra Europe Stochastic Factor Model (EURS1) Research Notes.

28. How are currency assets modeled?

The estimation procedure used for equities is also applied to the currency z-scores. Depending on the model, 2 or 4 currency factors are estimated and it is assumed that the aggregated exposure matrix $\mathbf{X}_{Agg}$ is block-diagonal, which means that equities have zero exposure to currency factors and vice versa. In the European model, not all pre-Euro currencies are included in the estimation universe to prevent skewness towards pre-Euro convergence.

29. How is the historical beta computed?

To compute an assets' historical beta, we apply the following procedure:

1. A winsorization procedure is applied to the historical returns and returns that are above 10σ are dropped and those between 10σ and 3σ are pulled into3σ. Sigma (σ) is estimated from median absolute returns.
2. Then, beta is calculated as the regression slope of regressing excess returns against the MSCI Europe Index, with a trailing 252-days window and a 21-day half-life.
3. Next, betas are again winsorized and extreme values are dropped or truncated.
4. Finally, betas are negatively and positively standardized.

30. How is the predicted beta computed?

The predicted beta is derived from the exposure of assets to the stochastic factors and the factor covariance matrix with the estimation universe as the market. For more information, see Barra Predicted Beta.

31. How is asset liquidity determined in the models?

Unlike Barra Fundamental Factor Models, which use trading volume data, Barra Stochastic Factor Models determine liquidity from total returns of the assets.

32. Which methodology is used to standardize past daily asset returns?

Daily asset returns are standardized by converting the return of an asset to a standardized Z-Score. This is done with the use of a non-parametric smoothed volatility estimator. The smoothed volatility estimator is obtained by convoluting the data with a two-sided exponential kernel (symmetric kernel with 5 days half-life).

33. Which Specific Risk model is used by EURS1?

The specific risk of the standardized z-scores is modeled in the first state space equation through the random variable $\mathbf{u}_t^{\mathbf{z}}$ whose covariance matrix $\mathbf{S}$ is assumed to be diagonal. To obtain the asset's specific risk, multiply $\mathbf{S}$ with the asset variances $\mathbf{V_A}$: $C_{Spec} = \mathbf{V_A} \cdot \mathbf{S^Z} \cdot \mathbf{V_A}$

It is important to highlight that in contrast to the fundamental factor models, there is no separate structural model to estimate specific risk. The estimation of S is performed simultaneously as part of the same model.

FAQs for Barra Stochastic Factor Models in Models Direct

1. What is the model start date for EURS1 in Models Direct?

EURS1 is delivered to clients in standard subscription with history back to 31-Dec-1996. For more information, see the EURS1 Datasheet.

2. How can I access ongoing and historical data?

The ongoing files will be delivered via your secure account on ftp.barra.com under the */<model>* folder (for example, /eurs1 and /nams1). Historical data will be sent via a separate ftp site. For more information, contact MSCI Client Service.

3. What is the file format for Barra Stochastic Factor Models delivered in Models Direct?

Barra Stochastic Factor Models are delivered in the Standard (SM/GM) format. For more information about the file formats, see Barra Stochastic Factor Models SM/GM File Format Guide.

Sample files and supporting documentation are available in the Models Direct Library.

4. How often are files purged from the ftp site?

Files are purged after 95 calendar days. More details are available here.

5. Which set of files are delivered with Barra Stochastic Factor Models?

The models deliver the following set of files to Models Direct clients. EURS1 is shown as an example.

Container Name (*zip)	***Files in container***
GMD_EURS1_100_yymmdd.zip	EURS1_Asset_ID.yyyymmdd
	EURS1_Asset_Identity.yyyymmdd
	EURS1_Daily_Asset_Price.yyyymmdd
	EURS1_ESTU_POR.yyyymmdd
	EURS1_Rates.yyyymmdd
	EURS1_100_SFMDlyFacRet.yyyymmdd
	EURS1_100_Factors.dat
N/A (Unzipped)	EURS1 _Holidays.yyyymmdd
GMD_EURS1_<HORIZON>_100_yymmdd.zip[2]	EURS1_<HORIZON>_100_Asset_SFMExposure.yyyymmdd
	EURS1_<HORIZON>_100_Asset_LSRCorrel.yyyymmdd

[2] <HORIZON> can be interpreted as D=Daily, M=Monthly or W=Weekly depending on the model subscription.

	EURS1_<HORIZON>_100_Asset_ Vol_Beta.yyyymmdd
	EURS1_<HORIZON>_100_SFMCovariance.yyyymmdd

6. What does the *yymmdd* extension on the GM zip package denote?

The *yymmdd* extension refers to the date of the model data, which is different from the file release date. Release dates can be found in the headers inside the file.

7. Will there be intra-month files?

No. The model is updated daily and new assets will be added to the standard daily deliverables.

8. How often is the Holidays file updated?

The Holidays file is delivered annually at the beginning of each year.

9. How can I recognize daily model deliverables versus corrections/reposts?

If a file is reposted, the original zip set is overwritten by the new zip set. The entire zip set is reposted even if only one file within the zip set is impacted. If a file is reposted, you will be notified via a news alert. Alternatively, you can check the ReleaseDateTime stamp inside some of the files and compare it with the previously released files.

10. Why is an ETF missing on certain dates in the ETF files?

If there is a holiday in the country that the ETF covers, it is dropped from the files. In the future, we plan to roll forward ETFs to maintain continuous coverage in the ETF Exposure and Asset Data files.

11. Where can I get guidelines on how to create a database to load the SFM models?

The SM/GM File Format Guide has instructions and a sample ER diagram to help you create your relational database.

12. Is there any new data delivered that has no equivalent in fundamental models?

The following additional data that has no equivalent in fundamental models:

- Exposures of currencies to 4 stochastic currency factors
- Currency specific risk
- Factor Scores

13. How do I calculate my portfolio risk numbers using Barra Stochastic Factor Models?

To calculate portfolio risk numbers using Barra Stochastic Factor Models, refer to Guide to Calculate SFM Risk Numbers.

14. How do I interpret the covariance matrix and exposures in the SFM model?

Product file containers include daily updated Covariance and Asset Exposure file. The covariance matrix file contains the daily estimated covariance matrix that is close to an identity matrix, but not exactly. This is due a combination of the numerical convergence of the Expectation Maximization algorithm and the use of a prior estimation to stabilize the factor space. Weekly and monthly covariance matrices tend to have significant off-diagonal elements due to the adjustments used to correct for serial correlations (autocorrelations). Stochastic currency factor covariances are not zero because they incorporate the level of interaction of currencies with equity factors. For more information, see EURS1 Guide to Calculate SFM Risk Numbers.

15. What is the significance of Currency Specific Risk?

Currency Specific Risk is used to calculate your managed and active portfolio risk in a non-local scheme. This means when using Currency Specific Risk together with the risk portion explained by the currency assets exposures to stochastic currency factors, you will be able to see total risk numbers on your portfolio that include the interaction between different currencies across your portfolio.

16. When using the factor model, why do my calculations for assets, such as LocTotalVol% and TotalVol%, not exactly match the numbers delivered in the flat files?

In the production process, the exposure and covariance matrix delivered in the flat files are rounded off. However, the fields LocTotaVol% and TotalVol% in the Asset_Vol_Beta file are direct model estimates, using full precison without rounding cut-off. This leads to a small difference between the local and total volatility stated in the flat files and the corresponding numbers, which are calculated using the rounded covariance matrices and exposures. The numerical imprecision is in the area of approximately 1.0e-6 and has no practical impact for predicting portfolio risk. However, if you exhibit a substantial mismatch, this should be treated as an indicator that your implementation of the model is not correct.

17. How are the ETF risk and beta values calculated in Models Direct?

The ETF risk and beta values are weighted values of the portfolio constituents including any cash positions. Total and specific volatility are based on the model base currency.

Historical and predicted betas do not include the cash portion of the ETFs and only the equity portion is considered. This is because calculating the value of historical and predicted betas for currency assets is not trivial, as there is no predefined market that can be used as a benchmark. Historical Beta is a weighted average of the constituent-level Historical Beta without cash portions of the portfolios. This means that the cash portion of an ETF contributes to the denominator and the equity portion to the numerator and denominator. For e.g., ETF XYZ has equity assets E_1 and E_2 with W_1 and W_2, and cash asset C_3 with W_3, where W_i represents the weight of the ith E/C asset.

HBETA and PBETA = $\frac{E_1 * W_1 + E_2 * W_2}{W_1 + W_2 + W_3}$

18. As a EUE3, USE4, GEM2/GEM3, or BIMe Models Direct client, can I use the same ID history for EURS1 or NAMS1?

Yes, you can. The EURS1 and NAMS1 Asset Identity and Asset ID files are a subset of other model data files mentioned.

19. How should Linked Specific Risk get calculated between linked assets?

Linked Specific Risk provides refined specific risk estimation for portfolios including different assets (linked) from a same issuer. To calculate Linked Specific Risk, you should follow the following logic:

For linked asset with one root asset:

$$LSR_{i,j} = \sqrt{\omega_i^2 \sigma_{iSp}^2 + \omega_j^2 \sigma_{jSp}^2 + 2\omega_i \omega_j \psi_{i(i)} \psi_{j(i)} \rho_{ij}}$$

Or for a linked asset with two root assets:

$$LSR_{i,j,k} = \sqrt{\omega_i^2 \sigma_{iSp}^2 + \omega_j^2 \sigma_{jSp}^2 + \omega_k^2 \sigma_{kSp}^2 + 2\omega_i \omega_j \psi_{i(i)} \psi_{j(j)} \rho_{ij} + 2\omega_i \omega_k \psi_{i(i)} \psi_{k(i)} \rho_{ik} + 2\omega_j \omega_k \psi_{j(j)} \psi_{k(j)} \rho_{jk}}$$

where,

$\omega_{i/j}$ is the weight of the ith or jth asset (root assets)

ω_k is the weight of kth asset

$\psi_{i/j}$ elasticity to root asset from root asset (always 1), which means $\psi_{i(i)/j(j)} = \frac{Cov(r_{i/j}, r_{i/j})}{\sigma_{i/j}^2} = \frac{\sigma_{i/j}^2}{\sigma_{i/j}^2} = 1$ where $i \vee j$

ψ_k elasticity to root asset from root asset (always 1), which means $\psi_{k(i/j)} = \frac{Cov(r_{i/j}, r_k)}{\sigma_{i/j}^2}$ where $i \vee j$

ρ_{ij} is the correlation of the ith asset with the jth asset, same applies for ρ_{ik} and ρ_{jk}

So given the aforesaid points, we conclude that:

$$LSR_{i,j,k} = \sqrt{\begin{array}{c} \omega_i^2 \sigma_{iSp}^2 + \omega_j^2 \sigma_{jSp}^2 + \omega_k^2 \sigma_{kSp}^2 + 2\omega_i \omega_j \frac{Cov(r_i, r_i)}{\sigma_i^2} \frac{Cov(r_j, r_j)}{\sigma_j^2} \rho_{ij} \\ + 2\omega_i \omega_k \frac{Cov(r_i, r_i)}{\sigma_i^2} \frac{Cov(r_i, r_k)}{\sigma_i^2} \rho_{ik} + 2\omega_j \omega_k \frac{Cov(r_j, r_j)}{\sigma_j^2} \frac{Cov(r_j, r_k)}{\sigma_j^2} \rho_{jk} \end{array}}$$

$$LSR_{i,j,k}^2 = \omega_i^2 \sigma_{iSp}^2 + \omega_j^2 \sigma_{jSp}^2 + \omega_k^2 \sigma_{kSp}^2 + 2\omega_i \omega_j \frac{\sigma_i^2}{\sigma_i^2} \frac{\sigma_j^2}{\sigma_j^2} \rho_{ij} + 2\omega_i \omega_k \frac{\sigma_i^2}{\sigma_i^2} \frac{Cov(r_i, r_k)}{\sigma_i^2} \rho_{ik} + 2\omega_j \omega_l \frac{\sigma_j^2}{\sigma_j^2} \frac{Cov(r_j, r_k)}{\sigma_j^2} \rho_{jk}$$

$$LSR_{i,j,k}^2 = \omega_i^2\sigma_{iSp}^2 + \omega_j^2\sigma_{jSp}^2 + \omega_k^2\sigma_{kSp}^2 + 2\omega_i\omega_j\rho_{ij} + 2\omega_i\omega_k\frac{Cov(r_i,r_k)}{\sigma_i^2}\rho_{ik} + 2\omega_j\omega_k\frac{Cov(r_j,r_k)}{\sigma_j^2}\rho_{jk}$$

$$LSR_{i,j,k}^2 = \omega_i^2\sigma_{iSp}^2 + \omega_j^2\sigma_{jSp}^2 + \omega_k^2\sigma_{kSp}^2 + 2\omega_i\omega_j\rho_{ij} + 2\omega_i\omega_k\psi_{k(i)}\rho_{ik} + 2\omega_j\omega_k\psi_{k(j)}\rho_{jk}$$

Or in matrix notation:

- For a linked asset with one Root ID

$$LSR_{i,j,k}^2 = [\omega_i \quad \omega_j]\begin{bmatrix}\sigma_{iSp}^2 & \psi_{j(i)}\rho_{ij}\\ \psi_{j(i)}\rho_{ji} & \sigma_{iSp}^2\end{bmatrix}\begin{bmatrix}\omega_i\\ \omega_j\end{bmatrix}$$

- For a linked asset with two Root IDs

$$LSR_{i,j,k}^2 = [\omega_i \quad \omega_j \quad \omega_k]\begin{bmatrix}\sigma_{iSp}^2 & \rho_{ij} & \psi_{k(i)}\rho_{ik}\\ \rho_{ji} & \sigma_{jSp}^2 & \psi_{k(j)}\rho_{jk}\\ \psi_{k(i)}\rho_{ik} & \psi_{k(j)}\rho_{kj} & \sigma_{kSp}^2\end{bmatrix}\begin{bmatrix}\omega_i\\ \omega_j\\ \omega_k\end{bmatrix}$$

FAQs for Barra Stochastic Factor Models in Barra Portfolio Manager

1. How much EURS1 history is provided in Barra Portfolio Manager?

For the first model release, 13 months of model history will be provided. We will provide data back to 31 Dec 2002 later this year.

2. Where can I find a description of the portfolios supplied with EURS1?

Benchmark portfolios supplied with EURS1 are exactly the same as the set of portfolios supplied with EUE3. For a complete list of supplied portfolios, visit Barra Portfolio Manager Help Center.

3. How much portfolio history is provided with EURS1?

For details, refer to Barra Portfolio Manager Help Center.

4. How do I get access to EURS1 in Barra Portfolio Manager?

Contact your account manager to get permissions for EURS1.

5. Which performance attribution scheme is used for Barra Stochastic Factor Models?

Barra Stochastic Factor Models use the same performance attribution used by others models in Barra Portfolio Manager. The choices are Factor-based, Allocation/Selection (Brinson Attribution), and Hybrid.

6. What is the currency of exposure of EURO underlying assets in Barra Portfolio Manager?

In EURS1, EURO assets are exposed to its legacy Euro currencies instead of EMUC.

7. Why can I not see SFM factors 1001-1004 in Barra Portfolio Manager?

Barra Portfolio Manager provides currency factors in a way similar to Fundamental Factor Models. Each equity asset has a currency risk coming from a single currency such as USD rather than from factors 1001-1004. The resulting total risk numbers are the same in Barra Portfolio Manager and Models Direct.

8. How is Linked Specific Risk calculated for assets corresponding to same issuer in Barra Portfolio Manager?

Linked Specific risk can be provided from multiple root IDs. Barra Portfolio Manager provides a LSR framework where only the Barra ID is linked to a unique root mapping. In future, we will support multiple root IDs for a linked specific risk asset in Barra Portfolio Manager.

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clientservice@msci.com

Americas

Americas	1.888.588.4567 (toll free)
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Boston	+ 1.617.532.0920
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Seoul	00798.8521.3392 (toll free)
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The company’s flagship product offerings are: the MSCI indices with close to USD 7 trillion estimated to be benchmarked to them on a worldwide basis[1]; Barra multi-asset class factor models, portfolio risk and performance analytics; RiskMetrics multi-asset class market and credit risk analytics; IPD real estate information, indices and analytics; MSCI ESG (environmental, social and governance) Research screening, analysis and ratings; ISS governance research and outsourced proxy voting and reporting services; and FEA valuation models and risk management software for the energy and commodities markets. MSCI is headquartered in New York, with research and commercial offices around the world.

[1] *As of September 30, 2012, as published by eVestment, Lipper and Bloomberg on January 31, 2013* *Apr 2013*