Diversification Benefits and Persistence of U.S.-Based Global Bond Funds

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Abstract

This paper examines diversification benefits and performance persistence of 188 U.S.-based global bond funds that survived and were defunct during the period of 1993 to 2004. Consistent with managed fund literature, global funds underperform broad-based benchmark indexes; however, the underperformance is less than the funds' expense ratio. The results using both simple and time-varying frameworks suggest that global funds provide higher total return and comparable risk-adjusted return to domestic bond funds. For U.S. investors specializing in domestic bond funds, global bond funds can enhance return by 0.5% to 1% per year without increasing risk. Global bond funds also provide incremental diversification benefits to equity fund investors. The funds exhibit short-run performance persistence, but this is difficult for investors to exploit especially in long-run. Global bond funds show no return seasonality during the sample period. On a risk-adjusted basis, larger and newer funds and funds with long maturity and low expense ratio perform well.

JEL classification: G11; G12; G15
Keywords: Global bond fund; International diversification; Performance persistence; Return seasonality

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1. Introduction

As of 2004, nearly half of managed bond funds in the U.S. markets were concentrated on intermediate-term government and high quality corporate bond funds. This subgroup is arguably representative of U.S. bond funds because it has characteristics that fixed-income investors prefer. With average credit quality of AA and the average maturity of 7 years, this asset class provides relatively safe investment with an intermediate-time horizon. Among many different types of bond funds available today, global bond funds can offer U.S. fixed-income investors an alternative to, or an addition to, investing in U.S. domestic bond funds as they are comparable quality and maturity to the domestic bond funds. The similarity makes global bond funds a promising investment vehicle to add to an investment portfolio. Moreover, global bond funds provide an easy, relatively low-cost way to implement internationally diversified bond portfolios for small investors.

As the name suggests, global bond funds invest in worldwide bond markets, including the U.S. bond markets. During the past 15 years, U.S.-based global bond funds have grown significantly: Between 1986 and 2004 the number of the funds increased from 9 to 137 and net assets under management increased from $2 billion to $25.2 billion (Pozen, 1998; Morningstar database). As of 2004, the market value of global bond funds accounted for about 3% of the value of all taxable bond funds. Global bond funds are expected to become more important in individual asset allocation as U.S. baby boomers approaching retirement begin to demand more fixed-income investment in their portfolios. In addition, the extended bear equity market in early 2000s reduced investors' desire to hold equity and hence increased demand for fixed income securities.

Despite their economic significance, global bond funds have received little attention in academia. In fact, the question of whether U.S. investors can gain diversification benefits by investing in global bond funds still remains, at best, inconclusive.[1] Furthermore, the issues of performance persistence, the relation between fund characteristics and performance, and return seasonality of global bond funds have never been addressed. To date, Detzler (1999) and Gallo,

[1] The diversification benefits of international investment via equity mutual funds are well established (e.g., see Bailey and Lim, 1992; Cumby and Glen, 1990; Chang, Eun, and Kolodny, 1995).

Lockwood, and Swanson (1997) are the only published studies that have examined global bond funds. Detzler analyzes performance of 19 international/global bond funds during the period from 1988 to 1995, and Gallo et al. examine 22 funds during the same period. Both studies find that the funds underperform the broad-based benchmark indexes based on Jensen-alpha.[2] Detzler also find that the funds' alpha is negatively related to the expense ratio. She concludes that the diversification benefits might be outweighed by expenses of the funds. The conclusions of the two studies are based on the comparison of international/global bond funds with the benchmark indexes. However, the indexes are not investible, and their returns do not account for transaction costs.

In this study, we evaluate performance of global bond funds by directly comparing risk-adjusted returns of global bond funds to those of comparable quality bond funds that invest only in the U.S. markets (i.e., domestic bond funds). The direct comparison provides two advantages. First, unlike the indexes, both global and domestic bond funds are available for investors and their returns are net after transaction costs. Thus, the transaction costs are taken into the consideration in this study. Second, the direct comparison allows us to test whether global bond funds can provide benefits to individual investors beyond investing only in domestic bond funds. In other words, this study answers whether global bond funds provide a better alternative or additional investment to domestic bond funds.

Our sample consists of 188 global and 531 domestic bond funds that existed or became deceased during the sample period from 1993 to 2004. Because the sample includes both surviving and non-surviving funds, the results in this study are not affected by survivorship bias. We compare performance of global bond funds to performance of domestic bond funds using both simple and conditional Sharpe ratios. The conditional Sharpe ratio allows for time-varying mean and variance. We also test whether U.S. investors whose portfolios are concentrated on domestic bond and equity funds receive incremental benefits by adding global bond funds into the portfolios. To provide a comprehensive study of global bond funds, we further analyze performance persistence and return seasonality of global bond funds and the relation between fund performance and fund characteristics. To our knowledge, this study is the first to analyze

[2] Using different methodologies, Blake, Elton and Gruber (1993) and Elton, Gruber and Blake (1995) find that domestic bond funds underperform benchmark indexes.

performance persistence and return seasonality on global bond funds and the first to evaluate global bond funds as an alternative or additional investment for U.S. retail investors.

Consistent with Detzler (1999), we find that global bond funds underperform benchmark indexes; however, the underperformance is less than the expense ratio. The results using a simple mean and variance framework are consistent with those using a time-varying framework. They suggest that global funds provide higher returns and comparable risk-adjusted returns to domestic bond funds. More important, global bond funds provide incremental gain for investors whose portfolios are concentrated on domestic bond funds. U.S. bond investors are better off using simple diversification strategies such as an equally weighted portfolio or a portfolio of 80/20 mixed between domestic and global bond funds. With these strategies, global bond funds can enhance returns by 0.5% to 1% per year without increasing risk. U.S. equity investors also obtain significant diversification benefits offered by global bond funds.

Global bond funds show some performance persistence. The 1-year ranking criteria can be used to predict next year's winners and losers. The funds in the top rank deciles perform significantly better than both an average fund and those in the bottom rank deciles. However, the ranking correlation of global bond funds is lower than the correlation of equity funds as found by prior studies. The low correlation could make it difficult for investors to exploit the opportunity. Although global bond funds perform well in September and December, their performance does not persist throughout the sample period. As expected, exchange return contributes to the returns of global bond funds. Specifically, 24% of differential return between global and domestic bond funds can be explained by exchange rate return. Finally, we find that fund performance can be explained by some characteristic variables. On a risk-adjusted basis, larger and newer funds and funds with long maturity perform better than smaller and older funds and funds with short maturity. In addition, the funds that charge lower expenses provide higher risk-adjusted returns than those that charge higher expenses.

The remainder of this paper is organized as follows. Section 2 details the sample selection process. Section 3 highlights methodologies used in the study. Section 4 analyzes performance and diversification benefits of global bond funds. Section 5 examines performance persistence, return seasonality, and the relation between performance and characteristics. Section 6 summarizes and concludes the paper.

2. Sample

We create the universe of our sample by merging 10 Morningstar Principia annual CDs from 1995 to 2004. We exclude funds whose net assets at inception date or as of December 1995, whichever later, are less than or equal to $5 million. To have sufficient returns to calculate standard deviation, we further eliminate funds with fewer than 36 monthly returns. The sample period is from January 1993 to December 2004. We start the sample period in January 1993 so that funds identified in 1995 CD have at least 36 consecutive monthly returns.

2.1. Global and Domestic Bond Funds

We define global bond funds as U.S.-based mutual funds that invest in worldwide bond markets, including the U.S. bond markets. From the universe, we select funds that are classified as international or worldwide bond funds by Morningstar. These funds include both funds that invest only in foreign markets and those that invest in foreign and the U.S. markets. To ensure that the funds hold both international and U.S. bonds, we exclude the funds that do not have an investment objective of investing in worldwide bond markets including the U.S. bond markets, and invest less than 80% of portfolio holding in bonds and less than 40% in foreign bond markets. Further, we exclude funds whose average rating is lower than BBB. Our final sample consists of 188 U.S.-based global bond funds. The average portfolio holdings of the funds are 67.69% of central government bonds, 22.72% of government agencies and ultra-large corporate bonds; the remainder is equity and cash. The average maturity of the global bond funds is 8.25 years, with the average credit rating of AA.

For the sample of domestic bond funds, we select U.S.-based bond funds from the universe that have an investment objective of investing in U.S. government bonds of all maturities and invest in U.S. high quality corporate bonds (i.e., AAA to BBB rated). These two criteria are used to find domestic bond funds whose portfolio holdings are comparable to the average portfolio holdings of the global bond fund sample. These criteria are met by 531 domestic bond funds. The average maturity of domestic bond funds is 8.05 years, with the average credit rating of AAA.

2.2. Monthly Returns and Fund Characteristics

We obtain monthly returns of the sample from Morningstar database. Because we only have December CDs and some funds do not survive until year-end, we fill in missing return data of non-surviving funds from the CRSP Mutual Fund database.[3] The returns are total net returns in U.S. dollars, after all administrative and trading expenses but before loads and assuming reinvestment of income and capital gain distributions.

Credit quality and duration of global and domestic bond funds are obtained from Morningstar. The rest of fund characteristic data such as maturity, expense ratio, size, and age are obtained from both CRSP Mutual Fund and Morningstar databases.

2.3. Benchmark Index

To complement the results of Detzler (1999), we also compare performance of global bond funds with broad-based bond indexes. The indexes are used as proxies for passive portfolios (benchmarks) of U.S. government bonds, U.S. investment grade bonds, and global bonds. The indexes include Lehman Brothers (LB) Intermediate-Term U.S. Government Bond Index, LB Long-Term U.S. Government Bond Index, LB Aggregate Bond Index, Salomon Smith Barney (SB) World Government Bond Index, SB World Government Excluding U.S. Index, and SB World Government Currency Hedged Index. We obtain monthly returns of the LB indexes from Morningstar and the SB indexes from Datastream International database.

2.4. Survivorship Bias

Although Morningstar reports only funds in operation, our sample is *almost* free of survivorship bias as we select funds that appear in at least one of the ten Morningstar annual CDs. Therefore, we include both surviving and non-surviving funds. Because one of the sample selection criteria is that funds must have at least 36 monthly returns, we exclude six (3%) global bond funds that are defunct within 3 years, which makes our sample not completely free of survivorship bias. Elton, Gruber, and Blake (2001) show that survivorship bias of Morningstar during 1994 to 1998 is minimal. Specifically, out of 375 funds, only 22 funds exhibit bias in

[3] CRSP calculates fund returns differently from Morningstar. Elton, Gruber and Blake (2001) find that CRSP returns are biased upward for equity funds and the difference in returns between CRSP and Morningstar is larger for older data and smaller funds. In our sample, we find that the average difference in returns between CRSP and Morningstar is −0.0006% for global bond funds and −0.0001% for domestic bond funds, both of which are insignificantly different from zero. We also find that the return differences for both global and domestic bond funds in the second half of the sample period (i.e., 1999−2004) are smaller than the differences in the first half (i.e., 1993−1998). Excluding returns from CRSP does not significantly change the conclusions.

total returns on an average of 0.86% per year or 7.16 basis points per month. However, most empirical findings show that, on average, mutual funds underperform benchmark indexes. Therefore, unless this study finds that global bond funds outperform the indexes and that the magnitude of the outperforming is greater than 7.16 basis points per month, the results in this study are unaffected by the survivorship bias.

Further, unlike most prior studies, the main objective of our analysis is to compare performance of global bond funds with performance of domestic bond funds. As mentioned previously, our sample would be free of survivorship bias if the 36-month restriction were not imposed. The 36-month restriction eliminates 6% (36) of domestic bond funds but only 3% (6) of global bond funds. Because the survivorship bias is an upward bias, the restriction might overestimate performance of domestic bond funds and underestimate performance of global bond funds. Therefore, the restriction biases against finding outperformance for global bond funds. However, we perform robustness check and find that the restriction does not significantly affect the results.

3. Methodology

3.1. Performance

Because our main purpose is to determine whether global bond funds can be a beneficial alternative or additional investment to domestic bond funds, we compare performance of global funds directly to performance of domestic bond funds. Following Ackermann, McEnally, and Ravenscaft (1999) who analyze performance of hedge funds, we use Sharpe ratio as a risk-adjusted performance measure. Sharpe ratio is defined as:

$$SHR_i = \frac{r_i - r_f}{\sigma_i} \qquad (1)$$

where

SHR_i = Sharpe ratio of fund *i*;

r_i = average monthly return of the fund;

r_f = average monthly return of 90-day U.S. Treasury bills; and

σ_i = standard deviation of monthly returns of the fund.

A higher Sharpe ratio implies outperformance of the fund on a risk-adjusted basis.

We calculate Sharpe ratio using two methodologies; (a) a simple or unconditional Sharpe ratio and (b) a conditional Sharpe ratio. For the simple Sharpe ratio, we assume that the return standard deviation is constant throughout the sample period. This assumption is widely used especially in analysis geared toward an average investor. However, time-varying volatility in asset returns is well-established in literature (Bollerslev, Chou, and Kroner, 1992). Ilmanen (1995) finds evidence that government bond returns in major bond markets are time-varying and predictable. Hunter and Simon (2004) use predetermined information variables similar to those used by Ilmanen to construct a conditional Sharpe ratio to evaluate the potential benefits of international bond investing. To allow for time varying, we calculate a conditional Sharpe ratio from the conditional mean and volatility of global and domestic bond funds using Equations (2) and (3) as follows (Hunter and Simon). We assume that the return series follow GARCH(1,1) process. Equations (2) and (3) are expressed as:

$$r_{i,t} = \alpha + \beta_1 r_{i,t-1} + \beta_2 SPREAD_{i,t-1} + \beta_3 EQRET_{i,t-1} + \beta_4 BONDRET_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

$$h_{i,t} = \omega + \gamma \varepsilon^2_{i,t-1} + \lambda h_{i,t-1} \quad (3)$$

where

$r_{i,t}$ = return of global and domestic bond funds at month *t*;

$SPREAD_{i,t-1}$ = lag of term spread, measured by return difference between long- and short-term SB World Government Bond Index for global bond funds, and return difference between long- and short-term LB U.S. Government Bond Index for domestic bond funds at month $t-1$;

$EQRET_{i,t-1}$ = lag of stock market return, measured by Morgan Stanley Capital International Equity Index return for global bond funds, and S&P500 Index return for domestic bond funds at month $t-1$; and

$BONDRET_{i,t-1}$ = lag of cross-market bond return, measured by LB U.S. Aggregate Bond Index return for global bond funds and SB World Government Bond Index return for domestic bond funds at month $t-1$.

The independent variables in Equation (2) are used to estimate conditional mean and volatility of global and domestic bond funds because prior studies—especially Ilmanen and Hunter and Simon—find that these variables are useful information in predicting domestic and international bond returns. Specifically, the lag of dependent variable is used to capture autocorrelation. SPREAD, a proxy for term spread risk factor, is found to have the highest explanatory power for

international bond returns (Ilmanen). EQRET, stock market return, is used to capture the lead-lag relation between returns of bond and stock markets (Hunter and Simon). $BONDRET_j$, cross-market bond return, is included to capture the lead-lag relation between domestic and global government bond markets. Hunter and Simon (2005) document the cross-market return relation between U.S. bond market and major bond markets. The lags of these variables can be viewed as information available to fund managers prior to time *t*.

3.2. Diversification Benefits

We evaluate whether U.S. investors receive incremental benefits by adding global bond funds into existing bond or stock portfolios by using the methodology developed by Elton, Gruber, and Rentzer (1987). Elton et al. show that a gain occurs when a new asset is added to an existing portfolio if Sharpe ratio of the new asset exceeds the product of Sharpe ratio of the portfolio and return correlation between the new asset and the existing portfolio. Therefore, if global bond funds provide incremental diversification benefits to the investors, the following equation should hold:

$$SHR_g > SHR_p \times \rho_{gp} \quad (4)$$

where SHR_g = Sharpe ratio of a global bond fund, SHR_p = Sharpe ratio of an existing portfolio, and ρ_{gp} = return correlation between the global bond fund and the existing portfolio. To evaluate the incremental diversification benefits of global bond funds, we calculate the difference between SHR_g and $SHR_p \times \rho_{gp}$ and test whether the difference is significantly greater than zero. A significantly positive difference suggests that global bond funds provide benefits to the investors, and a negative or insignificant difference suggests otherwise.

We calculate a return correction between an equally weighted portfolio of global bond funds and an existing portfolio and apply it to all global bond funds. Because the return correlation at portfolio level is greater than the correlation at individual fund level, the bias is against finding an incremental diversification benefit of global bond funds and strengthens our conclusion if global bond funds are found to be beneficial.

To allow for time-varying volatility, we also calculate the difference between SHR_g and $SHR_p \times \rho_{gp}$ using conditional Sharpe ratios and conditional correlation. To estimate the conditional correlation between global and domestic bond funds, we use a bivariate system of equations. As in Bollerslev (1990), we assume a GARCH(1,1) structure of conditional variances

and a nonzero constant conditional correlation between global and domestic bond fund returns. The equations are expressed as follow:

$$r_{i,t} = \alpha + \beta_1 r_{i,t-1} + \beta_2 SPREAD_{i,t-1} + \beta_3 EQRET_{i,t-1} + \beta_4 r_{j,t-1} + \varepsilon_{i,t} \quad (5)$$

$$h_{i,t} = \omega + \gamma \varepsilon^2_{i,t-1} + \lambda h_{i,t-1} \quad (6)$$

$$h_{ij,t} = \rho_{ij} \sqrt{h_{i,t}} \sqrt{h_{j,t}} \quad (7)$$

where $r_{i,t}$ = portfolio return of global and domestic bond funds at month *t*, ρ_{ij} = the constant return correlation between global and domestic bond fund portfolios, and all other variables are defined the same as the variables in Equations (2) and (3).

Ackermann et al. (1999), Edwards and Park (1996), and Irwin, Krukemyer, and Zulauf (1993) have applied the methodology of Elton et al. (1987) to examine the benefits of international diversification for equities. Unlike these studies, which use broad-based equity indexes as proxies for existing portfolios, we use index funds to represent existing portfolios of U.S. investors. We choose index funds rather than the indexes because the indexes are not investible and their returns are not accounted for trading expenses that investors incur if they want to implement the portfolios. Further, it is commonly known that, on average, passive portfolios perform as well as or outperform active portfolios, which implies that U.S. investors are better off by simply holding index funds. This provides another motivation for selecting index funds as representatives of existing portfolios of the investors.

We choose seven categories of index funds to cover the major asset classes. The categories are intermediate-term U.S. government bond funds, U.S. aggregate bond funds, balanced funds, small-cap equity funds, mid-cap equity funds, large-cap equity funds, and S&P 500 index funds. From the universe of the sample, we identify funds that are classified by Morningstar as index funds. For bond index funds to be included in the sample of the existing portfolios, their investment objective must be U.S. intermediate-term government bond funds, U.S. aggregate bond funds or balanced funds. For equity index funds, we use Morningstar categories. The existing portfolios consist of 7 intermediate-term U.S. government bond funds, 30 U.S. aggregate bond funds, 4 balanced funds, 51 small-cap equity funds, 39 mid-cap equity funds, 199 large-cap equity funds and 98 S&P 500 index funds.

3.3. Performance Persistence

If past performance can be used to predict future winners and losers, performance persistence exists. We adapt the procedure of Elton, Gruber, and Blake (1996) to examine performance persistence of global bond funds. The procedure involves performance rankings during two periods: (a) the selection period and (b) the evaluation period. During the selection period, funds are ranked and placed in deciles based on (a) average monthly Sharpe ratio (SHR) over the 1-year period, (b) average monthly SHR over the 3-year period, (c) 1-year holding period return (HPR), and (d) 3-year HPR. During the evaluation period, funds are ranked based on average monthly SHR calculated over 1 year following the selection period. The monthly SHR calculated in the evaluation period is a measure of realized performance.

For example, for the selection period ending in 1995, we rank the funds and place in deciles based on 1-year SHR and HPR calculated during January to December 1995 and 3-year SHR and HPR calculated during January 1993 to December 1995. The corresponding evaluation period is January to December 1996. We repeat the process for every year. The process is done nine times over the sample period.[4] The standard deviation for SHR is calculated using the entire sample period to reduce the effect of outliers over the period of 12 months. To test whether performance persistence exists among the funds, we calculate correlation of rankings between the selection and evaluation periods. The significant correlation suggests that past performance has predictive power.

3.4. Seasonality

We examine the presence of return seasonality among global bond funds by first analyzing average return in the calendar month of the funds along with the SB World Government Bond (SBWG) Index over the sample period. We choose SBWG Index as a benchmark because the majority of the composition of global bond funds is government bonds, and SBWG Index is widely used as a benchmark for global government bonds. We then use regression analysis to examine the return seasonality as in previous studies such as Bhabra, Dhillon, and Ramirez (1999) and Maxwell (1998). We run regressions between average monthly returns of the funds, both total and risk-adjusted returns, and a set of dummy variables representing calendar months except October. We select October as the comparison month

[4] We omit 1993 and 1994 so that all ranking criteria can be performed for equal number of periods.

because the average return in October is closest to the average return (about 0.6%) of all months for global bond funds. Because the study period covers three declining periods of U.S. and world bond markets, we also include dummy variables in the regressions to isolate the effects of these volatile periods. Further we include SBWG Index as a benchmark. The regression equation is written as:

$$r_t = \alpha + \beta_1 * SBWG_t + \sum_{i=2}^{12} \beta_i * D_{M,i} + \sum_{13}^{15} \beta_j * D_{V,j} + \varepsilon_t \quad (8)$$

where

r_t = average return and risk-adjusted return of all global bond funds at month *t* where *t* = 1, 2, …, 144;

$SBWG_t$ = return of SBWG Index at month *t*;

$D_{M,i}$ = dummy variables that take value of 1 for the month of January to December except October; and

$D_{V,j}$ = dummy variables that take value of 1 for three volatile periods that cover September through November 1994 for the 1994 U.S. market decline, July through September 1997 for the 1997 Asian crisis, and July through September 1998 for the 1998 Russian bond crisis.

If global bond funds exhibit seasonality pattern, we should observe significant coefficients on one or more calendar month variables.

3.5. Performance and Characteristics

To test whether characteristics of global bond funds can explain the performance, we regress the funds' returns on their characteristics such as maturity, size, age, expense ratio, load, management tenure and asset turnover. The model is expressed as:

$$r = \alpha + \beta_1 * \text{Maturity} + \beta_2 * \text{Size} + \beta_3 * \text{Age} + \beta_4 * \text{Expense Ratio} + \beta_5 * \text{Load} + \beta_6 * \text{Tenure} + \beta_7 * \text{Turnover} + \varepsilon \quad (9)$$

where

r = average monthly return and risk-adjusted return of a fund;

Maturity = average maturity (years) of fixed-income securities in the fund;

Size = natural log of net assets ($million) of the fund;

Age = number of years that the fund had been in operation;

Expense ratio = operating expenses and management and administrative fees as a percentage of net assets;

Load = total of initial and deferred sales charges;

Tenure = number of years that the current management had been with the fund; and

Turnover = turnover ratio, the ratio of the lesser of purchases or sales to average monthly net assets.

Maturity is included in the model to capture the maturity risk characteristics of global bond funds.[5] We perform the regression across fund-years and across funds. For fund-year regressions, r is the average performance over a year, and independent variables are at year-end. For across fund regressions, r is the average performance over the sample period, and independent variables are mean variables. The regression is run across funds to reduce influence of funds that survive for longer periods.

4. Performance and Diversification Benefits

4.1. Performance of Global Bond Funds in Comparison to Benchmark Indexes

To complement the study of Detzler (1999), we first compare performance of global bond funds to performance of benchmark indexes. Table 1, Panel A presents mean and standard deviation of monthly returns for global bond funds and the indexes. Global bond funds earn an average return of 0.591%, with a standard deviation of 1.952%. The returns for the indexes range from 0.5% (LB Intermediate-Term U.S. Government Bond Index) to 0.7% (LB Long-Term U.S. Government Bond Index). The average return for the SB World Government Currency Hedged Index is 0.5975% per month, with a standard deviation of 0.9014%. Given the hedging cost of as high as 40 basis points per year or 3.33 basis points per month (Burik and Ennis, 1990), the return after the cost is about 0.56% per month. Although lower than the return of the unhedged index (i.e., 0.6317% of SB World Government Index), the standard deviation of the hedged index is about half of the standard deviation of the unhedged index (1.8577%).

Table 1, Panel A also presents the difference in mean returns between global bond funds and the indexes. The differences for both World Government Bond unhedged indexes are significantly negative, which suggests that on the return basis, global bond funds underperform

[5] We thank the referee for suggesting this.

the benchmark indexes. The average underperformance of global bond funds is 5.51 basis points per month or 0.66% per year. Although this amount is less than the average annual expense ratio of 1.38% that the funds in our sample charged, the underperformance still persists after adjusted for the survivorship bias of approximately 0.86% per year (Elton et al., 2001).

Using the sample of 19 global and international bond funds, Detzler (1999) reports the mean monthly return in excess of 30-day U.S. T-bills of 23.17 basis points during the period of November 1988 to 1995. The mean monthly excess return for our sample is 23.33 basis points, with a median of 20.18% (not tabulated).[6] These returns are comparable to the excess return reported by Detzler, although sample compositions and sample periods between the two studies are vastly different. Our sample consists of 188 global bond funds, compared to Detzler's sample of 19 global and international funds. The sample period in this study is from 1993 to 2004 and covers three periods of volatile bond markets (i.e., the 1994 U.S. bond market meltdown, the 1997 Asian crisis, and the 1998 Russian default).

In Panel B of Table 1, we evaluate performance of global bond funds and benchmarks using Sharpe ratio. Global bond funds exhibit a mean Sharpe ratio of 0.1088 and a median of 0.1172. For benchmark indexes, the mean Sharpe ratio ranges from 0.14 for SB World Government Excluding U.S. Index to 0.3 for SB World Government Currency-Hedged Index. The finding of the highest Sharpe ratio for the Currency-Hedged Index provides support to the claim that currency-hedged portfolios provide better risk-return tradeoff than unhedged portfolios (Chang et al., 1995). The difference in mean monthly Sharpe ratios between global bond funds and indexes is also presented in Panel B of Table 1. The differences between global bond funds and all benchmark indexes are significantly negative. Overall, the results in Table 1 indicate that global bond funds significantly underperform benchmark indexes on the basis of both returns and risk-adjusted returns. These results are consistent with the finding of Detzler (1999) who compares performance of global and international bond funds to that of indexes using Jensen-alpha.

4.2. Performance of Global Bond Funds in Comparison to Domestic Bond Funds

[6] The mean monthly return in excess of the 90-day T-bill return for global bond funds is 23.44 basis points with a median of 20.81 basis points. Duffee (1996) argues that the 30-day T-bill rate is not a good proxy for risk-free rate due to idiosyncratic volatility.

Because the indexes are not investible and their returns do not include trading costs that investors incur if they implement the portfolios of indexes, we concentrate our performance analysis on the comparison of global bond funds with domestic bond funds. Both global and domestic bond funds are available for investors and their returns are net after trading expenses. Figure 1, which plots holding period returns for both funds over the sample period, shows that domestic bond funds underperform global bond funds over the sample period. In Panel A of Table 2, the average holding period return for global bond funds is 107.38%, compared to 71.28% for domestic bond funds. The mean (median) 1-year holding period return for global funds is 7.09% (6.6%) whereas for domestic funds it is 5.56% (5.45%). The average 3- and 5-year holding period returns of global funds are also higher than the returns of domestic funds.

Table 2, Panel B presents average return and standard deviation of global and domestic bond funds. Overall, global bond funds provide higher return and higher risk than domestic bond funds. For the entire period, the average monthly return of global bond funds is 0.59%, significantly higher than 0.46% of domestic bond funds. The standard deviation of global bond funds is 1.95 %, compared to 1.07 % of domestic bond funds. In the first half of the sample period (i.e., 1993-1998), the average return of global bond funds is significantly higher than the return of domestic bond funds, but it is comparable in the second half of the sample period (i.e., 1999-2004).

In Panel C of Table 2, for the entire sample period both mean and median Sharpe ratios for global bond funds are slightly higher than the ratios for domestic bond funds. Global bond funds earn 10.88 basis points per 1 unit of risk whereas domestic bond funds earn 10.6 basis points. Global bond funds significantly outperform domestic bond funds in the first subperiod, but underperform in the second subperiod. On a year-by-year basis, global bond funds outperform domestic bond funds in 7 out of 12 years whereas domestic bond funds outperform in 5 years.

Table 3 presents the conditional mean, volatility and Sharpe ratio of global and domestic bond funds. In Panel A of Table 3, for the entire sample period the conditional mean and volatility of global bond funds are significantly higher than the mean and volatility of domestic bond funds. The conditional Sharpe ratio of global bond funds is 0.1091, compared to 0.1073 for domestic bond funds. In Panels B and C of Table 3, the average conditional Sharpe ratios of global bond funds are 0.0753 and 0.1199 for the first and second subperiods, respectively. For

domestic bond funds, the conditional Sharpe ratios for the first and second subperiods are 0.0233 and 0.1721, respectively. These findings suggest that although global bond funds outperform domestic bond funds during the period from 1993 through 1998, they underperform during the period from 1999 to 2004. For the entire sample period, global bond funds perform as well as domestic bond funds. These results, based on conditional framework, are consistent with the results using unconditional Sharpe ratio in Table 2.

Overall, the results in Tables 2 and 3, coupled with those in Table 1 and Figure 1, suggest that although global bond funds significantly underperform benchmark indexes, they provide comparable risk-adjusted returns to domestic bond funds, which indicates that, for an individual portfolio, international diversification through global bond funds provides comparable risk-adjusted returns to investing only in domestic bond funds. This finding is in contrast to the argument of Detzler (1999) who compares performance of global and international bond funds to the performance of broad-based benchmark indexes.

Because returns of global bond funds are in U.S. dollar, we examine whether exchange rate shift can explain the return difference between global and domestic bond funds. In addition, we examine three other possible risk factors that might explain the differential return: the difference in risk characteristics such as liquidity and country-specific risk of government bond markets, and differences in credit quality and duration between global and domestic bond funds.[7] We regress the difference in monthly returns between global and domestic bond funds against these four factors. The exchange rate shift is measured by return of trade-weighted average index of the broad foreign currencies per U.S. dollar. The market characteristic difference is measured by the difference in returns between SB World Government Bond Index expressed in foreign currency and LB U.S. Government Bond Index. Differences in credit quality and duration are the differences in credit rating and duration, respectively. A credit rating of AAA equals 1, AA equals to 2, and so on.

We find that the differential return is significantly negatively related to exchange rate return (results not tabulated). About 24% of the differential return between global and domestic bond funds can be explained by exchange rate return. The return difference is also positively related to the difference in market characteristics but insignificantly related to the differences in

[7] Duration and quality are proxies for basic bond risk premiums (Ilmanen, 1995).

credit quality and duration. The exchange rate return and the differential market characteristics combined explain about 50% to 60% of the return difference.

4.3. Do Global Bond Funds Provide Incremental Gains to Existing Portfolios?

In this section, we analyze whether global bond funds provide incremental diversification benefits to U.S. investors who hold portfolios of domestic bonds, stocks or balanced portfolios. Elton et al. (1987) show that a diversification benefit is present when global bond funds are added to an existing portfolio if Sharpe ratio of global bond funds (SHR_g) is greater than the product between Sharpe ratio of the existing portfolio and the return correlation between global bond funds and the existing portfolio ($SHR_p \times \rho_{gp}$). To test the incremental diversification benefit of global bond funds, we compare SHR_g to $SHR_p \times \rho_{gp}$. Panel A of Table 4 presents the results.

Recall that the average Sharpe ratio for global bond funds is 0.1088. Aggregate bond index funds provide the highest risk-adjusted return during the sample period. Sharpe ratio for the aggregate bond index funds is 0.2216, compared to the second highest ratio of 0.1157 for balanced index funds. The lowest Sharpe ratio is 0.0236 for S&P 500 index funds. As expected, the correlation between global bond funds and domestic bond funds is high (0.6203). The correlations between global bond funds and the other two bond portfolios (i.e., U.S. Government Intermediate-Term funds, and Aggregate Bond funds) are above 0.5. The correlations between global bond funds and stock index funds are about 0.3—much lower than the correlations between global bond funds and bond index funds.

In the last column of Panel A of Table 4, we calculate the difference between SHR_g and $SHR_p \times \rho_{gp}$.[8] The difference for domestic bond funds is significantly positive, which suggests that, for U.S. investors who focus on domestic bond funds, adding global bond funds into the existing portfolio provides potential diversification gain. The differences for all other existing portfolios except aggregate bond index funds are positive and significant. The significant differences for equity index funds are due to low correlations between global bond funds and

[8] The t-statistic is calculated as follow: $t = \dfrac{\sum_{i=1}^{188} DIFF_i \Big/ 188}{S(DIFF)/\sqrt{188}}$ where $DIFF_i = SHR_{gi} - (SHR_p \times \rho_{gp})$, and S(DIFF) = standard deviation of DIFF.

equity index funds. The difference for aggregate bond index funds is significantly negative because the index funds earn a high Shape ratio during the sample period. These findings suggest that global bond funds provide incremental diversification benefits to not only domestic bond funds but also equity index funds.

The results using a conditional Sharpe ratio are also consistent with the results above. The conditional correlation between global and domestic bond funds is 0.6063. Therefore, $SHR_p \times \rho_{gp}$ equals to 0.0651 (i.e., 0.1073 × 0.6063). Given that the average conditional Sharpe ratio of global bond funds is 0.1091, the mean difference between SHR_g and $SHR_p \times \rho_{gp}$ is 0.044, significantly different from zero at less than 1% level. This finding confirms that global bond funds provide incremental diversification benefits to domestic bond funds.[9]

Because expense ratio is negatively related to performance and expense ratios of index funds are much lower than the ratios of global bond funds, [10] we further analyze incremental diversification benefits of global bond funds whose expense ratios are similar to those of index funds. We select global bond funds whose expense ratios are in the lowest quartile. The results are presented in Panel B of Table 4. In Panel B, we also select domestic bond funds whose expense ratios are in the lowest quartile. As expected, the average Sharpe ratio of global bond funds with lowest quartile expense ratio (0.1435) is higher than the average Sharpe ratio of all global bond funds (0.1088). Similarly, the average Sharpe ratio of domestic bond funds with lowest quartile expense ratio (0.1493) is higher than the average Sharpe ratio of all domestic bond funds (0.106). The correlation between low-expense global bond funds and low-expense domestic bond funds is 0.6712, which is slightly higher than 0.6203 between all global and domestic bond funds. The correlations between low-expense global bond funds and the other two bond index funds are also slightly higher, whereas the correlations with equity index funds are much lower. For example, the correlation with S&P500 is 0.1371 for low-expense global bond funds, compared to 0.3 for all global bond funds. This finding provides an interesting observation.[11]

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[9] Note that the conditional correlation of 0.61 is similar to the simple correlation of 0.62. This finding is consistent with the finding of Hunter and Simon (2005) who find that the constant conditional correlation is comparable to simple correlation.

[10] For example, the average expense ratios of global and domestic bond funds are 1.38% and 0.99%, respectively, compared to 0.38% for aggregate corporate bond index funds. See the description of Table 4 for expense ratios of other index funds.

[11] Further analysis shows that as expense ratio of global bond funds increases, the correlations with equity index funds increase, but the correlations with bond index funds decline.

In Panel B of Table 4, the mean differences between SHR_g and $SHR_p \times \rho_{gp}$ for all existing portfolios except aggregate bond index funds are significantly positive and higher than the differences in Panel A of Table 4.[12] The higher differences are results of higher Sharpe ratio of low-expense global bond funds and low correlations with equity index funds. The difference for the aggregate bond index funds is negative but insignificant. Overall, the results in Table 4 indicate that global bond funds are beneficial to existing portfolios of domestic bond funds as well as equity funds. The benefit is greater for global bond funds with a low-expense ratio.

To provide an intuition for the Elton et al. (1987) measurement of incremental gain, we rearrange the difference between SHR_g and $SHR_p \times \rho_{gp}$ to:[13]

$$\frac{R_g}{R_p} > \beta_{g/p} \tag{10}$$

Or, $$\frac{R_g / R_p}{\beta_{g/p}} > 1 \tag{11}$$

where R_g = excess return of global bond funds, R_p = excess return of the existing portfolio, and $\beta_{g/p}$ = ratio of return covariance between global bond funds and the existing portfolio to return variance of the existing portfolio.

R_g/R_p can be considered the reward ratio, and $\beta_{g/p}$ is amount of risk of global bond funds relative to the existing portfolio or the relative risk. Both equations imply that global bond funds provide an incremental diversification benefit to the existing portfolio if the return of global bond funds relative to the return of the existing portfolio is greater than the relative risk, or if the reward to risk is greater than 1. As an example, the corresponding number to Equation (11) for the existing portfolio of domestic bond funds is 1.9648 to 1.1269 or 1.7435, given that the average R_g and R_d are 0.2344 and 0.1193, respectively, and β_{gp} equals to 1.1269. The reward-to-risk ratio of 1.7435 implies that it is valuable to add global bond funds to a portfolio of domestic bond funds because the reward is 1.7435% per 1 unit of the risk.

The results in Table 4 suggest that U.S. bond investors can benefit from adding global bond funds to their existing domestic bond funds. To confirm the results, we further evaluate performance of the combined portfolios between domestic and global bond funds. We assume that investors follow one of two simple diversification strategies: (a) an equally weighted

[12] The mean differences for high-expense global bond funds are still positive, but the level of significance drops to 5%.

[13] We thank Steve Sears and the referee for suggesting the intuition.

portfolio of domestic and global bond funds (EW portfolio), or (b) 80% domestic bond funds and 20% global bond funds (80/20 portfolio). We select 80/20 combination because Clarke and Tullis (1999) show that for an equity portfolio, 20% to 30% of assets should be allocated to foreign equity.

Table 5, Panel A presents the average Sharpe ratio of the portfolios and global bond funds compared to domestic bond funds over the sample period. As previously discussed, for the entire sample period, global bond funds earn an average 0.1088 monthly risk-adjusted return over the sample period. The average risk-adjusted return of domestic bond funds is 0.106. For the EW portfolio, Sharpe ratio is 0.2012, which is significantly higher than the ratio for domestic bond funds. Similarly, Sharpe ratio for the 80/20 portfolio (0.1652) is significantly higher than the ratio for domestic bond funds. These results are consistent with the earlier findings and suggest that investors who pursue these two simple investment strategies can obtain an incremental diversification benefit by adding global bond funds into their domestic bond portfolios. For every 1% of risk as measured by standard deviations, investors who add global funds to their portfolios can enhance returns of their domestic bond portfolios by 5.92 to 9.52 basis points per month.

To show economic significance of the extra returns of EW and 80/20 portfolios, we calculate the difference in returns between domestic bond funds and a synthetic portfolio of EW and 80/20 with risk equal to domestic bond funds. The synthetic portfolio is created by mixing EW and the risk-free security, and 80/20 and the risk-free security. The extra returns with risk equivalent to domestic bond funds (Δr) can be expressed as: [14]

$$\Delta r = [r_f + SHR_p \times \sigma_d] - r_d \qquad (12)$$

where SHR_p = Sharpe ratio of the synthetic portfolio, r_f = T-bill rate, r_d = return of domestic bond funds, and σ_d = standard deviation of domestic bond funds.

For the entire period, the extra return for EW is about 0.08% per month or 0.96% per year.[15] For 80/20 portfolio, the extra return is 0.04% per month or 0.48% per year. For both portfolios, the extra returns of the first subperiod are similar to the returns of the entire period. The extra returns of the second subperiod are 1.31% and 0.91% per year for EW and 80/20

[14] This is the M^2 measure. Equation (12) is similar to Equation (2) of Chang, Eun, and Kolodny (1995) who analyze incremental returns of closed-end country funds.

[15] For the entire period, r_f = 0.3239%, r_d = 0.4609%, and σ_d = 1.0745%. For the first (second) subperiod, r_f = 0.3936% (0.2542%), r_d = 0.5059% (0.3701%), and σ_d = 1.0486% (1.0536%).

portfolios, respectively. These findings suggest that by adding global bond funds to domestic bond funds, investors can enhance return by 0.5% to 1% per year without increasing risk.

4.4. Performance of Global Funds during High Volatility Period in Global Bond Markets

As a supplement to our finding that global bond funds provide additional gain to U.S. investors, in this section we examine the performance of global bond funds during the periods of high volatility in the global bond market. Previous research argues that the benefits of international diversification tend to disappear during periods of highly volatile markets because return correlations of securities increase (Solnik, Bourelle, and Fur, 1996; Hunter and Simon, 2004). Hunter and Simon (2004) contend that U.S. bond investors can still benefit from international bond diversification but only through a currency-hedging portfolio. However, hedging is costly and complicated to implement for an average investor.

In Table 5, Panel B, we examine performance of the combined portfolios and global bond funds compared to domestic bond funds during three declining periods of world bond markets (i.e., the 1994 U.S. bond market meltdown, the 1997 Asian currency crisis and the 1998 Russian default). Panel B.1 of Table 5 presents average monthly returns. Not surprisingly, global bond funds performed best during U.S.-led meltdown in 1994, whereas domestic bond funds performed best during the Asian and Russian crises. However, combining all three subperiods, domestic bond funds exhibit the lowest average monthly return. The return for domestic bond funds during these high volatile periods is 5.02%, compared to 7.03% for global bond funds, and 6.43% and 5.77% for EW and 80/20 portfolios, respectively.

The risk-adjusted return results in Panel B.2 of Table 5 are consistent with the return results. Sharpe ratio for domestic bond funds is lowest during the 1994 period. Although domestic bond funds have the highest Sharpe ratio during the 1997 and 1998 periods, they provide the lowest ratio over the entire three periods of the volatile bond markets. Over the three periods, the EW portfolio earns the highest Sharpe ratio (0.2521), which is significantly higher than domestic bond funds (0.1344). The 80/20 portfolio also has significantly higher Sharpe ratio than domestic bond funds. Taken together, these results suggest that internationally diversified portfolios help reduce risk for bond fund investors during periods of volatile markets. Our results lend support to Hunter and Simon (2005) who find that in a high volatility period, correlations between U.S. and major bond markets, in fact, decrease not increase. These results

contradict the conventional wisdom that the benefits of international diversification disappear during high volatility periods.

5. Performance Persistence, Seasonality and Characteristics

5.1. Performance Persistence

Table 6, Panel A presents the average monthly Sharpe ratio realized over the 1-year evaluation period following the selection period when funds are placed in deciles on the basis of 1- and 3-year holding period returns (HPR) and 1- and 3-year Sharpe ratio (SHR). The column headings show the criteria used to rank funds during the selection period. On the basis of 1-year SHR, Sharpe ratio generally decreases from the top to the bottom deciles. For example, funds ranked in the top two deciles during the selection periods experience the highest average monthly risk-adjusted return, SHR, of 0.2551 and 0.1541, respectively, during the evaluation period, whereas those ranked in the bottom decile have the lowest average risk-adjusted return of 0.0317. We also find a similar pattern when using 3-year SHR, but not when using 1- and 3-year HPR as ranking criteria. However, the best performers of 1- and 3-year HPR are still in the top three deciles, and the worst performers are in the bottom three deciles.

The results of ranking correlation between the selection and the evaluation periods in Table 6, Panel A are in line with the results previously presented. All ranking correlations are positive and significant at the 1% level. The correlation for 1-year HPR (SHR) is 0.228 (0.2294), which is higher than 0.1679 (0.2178) for 3-year HPR (SHR). These findings suggest that past performance and future risk-adjusted performance of global bond funds are significantly correlated. These findings also suggest that the 1-year selection period has higher predictive power than the 3-year selection period. These results are consistent with the findings of Elton et al. (1996).[16] However, the correlations of global bond funds are much smaller than those of equity funds. Elton et al. report the correlation between 1-year selection period and 1-year evaluation period ranked by total returns as high as 1.0, and ranked by risk-adjusted returns, alpha, as high as 0.87.

Further analysis also shows that for all ranking criteria, the correlations for surviving funds are higher than the correlations for non-surviving funds. The correlations decrease as the

[16] See also Brown and Goetzman (1995) and Carhart (1997) who study performance persistence of equity funds.

time period increases.[17] Consistent with Carhart (1997), the worst performers are more consistent than the best ones. The worst performers are funds with high expense ratios, and the best performers are funds with low expense ratios.

The next obvious question is "Can information about past performance help earn higher risk-adjusted return than average in the future?" To examine the usefulness of information from the ranking, we compare the performance of top deciles to that of bottom deciles in Panel B of Table 6. The difference in Sharpe ratio between top and bottom deciles ranges from 0.15 to 0.22 per month. The difference for all ranking criteria is significant at the 1% level. Compared with the average, top deciles funds outperform the average funds significantly for all ranking criteria. These results suggest that investors selecting funds in the top deciles earn significantly higher risk-adjusted return than those who choose the funds from bottom deciles and from an average fund.[18]

The results in Table 6 are presented in terms of average Sharpe ratios over the last 9 years of the sample period. To further examine the predictive power of 1-year criterion, we analyze the ranking correlation year by year. The results of 1-year HPR are qualitatively similar to those of 1-year SHR and hence only the results of 1-year SHR are presented in Panel A of Table 7. The ranking correlations are significant for all years. The correlations are positive for Years 4, 5, 8, 9, 11 and 12, and negative for Years 2, 3, 6, 7 and 10. The positive correlations suggest that funds that do well in prior year (i.e., Years 3, 4, 7, 8, 10 and 11) continue to do well in the subsequent year. The negative correlations indicate that funds that do well in Years 1, 2, 5, 6 and 9 perform poorly in the following year and the reverse is true. These findings suggest that 1-year criteria both on SHR and HPR have predictive ability in 6 out of 11 years.

In Panel B of Table 7, we present the difference in Sharpe ratio between the top and bottom deciles and between the top deciles and average funds based on 1-year SHR. Top deciles outperform bottom deciles significantly in 5 out of 11 years. Top deciles also outperform the average funds in 7 out of 11 years. In Years 2, 3 and 7, the differences between the top and bottom deciles and between the top and average are significantly negative. This suggests that the previous year's losers ranked by SHR outperform the winners. Using total returns (HPR), we

[17] For example, based on the 1-year SHR, the ranking correlation for global bond funds that survive during June 1993 through July 1999 is 0.4701, and the ranking correlation for both surviving and non-surviving funds during the same period is 0.337.

[18] We also test whether investors who select actively traded global bond funds (with high turnover) earn higher risk-adjusted return and find rather weak support.

find that the top deciles outperform the bottom deciles in 5 out of 11 years and outperform average funds in 6 out of 11 years (not tabulated). These results show that the predictive ability of 1-year SHR ranking criteria is similar to the ability of 1-year HPR ranking criteria. Taken together, the results in Table 6 and 7 suggest that (a) short-run persistence does exist in global bond funds, (b) the ranking based on 1-year past performance provides higher predictability over next period's performance than the ranking based on 3-year past performance, and (c) on a yearly basis, the ranking based on SHR has similar predictive power to the ranking based on total return (HPR).

We further examine the usefulness of performance persistence in choosing global funds to combine with an existing portfolio of domestic bond funds. Specifically, we test whether investors who hold portfolios of global and domestic bond funds can benefit by replacing average global bond fund with top deciles global funds. We use two portfolios of global and domestic bond funds created earlier (i.e., EW and 80/20) as benchmarks. We create four additional portfolios by substituting average global bond fund with top deciles global funds ranked by 1-year HPR and 1-year SHR. These portfolios are called Top-EW and Top-80/20. Then we measure performance of the four portfolios during the 1-year period following the ranking period and compare with the benchmarks.

Table 8 reports average monthly SHR during the evaluation period of the four portfolios and benchmarks. Based on the 1-year SHR, the portfolios of Top-EW and Top-80/20 outperform the average of domestic and global funds in 7 out of 11 periods. Similar, the portfolios of Top-EW and Top-80/20 outperform the average portfolios in 6 out of 11 periods. However, none of the outperformance is significant. The result in this part is a bit puzzling to us. First, we show that mixing an average global fund with an average domestic bond fund provides significant gain. Second, we find that last year's best performer of global funds outperform average global funds in the subsequent year, an indication of performance persistence. However, the results in Table 8 suggest that no significant gain is found in mixing last year's winner of global funds with an average domestic fund over a portfolio of average global and domestic bond funds. These results lead us to conclude that the average portfolio is a well-diversified one, and thus no diversification gain is realized from performance persistence found in global bond funds.

5.2. Seasonality

Chang and Pinegar (1986), Chang and Huang (1990), Fridson (2000), and Maxwell (1998) show return seasonality for non-investment grade corporate bonds. The most pronounced seasonality in the non-investment grade bond returns is the January effect, which bonds produce unusually high excess returns in January. Maxwell (1998) also finds no seasonality on investment grade corporate bond.

Table 9 reports the average returns for global bond funds and SBWG Index by calendar months. Our initial results do not indicate any January effect in global bond funds and the index. For the funds, the average return (0.11%) is lowest in February. However, the median return of February (0.75%) is not lowest over the sample period of 12 years. Further analysis shows that only 4 out of 12 February months have negative returns, and all four negative returns concentrate in the first subperiod. The two highest returns for the funds as well as the SBWG Index are in September and December. Out of 12 September months, 10 have positive returns for the funds and 11 for the index. Out of 12 December months, 9 have positive returns for the funds, but only 8 for the index.

In Table 10, we present the regression results of the seasonality test. In Regression 1, we use total returns as a measure of performance and risk-adjusted returns (Sharpe ratio) for Regression 2. As expected, the coefficients for the SBWG Index are significantly positive for both regressions. The coefficients for January are positive in both regressions; however, they are insignificantly different from zero. The coefficients for February are insignificantly negative. The coefficients for September and December are positive but not significant at the 10 % level. These results suggest that global bond funds do not exhibit seasonality. Although this finding does not support the findings of some prior studies as previously mentioned, it is consistent with the finding of Maxwell (1998) who reports no seasonality on investment grade corporate bonds.

The coefficients for 1994 U.S. meltdown and 1998 Russian default are negative whereas the coefficient for 1997 Asian crisis is positive; however all the coefficients are not significantly different from zero. This suggests that the periods of volatile bond markets do not significantly affect returns of global bond funds over the sample period. When the sample is partitioned into two subperiods, the coefficients of 1994 U.S. decline and 1998 Russian default are significantly negative for the first subperiod (i.e., 1993–1998). These findings suggest that both events affect

the returns of global bond funds only in the short period. The insignificant coefficient of 1997 Asian crisis can be explained by small size of bonds issued by Asian countries.[19]

5.3. Relation between Performance and Characteristics

Table 11 presents the results of the regressions between performance and fund characteristics. Total returns are used as performance measure in Regressions 1 and 3. Sharpe ratio is used as performance measure in Regressions 2 and 4. The first two regressions are performed across fund-years and White-adjusted *p*-values are reported, whereas the last two regressions are performed across funds and *p*-values of t-tests are reported. The number of observations in the last two regressions drops to 182 due to unavailability of expense ratio and turnover.

As expected, the coefficient of maturity is significantly positive. In all regressions, controlling for maturity, performance is positively related to size.[20] This result suggests that with equal maturity, larger funds outperform smaller ones. The significantly negative coefficients for age indicate that newer funds perform better than older funds. In Regression 4, the expense ratio is significantly negative to Sharpe ratio. This finding indicates that funds that charge higher expense ratios are associated with lower risk-adjusted returns. The finding of negative coefficient of expense ratio is consistent with the findings of Detzler (1999) and Ferson, Henry and Kisgen (2003).[21] The slope coefficient of tenure is positive for Regressions 1 and 2, suggesting that funds with long tenure outperform those with short tenure. However, the significant coefficient of tenure might be influenced by global bond funds that survive for long periods because the coefficient is insignificant in Regressions 3 and 4.

The coefficients for load and turnover are not significant at the 10 % level. The insignificant coefficient for turnover implies that controlled for other factors, actively managed funds do not provide superior performance. This provides an interesting result that lends support to passively managed strategy.

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[19] Of the world bond markets, emerging markets comprise of only 3.88 % (Basta, 2000).

[20] We also include credit rating as an independent variable to capture another dimension of funds' risk characteristics. The coefficient of the credit rating is not significantly related to the risk-adjusted return.

[21] Detzler runs a regression between the funds' alpha and the single independent variable of the expense ratio and finds the negative coefficient. Our results in this part are generally consistent with Ferson et al. that young U.S. government bond funds with low expense and low turnover perform better in certain economics conditions than average U.S. government bond funds.

The adjusted R^2 for all models are comparable to the R^2 reported in prior studies. For example, using a sample of 2,029 fund-years, Chevalier and Ellison (1999) report the R^2 of 0.03, compared to 0.07 and 0.03 in Regressions 1 and 2. Ackermann et al. (1999) report an R^2 of 0.21 on a sample of 150 hedged funds whereas we report 0.39 in Regression 3 and 0.19 in Regression 4. Taken together, our findings suggest that performance of global bond funds is related to the funds' characteristics, namely maturity, size, age, and expense ratio. Investors are better off with large and new funds with long maturity that charge a low-expense ratio regardless of how actively managers trade their assets.

6. Summary and Conclusion

This article examines diversification benefits and performance persistence of 188 U.S.-based global bond funds during the period of January 1993 through December 2004, using both unconditional and conditional Sharpe ratios. Global bond funds are defined as mutual funds that invest in both foreign and U.S. bond markets. Consistent with managed fund literature, global bond funds underperform broad-based benchmark indexes. However, the underperformance is less than the funds' expense ratio. The results of time-varying framework are consistent with those under an unconditional framework and suggest that global bond funds provide higher total return sand comparable risk-adjusted returns to U.S.-based bond funds that invest only in U.S. bond markets (i.e., domestic bond funds). About 50% to 60% of the differential return between global and domestic bond funds can be explained by exchange rate return and difference in risk characteristics of government bond markets.

Using a methodology developed by Elton et al. (1987), we examine incremental diversification benefits of global bond funds. We find that for U.S. investors whose portfolios are concentrated in domestic bond funds, adding global bond funds to the portfolios can enhance the return by 0.5% to 1% per year without increasing risk. Global bond funds also provide incremental benefits to equity fund investors. Contradict to the conventional wisdom that benefits of international diversification decline during periods of high volatility, we find evidence that global bond funds and the combined portfolios of global and domestic bond funds outperform domestic bond funds significantly during the periods of volatile bond markets (e.g., 1994, 1997 and 1998).

Global bond funds show some performance persistence. The 1-year ranking criteria can be used to predict subsequent year's winners and losers. However, the ranking correlation of global bond funds is much lower than that of equity funds found in prior studies. Global bond funds do not exhibit seasonality pattern. Although the returns in September and December are higher than the returns in other months, they do not persist. Finally, we find that the risk-adjusted return of the funds is positively related to maturity and size and negatively related to age and expense ratio. These findings suggest that investors should select larger funds with long maturity, and avoid older funds with a high-expense ratio. In sum, global bond funds provide diversification benefits to U.S. bond investors during the sample period.

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Table 1
Return, Standard Deviation and Sharpe Ratio of Global Bond Funds and Benchmark Indexes

This table presents monthly return and standard deviation (Panel A) and Sharpe ratio (Panel B) of 188 U.S.-based global bond funds and broad-based benchmark indexes during the period of January 1993 through December 2004. In Panel A, mean and standard deviation (Std. Dev.) are the average monthly return (%) and the average standard deviation (%) of monthly returns across funds and indexes. In Panel B, mean and median Sharpe ratios are calculated across funds and indexes. Sharpe ratio is the ratio of average monthly return in excess of 90-day U.S. T-bills divided by standard deviation of monthly returns. The mean difference is the difference in mean returns for Panel A and Sharpe ratios for Panel B between global bond funds and benchmark indexes. The numbers in parentheses are p-values of t-tests for the zero mean difference.

Panel A: Monthly Return

	Mean	**Std. Dev.**	**Mean Difference**
Global Funds	0.5910	1.9520	
LB Intermediate-Term U.S. Government	0.4936	0.9029	0.0974 (<.0001)
LB Long-Term U.S. Government	0.7252	2.4982	-0.1342 (<.0001)
LB Aggregate	0.5696	1.1204	0.0214 (0.3334)
SB World Government	0.6317	1.8577	-0.0407 (0.0664)
SB World Government excluding U.S.	0.6605	2.3691	-0.0695 (0.0019)
SB World Government Currency Hedged	0.5975	0.9014	-0.0065 (0.7677)

Table 1 continued:

Panel B: Sharpe Ratio

	Mean	**Median**	**Mean Difference**
Global Funds	0.1088	0.1172	
LB Intermediate-Term U.S. Government	0.1879	0.1707	-0.0791 (<.0001)
LB Long-Term U.S. Government	0.1606	0.2183	-0.0519 (<.0001)
LB Aggregate	0.2193	0.2570	-0.1105 (<.0001)
SB World Government	0.1657	0.0829	-0.0569 (<.0001)
SB World Government exclude U.S.	0.1421	0.0849	-0.0333 (0.0005)
SB World Government Currency Hedged	0.3035	0.3177	-0.1948 (<.0001)

Figure 1
Holding Period Returns of Global and Domestic Bond Funds

This figure shows the growth of 1 dollar each invested in global and domestic bond funds during the period of January 1993 through December 2004. Global bond funds include 188 U.S.-based mutual funds that invest in both U.S. and foreign bond markets. Domestic bond funds include 531 U.S. mutual funds that invest only in the U.S. bond markets.

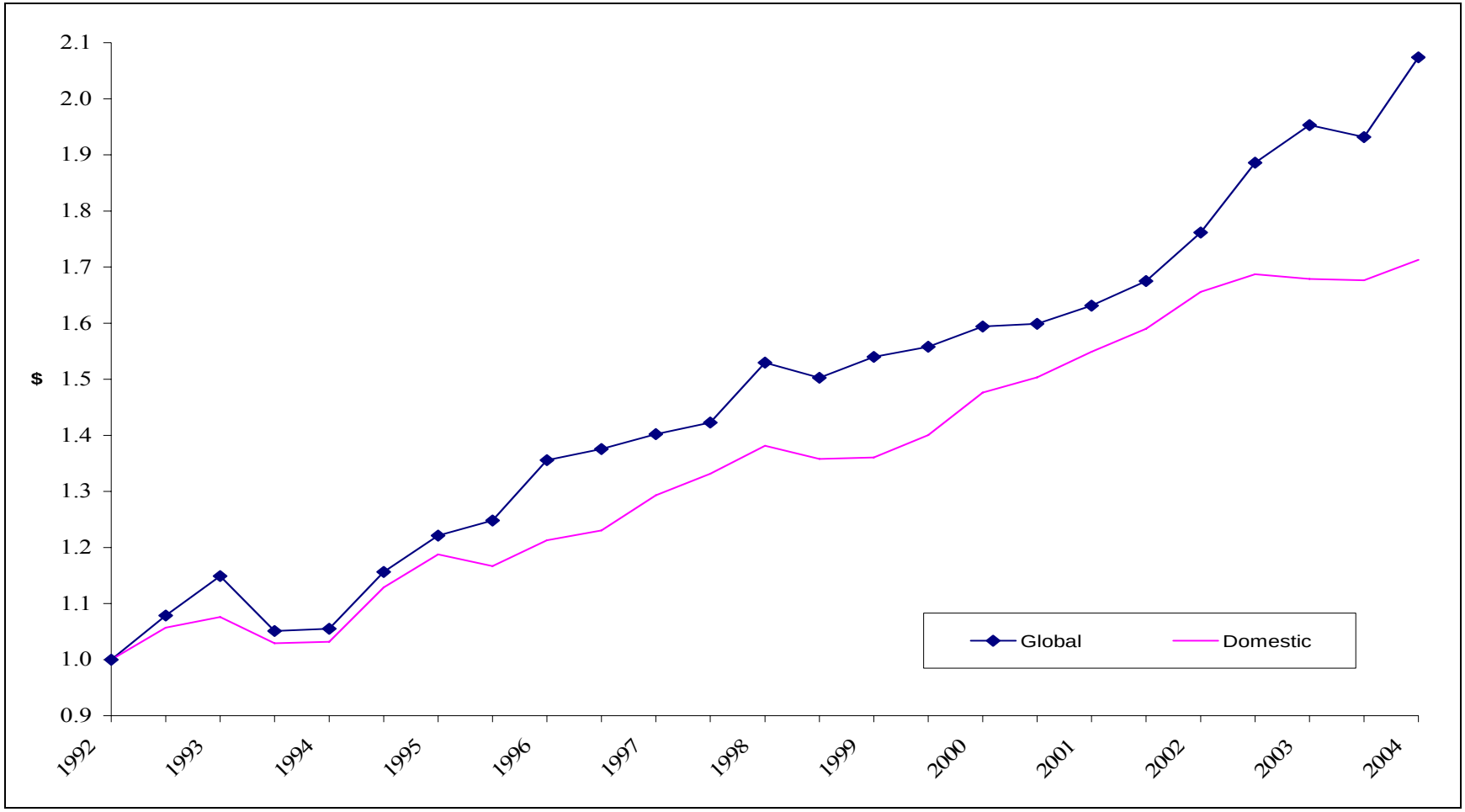

Table 2
Return, Standard Deviation and Sharpe Ratio of Global and Domestic Bond Funds

This table presents holding period return (Panel A), monthly return, standard deviation (Panel B) and Sharpe ratio (Panel C) of 188 U.S.-based global bond funds and 531 domestic bond funds during the period of January 1993 through December 2004. Global bond funds are funds that invest in both U.S. and foreign bond markets. Domestic bond funds invest only in the U.S. bond markets. In Panel A, mean and median holding period returns (%) are calculated across global and domestic bond funds. Holding period return is computed by compounding monthly returns over different periods. The 1-year holding period return is the average of annual compounding returns over 12 periods. The 3-year holding period return is the average of 3-year compounding returns rolling over 10 periods (i.e., January 1993–December 1995, January 1994–December 1996, etc). The 5-year holding period return is the average of 5-year compounding returns rolling over seven periods (i.e., January 1993–December 1997, January 1994–December 1998, etc.) In Panel B, mean and standard deviation are average monthly return (%) and average standard deviation (%) of monthly returns across global and domestic bond funds. In Panel C, mean and median Sharpe ratios are calculated across global and domestic bond funds. Sharpe ratio is the ratio of average monthly return in excess of 90-day U.S. T-bills divided by standard deviation of monthly returns. The mean difference is the difference in mean returns for Panel B and Sharpe ratios for Panel C between global and domestic bond funds, respectively. The numbers in parentheses are *p*-values of *t*-tests for the zero mean difference.

Panel A: Holding Period Return

	Global Funds		Domestic Funds	
	Mean	Median	Mean	Median
Entire Period	107.3765	77.7548	71.2849	75.6329
1-Year	7.0903	6.6048	5.5556	5.4465
3-Year	20.6104	18.4097	17.3080	17.6204
5-Year	33.0805	25.5153	28.6265	30.0600

Table 2 continued:

Panel B: Monthly Return

	Global			Domestic			Mean
Period	**N**	**Mean**	**Std. Dev.**	**N**	**Mean**	**Std. Dev**	**Difference**
Entire	188	0.5910	1.9520	531	0.4609	1.0745	0.1300 (<.0001)
1993-1998	186	0.7200	1.9243	513	0.5095	1.0486	0.2105 (<.0001)
1999-2004	171	0.3562	1.9680	476	0.3701	1.0536	-0.0139 (0.7417)
1993	115	1.2672	1.3416	410	0.6175	0.8574	0.6497 (<.0001)
1994	151	-0.4241	1.9419	452	-0.2815	1.0790	-0.1426 (0.0036)
1995	174	1.4486	1.9109	474	1.2067	0.9121	0.2420 (<.0001)
1996	180	0.9204	1.4328	479	0.2090	1.1294	0.7114 (<.0001)
1997	183	0.3023	1.7042	491	0.6437	0.9431	-0.3414 (<.0001)
1998	182	0.8278	1.9546	480	0.6073	0.8297	0.2205 (<.0001)
1999	171	-0.0207	1.6821	462	-0.1013	0.7455	0.0807 (0.2312)
2000	161	0.2479	2.1871	447	0.8242	0.7748	-0.5763 (<.0001)
2001	146	0.1852	1.8752	424	0.5684	1.1387	-0.3831 (<.0001)
2002	119	0.9907	2.0568	394	0.7407	1.1436	0.2500 (<.0001)
2003	112	1.2450	2.1263	369	0.1660	1.3771	1.0789 (<.0001)
2004	103	0.7281	1.7674	359	0.2266	0.9926	0.5015 (<.0001)

Table 2 continued:

Panel C: Sharpe Ratio

	Global			Domestic			Mean
Period	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**Difference**
Entire	188	0.1088	0.1172	531	0.1060	0.1161	0.0028 (0.7887)
1993-1998	186	0.1580	0.1494	513	0.0927	0.1020	0.0653 (<.0001)
1999-2004	171	0.0075	0.1025	476	0.0809	0.1291	-0.0734 (0.0005)
1993	115	0.5661	0.5725	410	0.3184	0.3532	0.2476 (<.0001)
1994	151	-0.4577	-0.4701	452	-0.6339	-0.6242	0.1762 (<.0001)
1995	174	0.5636	0.5041	474	0.6766	0.6984	-0.1129 (<.0001)
1996	180	0.2240	0.1741	479	-0.1946	-0.1937	0.4186 (<.0001)
1997	183	-0.0779	-0.1127	491	0.1832	0.1977	-0.2611 (<.0001)
1998	182	0.2196	0.2454	480	0.1780	0.1970	0.0416 (0.0048)
1999	171	-0.3235	-0.4240	462	-0.4612	-0.4770	0.1377 (<.0001)
2000	161	-0.1278	-0.1516	447	0.2774	0.3199	-0.4052 (<.0001)
2001	146	-0.0527	-0.0722	424	0.3270	0.2670	-0.3797 (<.0001)
2002	119	0.4554	0.4852	394	0.5763	0.5703	-0.1209 (<.0001)
2003	112	0.5234	0.5734	369	0.0717	0.0639	0.4517 (<.0001)
2004	103	0.3068	0.3192	359	0.0701	0.0880	0.2367 (<.0001)

Table 3
Conditional Return, Volatility and Sharpe Ratio of Global and Domestic Bond Funds

This table presents mean and median conditional mean return, volatility and Sharpe ratio of global and domestic bond funds. The conditional mean return and volatility are estimated from the following equations:

$$r_{i,t} = \alpha + \beta_1 r_{i,t-1} + \beta_2 SPREAD_{i,t-1} + \beta_3 EQRET_{i,t-1} + \beta_4 BONDRET_{i,t-1} + \varepsilon_{i,t}$$

$$h_{i,t} = \omega + \gamma \varepsilon^2_{i,t-1} + \lambda h_{i,t-1}$$

where $r_{i,t}$ = return of global and domestic bond funds at month t; $SPREAD_{i,t-1}$ = lag of term spread, measured by return difference between long- and short-term Smith Barney World Government Bond Index for global bond funds, and return difference between long- and short-term Lehman Brothers U.S. Government Bond Index for domestic bond funds at month $t-1$; $EQRET_{i,t-1}$ = lag of stock market return, measured by Morgan Stanley Capital International equity index return for global bond funds, and S&P500 index return for domestic bond funds at month $t-1$; and $BONDRET_{i,t-1}$ = lag of cross-market bond return, measured by Lehman Brothers U.S. Aggregate Bond Index return for global bond funds, and Smith Barney World Government Bond Index return for domestic bond funds at month $t-1$. The conditional Sharpe ratio is calculated from conditional mean return and volatility. In Panel A, the variables are calculated over the entire sample period of 1993 to 2004. In Panels B and C, the variables are computed over the periods of 1993 to 1998, and 1999 to 2004, respectively. The numbers in parentheses are *p*-values of *t*-statistics testing for zero mean difference between global and domestic bond funds.

Panel A: Entire Sample Period

	Global		Domestic		Mean
	Mean	**Median**	**Mean**	**Median**	**Difference**
Conditional Return	0.5839	0.5337	0.4610	0.4506	0.1229 (<.0001)
Conditional Volatility	4.4083	2.7167	1.3471	1.0573	3.0612 (<.0001)
Conditional Sharpe Ratio	0.1091	0.1183	0.1073	0.1244	0.0018 (0.8807)

Panel B: 1993-1998

	Global		Domestic		Mean
	Mean	**Median**	**Mean**	**Median**	**Difference**
Conditional Return	0.5824	0.5273	0.4451	0.4393	0.1373 (<.0001)
Conditional Volatility	4.5036	2.4663	1.3302	1.0389	3.1735 (<.0001)
Conditional Sharpe Ratio	0.0753	0.0879	0.0233	0.0429	0.0520 (<.0001)

Table 3 continued:

Panel C: 1999-2004

	Global		Domestic		Mean
	Mean	**Median**	**Mean**	**Median**	**Difference**
Conditional Return	0.5657	0.5379	0.4633	0.4613	0.1023 (0.0003)
Conditional Volatility	4.5409	2.7861	1.3603	1.0353	3.1806 (<.0001)
Conditional Sharpe Ratio	0.1199	0.1482	0.1721	0.2069	-0.0522 (0.0021)

Table 4
Sharpe Ratio of Existing Portfolios and Correlation between Global Bond Funds and Existing Portfolios

This table presents average Sharpe ratio of existing portfolios and return correlation between global bond funds and existing portfolios during January 1993 through December 2004. Sharpe ratio (SHR) is the ratio of average monthly return in excess of 90-day U.S. T-bills divided by standard deviation of monthly returns. The correlation (ρ_{gp}) is the correlation of monthly returns between the portfolio of global bond funds and an existing portfolio. The number in the fourth column is the product of Sharpe ratio of the existing portfolio and the return correlation. In the last column, the difference is the difference between Sharpe ratio of global bond funds and the number in the third column. The numbers in parentheses are p-values of t-tests for the zero difference. In Panel A, the numbers are calculated for all global and domestic bond funds. The average Sharpe ratio of global bond funds is 0.1088. The average expense ratio of global bond funds is 1.38%. The average expense ratios of existing portfolios are as follow: 0.99% for domestic bond funds, 0.33% for intermediate-term U.S. government bond funds, 0.38% for aggregate funds, 0.26% for balanced funds, 0.8% for small-cap funds, 0.83% for mid-cap funds, 0.70% for large-cap funds, and 0.64% for S&P500 funds. In Panel B, the numbers are calculated for global and domestic bond funds whose expense ratios are in the lowest quartile. The average Sharpe ratio of global bond funds with lowest quartile expense ratio is 0.1435. The average expense ratio of the lowest quartile global bond funds is 0.68%, and the ratio of the lowest quartile domestic bond funds is 0.45%.

Panel A: All Global and Domestic Bond Funds

Existing Portfolios	SHR_p	ρ_{gp}	$SHR_p \times \rho_{gp}$	Difference
Domestic Bond Funds	0.1060	0.6203	0.0658	0.0430 (<.0001)
Intermediate-Term U.S. Government Funds	0.1490	0.6042	0.0900	0.0187 (0.0474)
Aggregate Bond Funds	0.2216	0.6535	0.1448	-0.0360 (0.0002)
Balanced Funds	0.1157	0.4187	0.0484	0.0603 (<.0001)
Small-Cap Funds	0.1138	0.3039	0.0346	0.0742 (<.0001)
Mid-Cap Funds	0.1091	0.3136	0.0342	0.0745 (<.0001)
Large-Cap Funds	0.0508	0.3015	0.0153	0.0934 (<.0001)
S&P500 Index Funds	0.0236	0.3009	0.0071	0.1017 (<.0001)

Table 4 continued:

Panel B: Global and Domestic Bond Funds with Lowest Quartile Expense Ratio

Existing Portfolios	SHR_p	ρ_{gp}	$SHR_p \times \rho_{gp}$	Difference
Domestic Bond Funds	0.1493	0.6712	0.1002	0.0432 (0.0133)
Intermediate-Term U.S. Government Funds	0.1490	0.6583	0.0981	0.0454 (0.0096)
Aggregate Bond Funds	0.2216	0.6824	0.1512	-0.0077 (0.6480)
Balanced Funds	0.1157	0.2537	0.0293	0.1141 (<.0001)
Small-Cap Funds	0.1138	0.1482	0.0169	0.1266 (<.0001)
Mid-Cap Funds	0.1091	0.1543	0.0168	0.1266 (<.0001)
Large-Cap Funds	0.0508	0.1358	0.0069	0.1365 (<.0001)
S&P500 Index Funds	0.0236	0.1371	0.0032	0.1402 (<.0001)

Table 5
Performance of Portfolios of Global and Domestic Bond Funds

This table presents performance of domestic and global bond funds, an equally weighted portfolio of global and domestic bond funds (EW) and a portfolio of 80% domestic bond funds and 20% global bond funds (80/20). Performance is measured by Sharpe ratio and holding period returns. Sharpe ratio is the ratio of average monthly return in excess of 90-day U.S. T-bills divided by standard deviation of monthly returns. In Panel A, Sharpe ratio is calculated over the entire sample period from January 1994 through December 2004, and two subperiods. In Panels B and C, performance is computed over three periods of volatile bond markets. For all panels, the numbers in parentheses are *p*-values of *t*-tests for the zero mean difference between domestic bond funds and global bond funds, EW, or 80/20.

Panel A: Sharpe Ratio

Period	Domestic	Global	EW	80/20
Entire	0.1060	0.1088	0.2012	0.1652
		(0.7887)	(<.0001)	(<.0001)
1993-1998	0.0927	0.1580	0.1882	0.1488
		(<.0001)	(<.0001)	(<.0001)
1999-2004	0.0809	0.0075	0.2141	0.1817
		(0.0005)	(<.0001)	(<.0001)

Panel B: Performance during Volatile Periods

B.1. Holding Period Returns

	Domestic	Global	EW	80/20
Sep-Nov'94	-1.6498	0.7091	-0.4541	-1.1712
		(<.0001)	(<.0001)	(<.0001)
Jul-Sep'97	2.7851	2.6079	2.7187	2.7689
		(0.2249)	(0.1897)	(0.7481)
Jul-Sep'98	4.1524	3.9920	4.0820	4.1413
		(0.6071)	(0.3439)	(0.8817)
All months	5.0165	7.0307	6.4262	5.7714
		(<.0001)	(<.0001)	(<.0001)

B.2. Sharpe Ratio

	Domestic	Global	EW	80/20
Sep-Nov'94	-0.9576	-0.0834	-0.5213	-0.8059
		(<.0001)	(<.0001)	(<.0001)
Jul-Sep'97	0.4535	0.2300	0.4267	0.4829
		(<.0001)	(0.0050)	(0.0020)
Jul-Sep'98	0.9038	0.5490	0.8480	0.9407
		(<.0001)	(0.0016)	(0.0370)
All months	0.1344	0.2584	0.2512	0.2059
		(<.0001)	(<.0001)	(<.0001)

Table 6
Realized Sharpe Ratio and Ranking Correlation for Different Ranking Criteria

Panel A of this table presents the average monthly Sharpe ratio of global bond funds realized in the year following the estimation periods. In the estimation period, global funds are ranked and placed in deciles on the basis of 1- and 3-year holding period return (HPR) and 1- and 3-year Sharpe ratio (SHR). The ranking correlation is the correlation of performance ranking between two periods: estimation period and evaluation period. The estimation period is either 1- or 3-year period. The evaluation period is 1 year subsequent to the estimation period. Panel B presents the difference in Sharpe ratios during the evaluation period between the top and bottom deciles, and between the top deciles and average funds for different ranking criteria. The numbers in parentheses in Panel A are *p*-value testing for the zero ranking correlation, and the numbers in parentheses in Panel B are *p*-values testing for the zero difference.

Panel A: Realized Sharpe Ratio and Ranking Correlation

		Deciles Formed on the Basis of:			
Deciles		**1-Year HPR**	**3-Year HPR**	**1-Year SHR**	**3-Year SHR**
Top	1	0.2156	0.2186	0.2551	0.1996
	2	0.1551	0.1441	0.1541	0.1879
	3	0.2157	0.1795	0.1345	0.1790
	4	0.0920	0.1106	0.0963	0.1178
	5	0.0758	0.0137	0.0395	0.0258
	6	0.0478	0.0588	0.0357	0.0781
	7	0.0539	0.0935	0.0678	0.0483
	8	-0.0040	0.0279	0.0340	0.0407
	9	0.0325	0.0135	0.0808	0.0293
Bottom	10	0.0442	0.0690	0.0317	0.0211
Rank Correlation		0.2280 (<.0001)	0.1679 (<.0001)	0.2294 (<.0001)	0.2178 (<.0001)

Panel B: Difference in Sharpe Ratios between Top and Bottom Deciles and between Top Deciles and Average Funds

	Deciles Formed on the Basis of:			
Deciles	**1-Year HPR**	**3-Year HPR**	**1-Year SHR**	**3-Year SHR**
Top vs. Bottom	0.1714 (0.0002)	0.1496 (0.0001)	0.2234 (<.0001)	0.1785 (<.0001)
Top vs. Average	0.1240 (<.0001)	0.1254 (<.0001)	0.1629 (<.0001)	0.1074 (<.0001)

Table 7
Realized Sharpe Ratio Based on 1-Year SHR Ranking Criteria

Panel A of this table presents the average monthly Sharpe ratio of global bond funds realized in a year following periods when global bond funds are ranked and placed in deciles using one-year Sharpe ratio. The ranking correlation is the correlation of performance ranking between two periods: the estimation period and the evaluation period. The estimation period is a 1-year period, starting in Year 1 through Year 11. The evaluation period is 1 year subsequent to the estimation period (i.e., Year 2–Year 12). Panel B presents the difference in Sharpe ratios during the evaluation period between the top and bottom deciles and between the top deciles and average funds for different ranking criteria. The numbers in parentheses in Panel A are *p*-values testing for the zero ranking correlation, and the numbers in parentheses in Panel B are *p*-values testing for the zero difference.

Panel A: Realized Sharpe Ratio and Ranking Correlation

Period	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Top 1	-0.6773	0.3205	0.5946	0.2342	0.3054	-0.4725	0.0643	0.1330	0.5112	0.6934	0.5486
2	-0.7040	0.4941	0.2831	0.1426	0.2275	-0.4756	-0.0122	0.2124	0.3416	0.5671	0.3801
3	-0.6256	0.5682	0.1249	0.0873	0.1268	-0.3664	0.0323	0.2396	0.3324	0.6411	0.2964
4	-0.5989	0.4831	0.1868	-0.0312	0.0684	-0.3085	-0.0532	0.0041	0.3373	0.6134	0.3595
5	-0.4824	0.4183	0.0883	-0.0908	0.1515	-0.3585	-0.0655	-0.2745	0.4023	0.5257	0.3177
6	-0.3908	0.5767	0.1268	-0.1488	0.1801	-0.2778	-0.1261	-0.1658	0.4064	0.3119	0.2895
7	-0.4801	0.6266	0.2059	-0.1719	0.3154	-0.3215	-0.2432	-0.0702	0.6462	0.2431	0.2667
8	-0.3506	0.3958	0.1268	-0.2310	0.2349	-0.3808	-0.2264	-0.1636	0.5151	0.5270	0.2582
9	-0.6667	0.5556	0.3373	-0.2257	0.3148	-0.1347	-0.2817	-0.2019	0.4969	0.5020	0.1827
Bottom 10	-0.0886	0.6111	0.1397	-0.3297	0.2508	-0.1432	-0.3702	-0.2374	0.5750	0.6263	0.1739
Ranking Correlation	-0.4486 (<.0001)	-0.1747 (0.0319)	0.2048 (0.0067)	0.7192 (<.0001)	-0.1716 (0.0216)	-0.3421 (<.0001)	0.4675 (<.0001)	0.6562 (<.0001)	-0.3346 (0.0002)	0.3191 (0.0006)	0.6192 (<.0001)

Panel B: Difference in Sharpe Ratios between Top and Bottom Deciles and between Top Deciles and Average Funds

Period	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Top vs. Bottom	-0.5887 (<.0001)	-0.2906 (0.0113)	0.4549 (<.0001)	0.5639 (<.0001)	0.0546 (0.2683)	-0.3293 (0.0033)	0.4344 (0.0001)	0.3703 (<.0001)	-0.0638 (0.4861)	0.0671 (0.4995)	0.3747 (<.0001)
Top vs. Average	-0.1673 (0.0272)	-0.1839 (0.0046)	0.3741 (<.0001)	0.3107 (<.0001)	0.0880 (0.0043)	-0.1475 (0.0316)	0.1921 (0.0003)	0.1857 (0.0003)	0.0558 (0.3672)	0.1700 (0.0126)	0.2418 (<.0001)

Table 8
Performance of Portfolios of Top Ranked and Average Global and Domestic Bond Funds

This table presents the average monthly Sharpe ratio of six portfolios. EW is the equally weighted portfolio of global and domestic bond funds. The 80/20 is the portfolio of 80% domestic bond funds and 20% global bond funds. Top-EW and Top-80/20 are created replacing all global bond funds with top-ranked global bond funds. The global funds are ranked into deciles based on 1-year holding period return (HPR) and 1-year Sharpe ratio (SHR) in year *t*–1. The numbers in parentheses are *p*-values testing for the zero difference in Sharpe ratios between EW and Top-EW, and between 80/20 and Top-80/20.

		Top-EW			Top-80/20	
		Ranked by			Ranked by	
Period	**EW**	**SHR**	**HPR**	**80/20**	**SHR**	**HPR**
2	-0.6831	-0.8349	-0.8245	-0.6916	-0.7597	-0.7884
		(0.7052)	(0.7488)		(0.8413)	(0.7934)
3	0.7497	0.6541	0.6673	0.7632	0.7513	0.7567
		(0.7313)	(0.7564)		(0.9598)	(0.9780)
4	0.1243	0.2552	0.4360	-0.0723	-0.0288	0.1193
		(0.7025)	(0.3445)		(0.8953)	(0.5713)
5	0.0390	0.2950	0.1991	0.1416	0.2737	0.2367
		(0.4423)	(0.6224)		(0.6436)	(0.7475)
6	0.2749	0.3363	0.1768	0.2386	0.2611	0.2100
		(0.7737)	(0.7346)		(0.9137)	(0.8883)
7	-0.4157	-0.5529	-0.1587	-0.4776	-0.5409	-0.3591
		(0.5711)	(0.3292)		(0.7761)	(0.6059)
8	0.0668	0.1541	0.1913	0.2317	0.2722	0.2954
		(0.7583)	(0.6595)		(0.8838)	(0.8179)
9	0.0866	0.1814	0.1308	0.1906	0.2297	0.2121
		(0.7359)	(0.8294)		(0.8959)	(0.9243)
10	0.6694	0.5739	0.4469	0.6475	0.5975	0.5761
		(0.7148)	(0.3981)		(0.8676)	(0.7832)
11	0.5450	0.5620	0.5748	0.2853	0.2965	0.3380
		(0.9706)	(0.9447)		(0.9791)	(0.9017)
12	0.3324	0.4424	0.1938	0.2125	0.2616	0.1939
		(0.7536)	(0.5234)		(0.8698)	(0.9475)
Average	0.1627	0.1879	0.1849	0.1336	0.1467	0.1628
		(0.7830)	(0.8021)		(0.8769)	(0.7259)

Table 9
Returns by Calendar Month

This table presents mean and median returns (%) of 188 U.S.-based global bond funds and Smith Barney World Government Bond (SBWG) Index by calendar month over the period from January 1993 through December 2004. For global bond funds, mean (median) is the mean (median) of average return of funds at a calendar month across the sample period.

	Global Funds		SBWG Index	
Month	**Mean**	**Median**	**Mean**	**Median**
January	0.3683	0.4739	-0.1374	0.0730
February	0.1085	0.7505	0.1303	0.0615
March	0.2408	0.4202	0.6163	0.0560
April	0.4369	0.9671	0.1058	0.0420
May	0.7545	0.2461	1.0555	0.7805
June	0.3702	0.2124	0.5954	0.4015
July	0.2160	0.5744	0.2815	0.2600
August	0.8262	0.3365	0.7785	0.4255
September	1.4281	1.2043	1.8553	1.2980
October	0.6930	0.8485	0.8842	0.7670
November	0.8124	1.1064	0.1993	-0.2925
December	1.3989	1.2835	1.2158	0.9485

Table 10
Regression Results for Seasonality

This table presents the regression results between performance of 188 U.S.-based global bond funds and independent variables from January 1993 through December 2004. In Regression 1, performance is measured by mean monthly return of the funds. In Regression 2, performance is measured by mean Sharpe ratio of the funds. Sharpe ratio is the ratio of monthly return in excess of 90-day U.S. T-bills divided by standard deviation of monthly returns. The independent variables consist of monthly returns of Smith Barney World Government Bond (SBWG) Index and two sets of dummy variables that represent (a) the months of January to December except October, and (b) three periods of volatile bond markets (i.e., September–November 1994 for 1994 U.S. decline, July–September 1997 for 1997 Asian crisis, and July–September 1998 for 1998 Russian default). *N* is the number of observations (i.e., number of months during the sample period). The numbers in parentheses are *t*-statistics of the slope coefficients. *** indicates significant level at 1%.

Table 10 continued:

Regression Variables	**1 Return**	**2 Sharpe Ratio**
Constant	0.2036	0.0307
	(0.73)	(0.23)
SBWG Index	0.5890***	0.6166***
	(13.05)	(15.60)
January	0.2457	0.1609
	(0.63)	(0.86)
February	-0.1718	-0.1030
	(-0.44)	(-0.55)
March	-0.3258	-0.1907
	(-0.84)	(-1.02)
April	0.1710	0.0551
	(0.44)	(0.29)
May	-0.0708	-0.0613
	(-0.18)	(-0.33)
June	-0.1841	-0.0878
	(-0.47)	(-0.47)
July	-0.1348	-0.0133
	(-0.34)	(-0.07)
August	0.1826	0.0195
	(0.46)	(0.10)
September	0.1817	0.1021
	(0.46)	(0.54)
November	0.5229	0.2204
	(1.35)	(1.19)
December	0.4792	0.1969
	(1.23)	(1.06)
1994 U. S. Decline	-0.3769	-0.1801
	(-0.66)	(-0.66)
1997 Asian Crisis	0.3373	0.1620
	(0.59)	(0.59)
1998 Russian Default	-0.5604	-0.3247
	(-0.97)	(-1.17)
N	144	144
Adjusted R^2	0.5653	0.6496
p-value of *F*-test	<.0001	<.0001

Table 11
Regression Results between Fund Performance and Characteristics

This table presents the regression results between performance of U.S.-based global bond funds and fund characteristics. In Regressions 1 and 3, performance is measured by the average monthly return. In Regressions 2 and 4, performance is measured by the average monthly Sharpe ratio. Sharpe ratio is the ratio of monthly return in excess of 90-day U.S. T-bills divided by standard deviation of monthly returns. Maturity is average maturity of bonds in a fund. Size is the natural log of net assets ($million) of a fund. Age is number of years that a fund has been in operation. Expense ratio is operating expenses and management fees including 12b-1 fees expressed as a %age of net assets. Load is the total of initial and deferred sales charges. Tenure is number of years that the current management team had been with the fund. Turnover is the ratio of the lesser of purchases or sales to average monthly net assets. Fund characteristics are obtained from CRSP and Morningstar. The regressions are performed across fund-years for the first two regressions and across funds for the last two regressions. For Regressions 3 and 4, the independent variables for each fund are mean values across the sample period. *N* represents number of observations with all available independent variables. The numbers in parentheses are White-adjusted *p*-values for Regression 1 and 2 and *p*-values of *t*-statistics for Regression 3 and 4. ***, **, * represent significant level at 1%, 5% and 10 %, respectively.

Variables	**Regression 1 Return**	**Regression 2 Sharpe Ratio**	**Regression 3 Return**	**Regression 4 Sharpe Ratio**
Constant	-0.0589	-0.0660	-0.0065	0.0291
	(0.6305)	(0.2722)	(0.9514)	(0.6232)
Maturity	0.0539***	0.0117***	0.0648***	0.0171***
	(<.0001)	(0.0010)	(<.0001)	(<.0000)
Size	0.0719***	0.0288***	0.0585***	0.0246**
	(<.0001)	(0.0012)	(0.0013)	(0.0134)
Age	-0.0249***	-0.0040	-0.0331***	-0.0185***
	(0.0005)	(0.3242)	(0.0002)	(0.0002)
Expense Ratio	0.0633	-0.0335	-0.0010	-0.0647***
	(0.2108)	(0.1753)	(0.9813)	(0.0081)
Load	-0.0121	-0.0045	-0.0006	0.0049
	(0.3121)	(0.4635)	(0.9520)	(0.4087)
Tenure	0.0138*	0.0100**	0.0146	0.0081
	(0.0638)	(0.0207)	(0.2171)	(0.2153)
Turnover	-0.0159	0.0014	-0.0020	0.0062
	(0.1653)	(0.8174)	(0.8566)	(0.3083)
N	1,058	1,058	182	182
Adjusted R^2	0.0716	0.0255	0.3896	0.1922
p-value of *F*-test	<.0001	<.0001	<.0001	<.0001