

## **Taking Advantage of Time Zone Differences between Global Stock Markets to Deliver Improved Return**

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### **DETAILED ABSTRACT**

The search for higher investment returns is a constant and continuing theme for investors around the world. This is true for all types of investors and across all asset categories. As new information becomes available, or as expectations regarding future cash flows change, individuals and institutions are motivated to adjust their portfolios in search of higher rates of return and/or lower risk. As a result of these actions, asset prices change and the balance sheets and financial prospects of market participants may be significantly impacted, for better or worse.

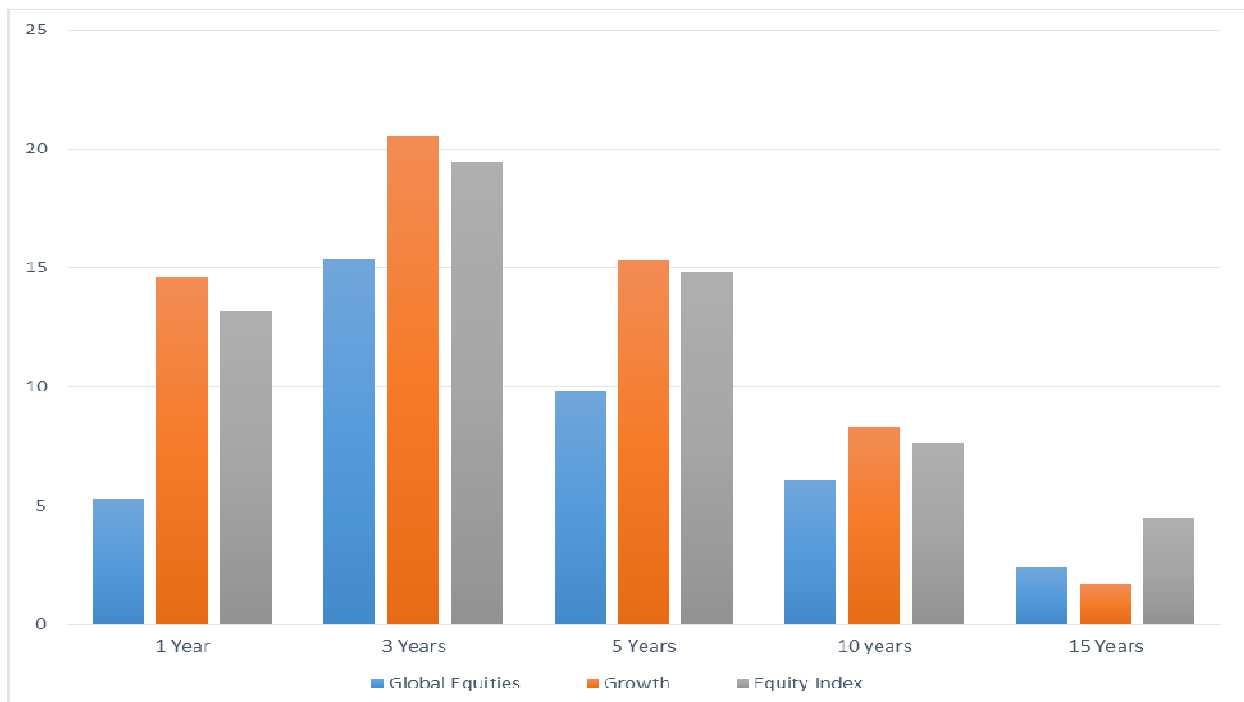
While the drive for higher yields has not fundamentally changed over the years, the economic, financial and institutional environment does evolve and change. These changes impact investor attitudes and investment strategies in various ways. For example, the overheating of the housing market, and the subsequent housing crash, left many investors skittish about the future prospects for the housing market. Beyond this, in response to the financial crisis of 2008 and the subsequent recession, the Federal Reserve System continues to pursue a policy of extraordinary monetary ease which has resulted in interest rates being “zero lower bound.” But this unprecedented interest rate environment has damped investor enthusiasm for treasury and other fixed income securities. In part, the Fed’s strategy to stimulate economic activity included a deliberate attempt to induce investors to seek higher yields by investing in the equity market.

Moreover, in recent years, the equity market itself has evolved and changed in ways that impact investment strategies. For example, the ongoing globalization (integration) of the world’s money and capital markets has connected the economies and financial markets of different nations to an unprecedented extent. Today, economic or financial events in one nation can significantly impact the economies and financial markets in other nations anywhere in the world. In addition, advances in information technology and the proliferation of investment funds and equity market indexes have made it possible for individuals to adopt investment strategies not previously available. For example, it is possible today for an individual investor to move money between various stock market funds or stock indexes, including funds or indexes with different exposures to companies based in different time zones around the world, very quickly and with little or no transactions costs.

One specific investment strategy now available to individual investors, as well as to institutions, is to attempt to take advantage of time zone differences in stock price movements. Many studies have attempted to determine if the performance of a particular stock exchange on a given day has a significant influence on the performance of another stock exchange when these stock exchanges are operational in different time zones. This paper attempts to identify and measure the possible gains from a strategy designed to take advantage of these relationships.

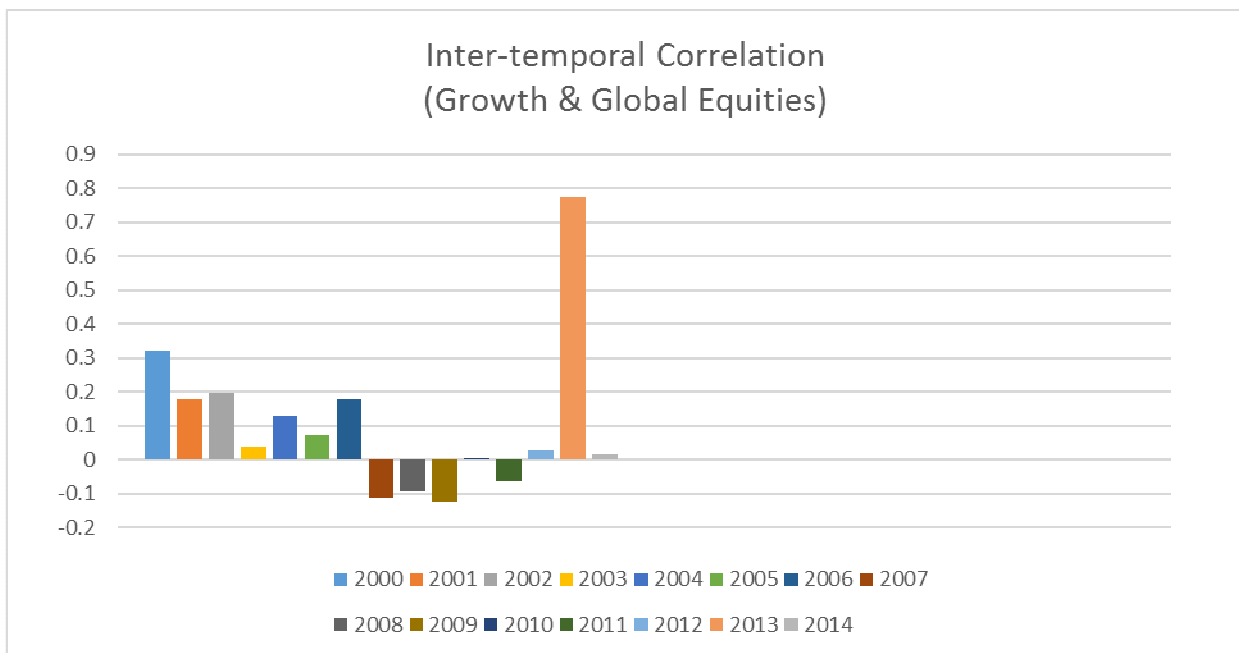
More specifically, using data for the Teachers Insurance and Annuity Association - College Retirement Equities Fund's (TIAA-CREF) Growth fund and its Global Equities fund, this study evaluated investment options to achieve an improved rate of return (ROR) by taking advantage of inter-temporal correlations. Unit values for these variable annuity accounts, and also for TIAA-CREF's Equity Index fund, were downloaded from the TIAA-CREF website. This total period represents 5,479 days spanning 15 years and includes 3,803 days with reported unit values. For the 3,803 days with reported data, stock values increased in 2005 of these days and decreased in 1,780 days. For the remaining 18 days stock values did not change. The 1-year, 3-year, 5-year, 10-year and 15-year average annual returns to the three indexes are shown in Figure 1, below.

**Figure 1 (January 2000-December 2014)**  
**TIAA-CREF Growth, Equity Index, and Global Equities Annual Returns**



Additionally, the inter-temporal correlation coefficients between the daily returns on the Growth fund, the Global Equities fund, and the Equity Index fund were computed and evaluated. It was found that on days when the value of the Growth fund increased significantly, the daily returns on the next day's Global Equities fund were positively influenced. By contrast, for days when the Growth fund declined significantly in value, the (next day) daily returns to the Global Equity fund were not significantly impacted. The inter-temporal daily correlation coefficients between the Growth fund and the Global Equities fund, sorted by year, are shown in Figure 2, below.

**Figure 2 (2000-2014)**  
**Daily Correlation Coefficients between the Growth Index and Global Equities Funds with a Lag of One**



To demonstrate how an investor might take advantage of these inter-temporal relationships, this study considered an initial investment of \$1000 beginning January 1, 2000. The resulting balances on December 31, 2014, based on three specific scenarios, were then determined. In the first scenario, the initial balance of \$1,000 was invested in the TIAA-CREF Growth fund. The resulting balance at the end of December, 2014 was \$1,281.42. Under the second scenario, the initial balance of \$1,000 was invested beginning January 1, 2000 in the Global Equities fund. The resulting balance on December 31, 2014 was \$1,427.17. In the third and final scenario (Table I), the \$1,000 was invested in the Growth fund beginning January 1, 2000, and, on each day the Growth fund was on its way to gain “n” percent in value, the entire balance was transferred to the Global Equities fund before the market closed on that day. Upon investing in the Global Equities fund for exactly one day, the entire balance was transferred back to the

Growth fund. This strategy was continued through December 31, 2014. Allowing “n” to assume integer values from 1 to 12, the resulting balances under this third strategy were determined. The results show a significant improvement in the investment rate of return compared to the first and second scenarios, which do not take advantage of the inter-temporal correlations. Table 1, below, shows the special case of Scenario 3, i.e., when  $n = 3$ .

**Table 1 (January 1, 2000 through December 31, 2014)  
\$1000 Invested in Growth Equities and Global Equities (Option  $n=3$ )**

<b>Fund Name</b>	<b>Jan. 1 2000</b>	<b>After 1 year</b>	<b>After 3 years</b>	<b>After 5 years</b>	<b>After 10 years</b>	<b>Dec. 31 2014</b>
<b>Growth</b>	\$1,000	\$792.85	\$427.50	\$580.28	\$619.45	\$1,281.42
<b>Global Equities</b>	\$1,000	\$833.83	\$525.29	\$796.27	\$877.65	\$1,427.17
<b>Growth &amp; Global</b>	\$1,000	\$960.29	\$618.64	\$858.95	\$951.43	\$1,943.04

As indicated above, Scenario 3 resulted in an improved investment performance for every time period considered (i.e., 1-year, 3-year 5-year 10-year, and 15-year periods) compared to Scenarios 1 and 2. That is, the strategy of transferring money from the Growth fund to the Global Equities fund (and then back again, one day later) when the Growth fund gained three percent or more resulted in a significantly higher closing balance in every case. For example, for the 15-year investment period, the closing balance for Scenario 3 was \$1,943.04, compared to just \$1,281.42 and \$1,427.17 for Scenarios 1 and 2, respectively. In terms of rates of return, Scenario 3 generated an average annual rate of return of 2.64 percent, compared to 1.66 percent and 2.39 percent for Scenarios 1 and 2, respectively.

Future research may evaluate additional stock funds or stock indexes to determine their inter-temporal relationships and the potential for greater investment returns.

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