Opportunities In Global Bonds

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FQ Perspective

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Global Tactical Asset Allocation is a strategy that seeks to add value by shifting a portfolio's exposures both across broad asset classes (global stocks, global bonds, and cash) as well as across individual markets within each asset class (i.e., country selection within asset classes). The strategy seeks both value added and the risk control benefits of diversification. When it comes to country selection, the magnitude of return differentials is largest within the equity asset class, so for many investors this has led to their placing a higher focus on stock market selection. What we wish to do here is to highlight the opportunities that do exist in significant and attractive magnitude within the fixed income asset class.

We first address the issue of why investing in global bonds is attractive, showing that there is plenty of opportunity. We then show how active management can help exploit that opportunity. Next we discuss a general methodology of how to decide among the bonds of different countries. Following that, we give specifics of variables that can be used to quantitatively model this decision. Finally, we conclude with a discussion of possible next steps to further enhance this model.

Enhancing Returns and Lowering Risk

At the most basic level, investing involves a trade-off between return and risk. Diversification is a simple but powerful tool to provide greater opportunities for increased returns, while lowering overall risk. Thus, at a conceptual level, increasing the number of positions available by investing in the government bonds of various countries provides advantages to both the reward and risk sides of the equation. Now let's examine these in a bit more detail.

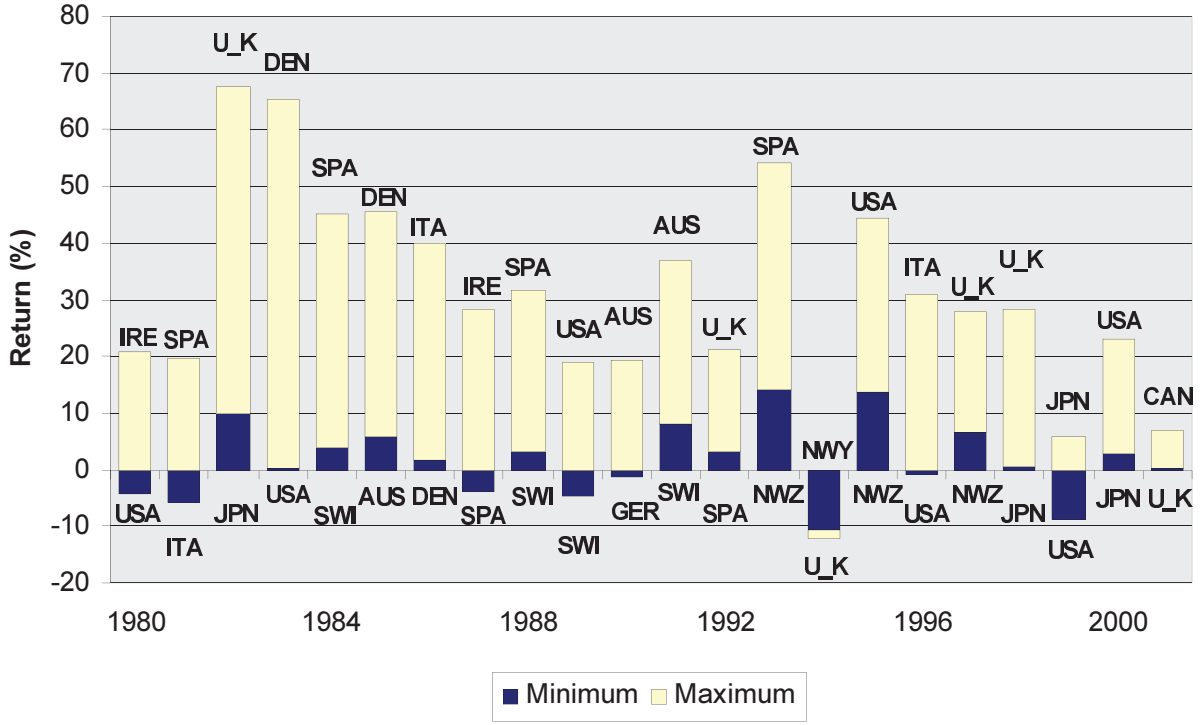
Exhibit 1 shows the dispersion in bond returns for the developed markets, for every year since 1980, using returns in local currency (i.e., a loose approximation of "hedged returns") of the 7 – 10 year bond futures for all calculations. The range of returns is shown, with the highest and lowest countries labeled. Clearly, there are large differences in returns from country to country. The opportunity to add value via global bond selection is enormous.

So-called "conventional wisdom" says that deviations in bond returns have diminished over time, due in part to increasing globalization of the world's economy. Such a diminishment is certainly apparent, and reflected in the lowered dispersion in returns as the years pass. Whether this is due to globalization or to the return to more stable consumer and producer price levels is not clear. Importantly, however, while dispersion has lowered, *it is still far from zero*.

One can also make similar arguments for country selection in stock markets, where we see somewhat less dispersion among country returns, but still very large dispersion nevertheless. This may be due to the more global approach investors now take, as well as to the way companies have become increasingly multi-national in both operations and sales. We think the jury is still out on precisely why this has happened. Both sector effects and country effects play a role in stock market returns, and the former have increased over the years.

Another issue that some may have is the establishment of the EMU. With a single currency and central bank, the bond markets of the member nations now function much like one country. As their bond returns have converged, this has reduced opportunities to pick among

Exhibit 1
International Bond Opportunity



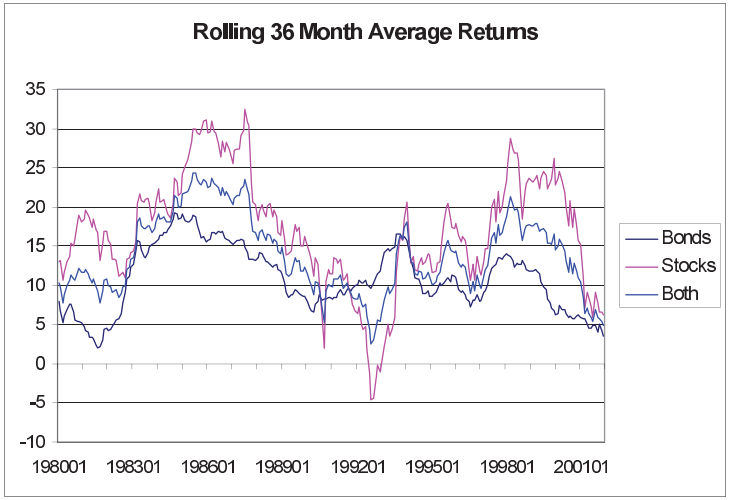
them. But the returns of European markets have always been more closely aligned between each other than with the rest of the world. We do treat the EMU nations as a single country, but there are plenty of opportunities still to distinguish between the EMU and the rest of the world[1].

[1] *For a similar discussion about the effect the formation of the EMU had on currency returns, see Darnell, Vaughn, and Maramot, "Investment Implications of the EMU," **Journal of Investing**, Winter, 1998 at http://www.firstquadrant.com/Publications-General%201998-1999.htm.*

Now let's consider the risk side of the equation. Obviously the benefit here is diversification, from increasing the number of sources of return. As one way of seeing this, Exhibit 2 shows the 36 month rolling annualized returns of three hypothetical portfolios. These are an equal weight of all developed government bond markets, an equal weight of the same country stock markets, and an equal mix of the two. Stocks clearly provide higher returns than bonds (17.1% vs. 11.4% annual from 1980 through the end of 2001) but with higher risk (14.3% vs. 4.4% standard deviation in that period). The mix of the two provides

a happy median, with 14.2% annual returns and 8% standard deviation. Importantly, a mix smoothes out the large downdrafts that can occur in a stock-only portfolio, as investors are seeing once more in the current market environment.

Exhibit 2

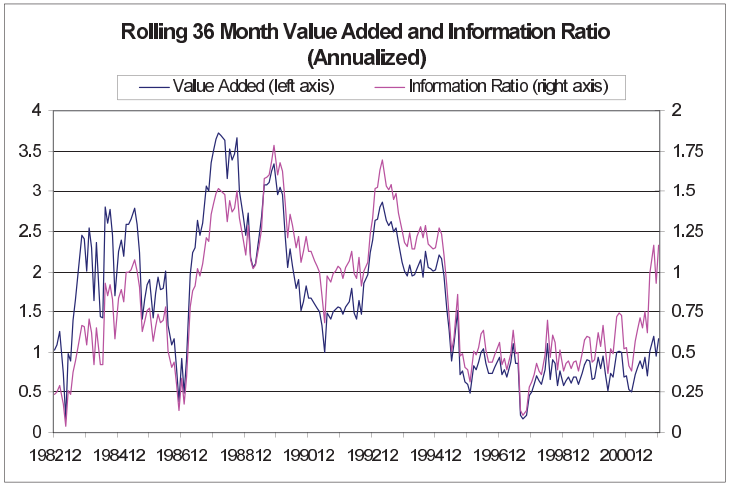


Actively Managing the Opportunities

The portfolios shown above are hypothetical, but raise the important question of an appropriate benchmark. For global stocks, a standard benchmark is the MSCI. For bonds, the standard is the Salomon World Global Bond Index (WGBI). The country weighting of the former is determined by the market capitalization of the constituents; the country weighting of the latter is determined by the amount of government debt issued. This is a crucial difference. A stock which does well will see its market capitalization increase; its greater weight in the index is because of merit. However, a country's weight in the WGBI is determined not by merit, but rather by unfavorable conditions. To return to the stock analogy, when a company issues more shares in a seasoned equity offering, there is a short-term bump up in price when its shares in the index are increased. But the longer term trend is bearish, because of the dilution of existing shares. Similarly, a country which suffers a budget deficit and must issue increased amounts of debt is not necessarily a good long term bet. This is an important reason for *active* management of government bonds. The countries with growing weights in the benchmark are often the ones whose economies have performed the *worst*.

Many fixed income investors focus only on domestic bonds. Many others invest in international bonds but only at passive index weights. Global bonds therefore are an attractive asset class not only because of diversification, but also because of the ability to enhance returns with active management. Exhibit 3 gives an example of the potential value added from active global bond management.

Exhibit 3



These results are from a simulation run from 1980 through 2001. Only the seven most liquid bond markets were used (Australia, Canada, EMU, Japan, Switzerland, UK, and USA) and both long and short positions were allowed. The annualized alpha for this model is 1.5% in a fairly low risk simulation; the overall information ratio is 0.67. In fact, over any three year period there is never a negative active return. Value added is higher in the 1980's, but with greater variation, as we might expect given the larger dispersion in returns during that decade. As the 1990's advance, active returns are lower, but also notably smoother.

There clearly is opportunity to be had in the active management of global bonds. Of course, an important issue is how to build such a model to exploit this opportunity. We advocate a systematic quantitative model based on fundamental relationships. In fact, the results shown above are from the recent version of First Quadrant's global bond model. We next discuss general considerations in building such a model, before turning to the specific details.

General Methodology

There are a number of different vehicles to gain global bond exposure. At First Quadrant we typically use futures, which are both liquid and have low transaction costs. For consistency of analysis, we focus on bonds of similar maturity, the 7 to 10 year basket. We also restrict consideration to developed markets. Because there is minimal default risk with these government obligations, they are far safer than emerging market debt. This latter set of countries is also subject to additional idiosyncratic considerations, and is typically treated as a separate asset class. Additionally, we consider hedged returns, i.e. in the local currency. There are plenty of opportunities in currency returns as well, but these again are a separate asset class. For those investors who wish currency exposure, we have such a mechanism at First Quadrant, governed by a separate set of models.

Broadly speaking, bond markets are affected by two types of information: financial and economic. The former include factors such as interest rates, currency exchange rates, and stock market data. The latter include inflation, deficit amounts, trade data, and monetary policy variables. We examine both types of data for their effects in predicting future bond returns, always asking the fundamental question of how the data will affect both international and domestic investors.

Such an approach ensures that we always have an intuitive justification behind our investing. The next step is to translate this fundamental understanding into numerical forecasts of bond returns, and for this we use rigorous quantitative models. More specifically, we use pooled regressions based on the current state of the markets and economy to forecast the desired prospective bond returns.

Let's examine this last statement in a little more detail. A pooled regression uses both cross-sectional and time-series information. The relationships we seek here should be valid not just for a single country, but for a broad range of countries[2]. In addition, the relationships should be valid over a long time history, in a variety of market environments. A pooled approach ensures that both of these criteria hold true, and in the process builds both greater statistical and fundamental support[3]. All models are built using *ex-ante* relationships; that is, only data which would have existed at the time of the modeling are permitted.

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2 *There are of course predictive variables which only exist or work for a limited subset of countries. These are not the main focus of this piece, but will be discussed briefly later.*

3 *One topic we'll only mention here is the treatment of the EMU. Because these countries now have a common currency and central bank, in many ways they should be treated as a singly entity financially. Yet they also have a long history as separate countries, which can be useful for model building. We have examined several different methods to deal with this issue. All give quantitatively similar results.*

Two important components of our methodology, intimately related to the twin time-series and cross-sectional approaches, are the processes of *relativization* and *standardization*. The former term means that every variable is considered *relative* to the values of other countries. This applies to both dependent and independent variables. These models seek to predict which bond markets will outperform or underperform a world average; therefore it is their relative returns that we care about. Similarly, what is most important when considering predictive variables is their magnitude relative to that of other countries.

The second term, *standardization*, refers to the treatment of data through time. It is not sufficient to examine relative values of the dependent variables, because different countries have different levels of what is considered "normal" for these values, and these can persist across very long time periods. For example, the Japanese unemployment rate has typically been far below that of other developed countries, while the Swiss persistently have higher current account balances. These persistent levels become priced by the market; what matters more is differences from these levels. We account for these differences by *standardizing* the independent variables across their time history. That is, at any given point in time, we measure a variable as the number of standard deviations away from its historical mean.

One can perform these two transformations in either order. Theoretically there is no compelling reason for which should go first. We have an intuitive preference for relativizing and then standardizing, as investors in a global bond market are more likely to compare values across markets. Comparing across time is a sophistication that requires more thought and far more data. This intuition is justified by historical simulation, and hence we first relativize and then standardize in our models.

Predictive Variables

We have so far argued that global bonds present an attractive investing opportunity and described a general methodology for doing so. Now we get to the meat of the matter. In this section we describe the variables used to forecast the bond returns, and give justification to each of them. As touted above, they contain both financial and economic information.

One important variable is the *bond risk premium*, which is measured as the difference between long term and short term fixed income yields and reflects the slope of the yield curve. A yield curve with a high slope signals that bonds are attractive relative to other markets as the currency hedged investor will see a greater yield. Furthermore, steeper yield curves tend to flatten, rewarding the investor in long term yields.

It is interesting to compare this variable to its equivalent for stock country selection. This is the equity risk premium, defined as the stock earnings yield (earnings divided by price) minus the cash yield. As a stock index has its price increase relative to earnings, it becomes more expensive. Its risk premium decreases, and that index is less desirable as its stretched valuations are more likely to revert to the norm. Similarly, as the price of a country's bonds increases, the required yield will decrease. That country's bonds will be less desirable, as those stretched valuations are likely to revert to normal levels.

Working together with the bond risk premium is the *curve height*. This measure of the level of the yield curve is given as the average of long term and short term fixed income yields. Countries with higher yields will more likely attract funds, all else being equal. Notably, curve height works particularly well together with the bond risk premium, helping to explain which way the curve will adjust. For example, long-term rates are most likely to decline with both a steep yield curve and high overall interest rates. However, when the yield curve is steep but overall rates are low, the short-term rates are more likely to rise.

The curve height is perhaps the least intuitive of the variables, so let's motivate it a bit further, as it is quite powerful in predicting bond returns. As noted above, curve height works best when combined with the bond risk premium. Not only does the R-squared of the bivariate model increase dramatically, but the *t*-statistics of both variables increase relative to the univariate models. Another way of thinking of these two variables is to consider a decomposition of the yield curve. The first two terms are level and slope, corresponding to our two variables, followed by higher order curvature terms. The approach we use here takes these most important first two terms and applies them globally across countries. Finally, note that the coefficients of these two terms are roughly equal. When combined we get a bond risk premium but with greater weight given to the bond yield. It is certainly reasonable that many investors (those who have not hedged their currency exposure, for example) will pay more attention to the bond yield than the cash yield, in essence giving it more weight.

A longer acting economic variable is the percentage change in the *money supply M2* over the most recent 3 months compared to the prior 12 months. A growth in M2 is indicative of expansionary monetary policy and hence of future inflation. High inflation is risky to the holder of bonds because it lowers the real return and because central banks will fight high inflation by raising interest rates.

M2 is a variable which has had predictive power over the past 25 years, but worked particularly well in the 1980's when high inflation was of much greater concern than it is today. However, it is still quite useful to keep in the model. While inflation has subsided notably in developed countries, there is the possibility it may rise again. And certainly keeping inflation low still is a major government concern. The European Central Bank, for example, explicitly has a 4.5% money supply growth limit for the EMU. Thus we find M2 to still be a useful variable in today's market environment.

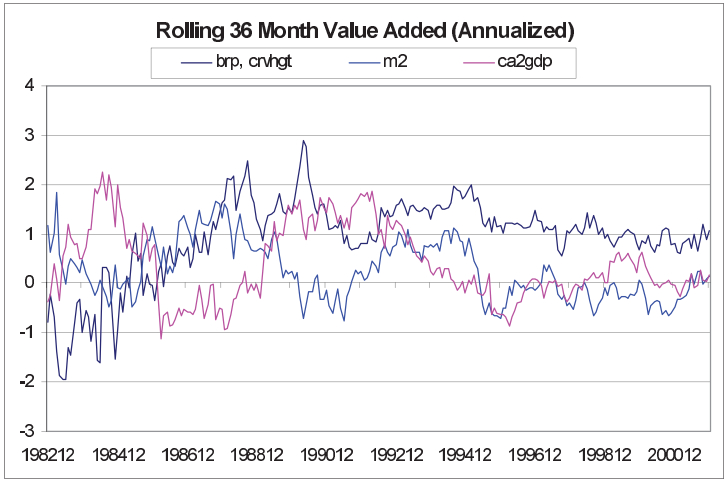
Finally, the last variable used is the *current account balance as a ratio of GDP*, taken as the change in the most recent 12 months compared to the prior 4 years. Current account balance is a broader indication of international trade than goods and services, also including income, charity and foreign aid. A positive balance indicates net inflows. Countries with large negative balances are in essence borrowing money from abroad to finance current consumption. This creates a risk of currency devaluation to redress the demand imbalance, which would degrade the bond returns of foreign investors. To attract foreign capital, bond yields would need to be raised.

This last economic ratio is by far our slowest moving, and also has the least predictive power. Nonetheless, it is still quite useful in the model. The current account balance acts quite nicely together with the faster moving financial data, smoothing out the lows of predictive power and adding modest value. The longer time averages also mitigate the problems of using economic data. The data must be lagged by several months due to delays in availability, but these only have a minor effect on results. Similarly, subsequent revisions of the data are washed out by the long averages. In fact, using shorter time spans actually weakens the predictive power notably.

We've already seen how these four variables perform together in Exhibit 3 above. It is also instructive to examine them separately. Exhibit 4 shows the value added from three separate simulations. One uses only the yield variables for forecasting. Another uses only M2, and the third only the current account balance. After a rough spot in the early 1980's, the yield variables maintain a very steady value added. This is augmented by the other two economic variables, which while less powerful provide nice benefit in the long run.

Over time, we've also looked at a number of other potential variables. Some of these, such as inflation, were very intuitive but simply did not work well in predicting future bond returns. Perhaps such variables

Exhibit 4



are very quickly priced by the market. Other variables, such as stock market volatility, which could spur a flight to quality into bonds, worked in some countries but not generally enough. Still other variables either were too weak, or too colinear, or had too many data quality problems (delays, short history, country availability, revisions, e.g.). There are a few, however, that we are still considering for future inclusion. We will now briefly discuss those variables, their motivation, and considerations.

One promising variable is *currency appreciation*, measured over the past 6 months. That currency returns and bond returns are related is no surprise; what is interesting is how they are related. A currency which has appreciated leads to subsequently better bond returns. This is seemingly in contrast with First Quadrant's country selection for stocks, which uses a currency valuation variable, and finds that as a country's currency gets cheaper prospective stock returns increase. At first, we thought that foreign investors were simply paying attention to momentum. Currency returns do tend to have some serial correlation, and unhedged foreign investors certainly prefer countries whose currency will appreciate. However, further digging shows there is more to it than just momentum.

Consider what happens when a country's currency appreciates. This tends to be bad for the stock market, because it is more difficult to sell goods abroad and easier for cheaper imports to take away market share. Thus it is not only future currency valuation concerns that cause stock markets to go down as the currency appreciates and thus gets more expensive. It is also the negative impact on sales and earnings. When a currency appreciates, this tends to be good for the bond market. A higher currency means cheaper imports and hence less prospective inflation. Not only is it easier for the central bank to lower rates, but there will be less of an inflation premium as well. Bond yields will drop, and bond returns increase. This argument is borne out by historical evidence: currency appreciation is in fact an excellent predictor of future inflation. Having settled the interpretation of the variable, we are now testing how it performs in combination with the other variables we are using. Currency appreciation will likely be added to our model shortly.

Another promising variable is *swap rates*. Swaps began trading in the mid-1980's, but rapidly caught on and now are a very liquid widely used instrument. They also have excellent predictive power for future bond returns. By exchanging a fixed rate for a floating rate over a number of years, swaps in some sense sample the yield curve. But they suffer two drawbacks. One is their short history, which makes it difficult to compare on an equal footing with other factors. The other drawback is potential colinearity with the bond yield variables. We are continuing to investigate these issues, and are hopeful they can be resolved.

Another variable being considered is *stock-bond beta*, motivated by several articles. This variable is calculated as the covariance between local stock and bond returns over the prior 12 months divided by the variance of local stock returns. It thus functions as a measure of the risk premium attached to bonds versus stocks by a local investor. While showing nice predictive power alone, stock-bond beta is less useful in combination with other variables. In addition, the behavior of stock-bond beta is not always intuitive, especially when broken into regimes such as greater than 1, less than 1, and negative, or when examining as a function of correlation and ratio of standard deviations. If it can eventually pass these tests, the variable may be added.

A final variable to be mentioned is the *change in GDP*, measured as the most recent quarter relative to the prior quarter. This variable has fine intuition, as a rapidly expanding GDP means that the economy is growing rapidly. Bonds will have difficulty competing with other investments such as equities in such an environment, and hence must offer higher yields, leading to poor returns. Furthermore, a central bank is more likely to raise interest rates to avoid overheating the economy. Also note that this variable acts quite differently from the current account balance as a ratio of GDP, which is longer term and driven more by changes in the numerator. The problem with GDP is data quality and robustness. GDP figures for a quarter often arrive with a delay of 3 months or more, and then are subject to several revisions. Changes in the transform to allow longer lags or averages caused strong losses in predictive power. We'll continue to monitor GDP data and revisions, but for now it appears to be not usable.

Future Work

This new global bond model is quite sound fundamentally and empirically, and we have begun investing with its signals. There is still additional work to be done. As noted above, there are still several variables under consideration for addition to the model. Additionally, by establishing a base model in which we at First Quadrant have confidence, we now have a number of opportunities to further expand our work in global bond modeling and to quantitatively measure their benefits.

One potentially valuable piece of research we have already started is looking at models of duration. The country selection model discussed here focused on 7 – 10 year futures, but for many countries liquid futures of varying maturities exist. Taking positions at varying points along the yield curve offers a whole new dimension of alpha opportunities, and we are currently evaluating the potential benefits and how to model them.

While the relative changes of different variables contained in a pooled model captures a great deal of explanatory power in international bond returns, there are certainly effects that pertain to just one or a few countries. These effects can be captured with local country models. Such models might contain variables which only exist for a single country, such as mortgage backed security rates in the USA. Other variables may be only effective for a subset of countries. Examples could include commodity prices for those countries most dependent on raw materials (Japan or Australia, e.g.), or the effects of a larger country on a smaller neighbor (Canadian rates affected by USA rates, e.g.). Having a pooled model in place allows us to evaluate whether these local models are already accounted for by the pooled models. For example, the effects of commodity prices in Japan may be contained within the current account balance.

Another exciting possibility is to examine shorter term effects on bond prices. These could be particularly useful for the timing of our trades. Examples include the richness of futures, the amount of open interest during the roll, new bond issuance by a government, and various technical factors.

A final class of potential models that we'll mention is those based on discrete events that occur only infrequently. A good example is changes in tax rates, which some academic evidence shows are capitalized in security pricing. Discount rate changes by a central bank may have one-time influences at announcement beyond their effects on the shape of the yield curve. The uncertainty of an upcoming election has been claimed to lower prices. Still another example is calendar effects related to fund flows.

Conclusion

This paper has motivated the investing opportunities of international government bonds, and then described a methodology for building a forecasting model. We discuss the actual variables that are used in our model, and show the resulting performance. Finally, we've briefly listed some future work. This new global bond model has gone live, and we look forward to it being a strong contributor to First Quadrant's Asset Allocation process.

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