International, Ten-Year Bonds

Correlation of Worldwide Bond Yields

Using Python to Analyze the Global Debt Market for Ten-Year Government Bonds

Unprecedented asset purchase programs delivered by various Central Banks have dragged down bond yields around the world.

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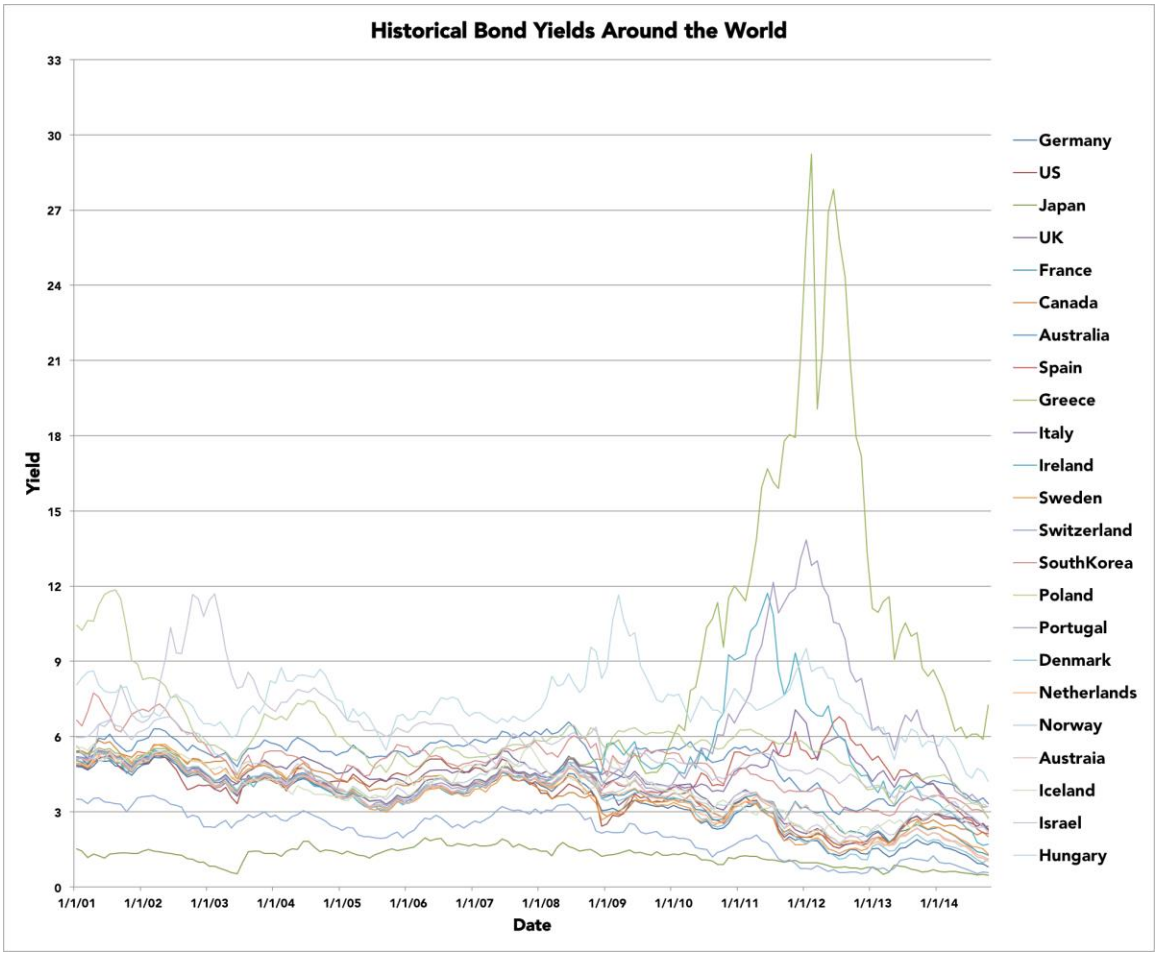
Over one hundred countries currently have outstanding debt in the bond market. Although the yields on these bonds differ from country to country, some general trends exist. For example, in recent years, due to slowing global growth and unprecedented asset purchases by Central Banks, bond yields around the world have been sinking lower. Earlier this year, Japan and numerous countries in Europe were issuing bonds with yields below 0%. In other words, investors were paying these countries to borrow their money. On average, however, bond yields have risen in the past two months. The yield on 10-year Japanese government bonds is currently 0.052%, for example, up from a low of -0.295% reached earlier this year. A graph of historical bond yields for various countries is displayed below.



As seen in the graph above, bond yields between some countries are clearly correlated. For example, because the European Central Bank (ECB) determines monetary policies for the Eurozone, bond yields for Eurozone countries often rise and fall together. For example, when the ECB expanded the Central Bank's asset purchase program in March, bond yields fell throughout Europe. Other correlations exist in the global bond market, too, and the purpose of this snapshot report was to study and reveal these different correlations.

Using the Federal Reserve Economic Data Catalog, historical, monthly ten-year government bond yields for a variety of countries were synthesized into a single dataset. Python was used to find calculate the correlation matrix for this dataset, and a csv file of the correlation coefficients between bond yields for each country can be downloaded by clicking here.

Please note: correlation between the bond yields of two countries is simply the covariance of these two bond yields divided by the product of the standard deviations of each country's bond yields. In mathematical terms, $\rho_{X,Y} = Cov_{X,Y} \div (\sigma_X * \sigma_Y)$, where X and Y represent the historical bond yields of two countries in the dataset, $\rho_{X,Y}$ is the correlation coefficient between these two countries, $Cov_{X,Y}$ represents the covariance of the bond yields of these

two countries, and $\sigma_X * \sigma_Y$ represents the product of the standard deviations of the bond yields for each country.

Correlation coefficients range from -1 to 1. A correlation coefficient of 0 represents no association between two variables, whereas a value greater than 0 represents a positive association between two variables. A larger correlation represents a stronger association, too, with a value of 1 representing a perfect linear relationship between two variables. As seen in the dataset, Denmark and Germany have the highest correlation coefficient (0.994). Thus, the yields of ten-year German government bonds have almost a perfect linear relationship with ten-year government bonds from Denmark.

Click here to download the data used in this snapshot financial report.