

Interdependence of Daily Returns Among Major Global Equity Markets

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DETAILED ABSTRACT

One of the few constants in a rapidly changing financial environment is the desire of investors to maximize their investment return and/or reduce risk. This remains true for both individual and institutional investors, and across asset categories. However, the strategies that investors employ to achieve these objectives are, ultimately, constrained or empowered by the institutional and technological environments in which they operate. As these environmental factors evolve, smart investors will inevitably adopt new strategies in pursuit of their unchanging objectives. This article describes, and demonstrates empirically, a new investment strategy made possible by key changes in the economic and technological environments investors face. Specifically, we demonstrate how investors may take advantage of price correlations between worldwide equity markets and time zone differences to deliver improved investment results.

Even casual observation confirms that the economic and financial environment in which investors operate has changed dramatically in recent decades. First, the growing integration of the world's goods and capital markets has linked national economies and equity markets to an extent never experienced before. Economic trends, or disruptions, in one country are felt by other economies and their financial markets around the world. One need not look far for examples: an apparently slowing Chinese economy impacts business confidence and financial markets in developed or developing economies around the world. On-and-off fears about the sovereign debt crisis in Greece and the future of the Euro ramify in currency and financial markets of other countries with surprising speed. Speculation about exactly when the Federal Reserve will depart from its zero interest rate policy impacts capital and money markets worldwide, and possibly the policies of central banks of other nations.

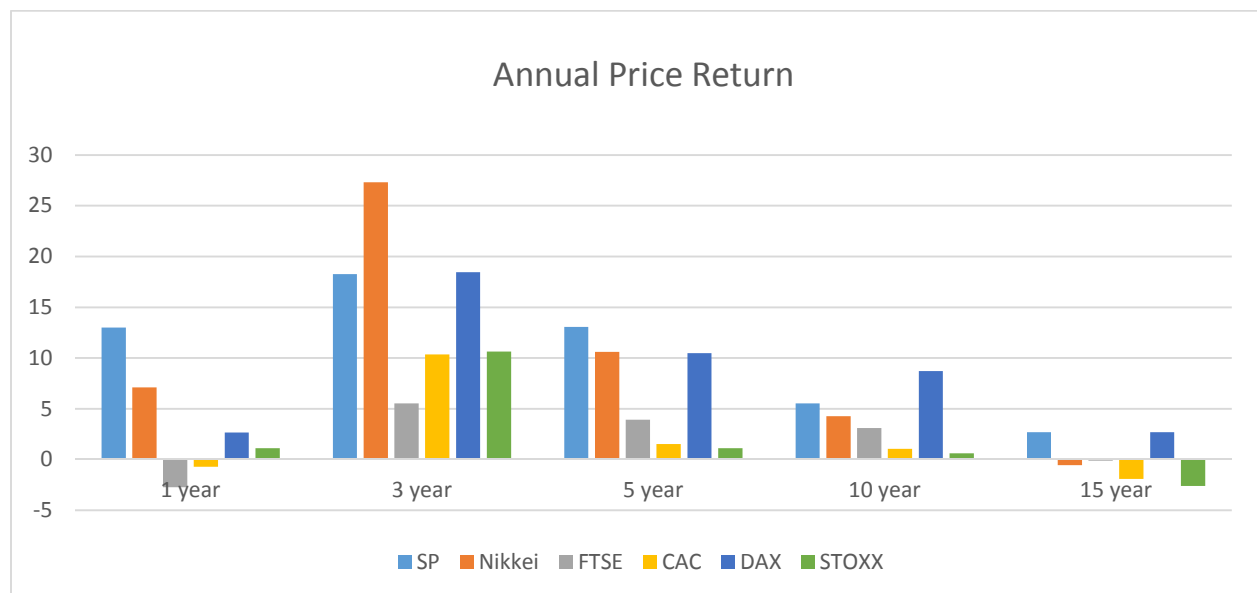
Second, the striking proliferation of equity indexes and stock market mutual funds around the world, have created new opportunities to invest in foreign markets or to diversify on a global scale. And third, advances in information and computer technology have created opportunities for investors to move funds more quickly, and at minimal or no transactions expense, between money and capital markets across continents. The combination of these events has created new opportunities for investors seeking higher investment returns and/or reduced risk. As an example, it is now realistic for investors to transfer money among stock indexes or mutual funds around the world, including indexes or funds with exposures to companies based in different time zones, to take advantage of observed stock price correlations.

A number of prior studies have attempted to estimate the correlations between stock prices (or stock price volatility) of various equity indexes around the world. This study not only identifies the daily price correlations between six major world equity markets for the most recent 15-year period, but it also evaluates the investment performance of specific strategies designed to take advantage of these price correlations between equity markets that are operational in different time zones.

More specifically, using the S&P 500 stock index, the Nikkei 225, the FTSE 100, the CAC 40, the DAX and STOXX index values for the period January 1, 2000 through December 31, 2014, we performed various statistical analyses between the daily index values to determine which exchanges influence the other(s), with the ultimate goal of achieving an improved rate of return (ROR) by taking advantage of intertemporal correlations. The daily values for these global equity market indexes were obtained from the Yahoo Finance website. This total period covers 15 years and 5,479 days. For the individual indexes, it includes 3773 days of reported values for the S&P 500; 3693 days of reported values for the Nikkei 225; 3835 days of reported values for the CAC 40; 3823 days of reported values for the DAX 30; 3906 days of reported values for the FTSE 100; and 3830 days of reported values for the STOXX 50. Overall, it includes 3504 days during which all the indexes reported values.

The 1-year, 3-year, 5-year, 10-year and 15-year average annual returns to these indexes are shown in Figure 1, below. As indicated, these average annual returns exhibited significant variability over the various time periods.

**Figure 1 (January 2000-December 2014)
Selected Global Equity Market Indexes Annual Price Returns**



Additionally, the intertemporal correlation coefficients between the daily returns on the selected stock market indexes were computed and evaluated. It was found that changes in the value of the S&P 500 had the most significant influence on the performance of the daily next day returns on Nikkei 225 index (with $r = 0.45$). By contrast, changes in the value of S&P 500 had the least significant influence on the performance of the next day German DAX (with $r = .17$). The daily correlation coefficients between the S&P 500 and the other global equity market indexes, for both the “next day” and the “previous day,” are shown respectively in Table 1 and Table 2, below.

Table 1 (2000-2014)

Daily Correlation Coefficients between the S&P 500 Index and the Next Day Values of the Global Equity Market Indexes

	S&P 500	SP+1	Nikkei+1	FTSE+1	CAC+1	DAX+1	STOXX+1
S&P 500	1						
SP+1	-0.0812	1					
Nikkei+1	0.453686	0.179088	1				
FTSE+1	0.251361	0.575248	0.364431	1			
CAC+1	0.240246	0.596499	0.353762	0.887871	1		
DAX+1	0.174438	0.637923	0.323152	0.812247	0.890552	1	
STOXX+1	0.223235	0.612066	0.341779	0.880318	0.973587	0.928331	1

Table 2 (2000-2014)

Daily Correlation Coefficients between the S&P 500 Index and Previous Day Values of the Global Equity Markets Indexes

	S&P 500	SP-1	Nikkei-1	FTSE-1	CAC-1	DAX-1	STOXX-1
S&P 500	1						
SP-1	-0.08116	1					
Nikkei-1	-0.03974	0.178858	1				
FTSE-1	-0.05424	0.574954	0.364636	1			
CAC-1	-0.06645	0.595992	0.354115	0.887882	1		
DAX-1	-0.0417	0.637798	0.323198	0.812216	0.890394	1	
STOXX-1	-0.06093	0.611755	0.342013	0.880353	0.97357	0.928274	1

How the U.S. equity market, as represented by the S&P 500, influences, and how is it influenced by, the other major global equity markets, are revealed in Figures 2 and 3, below. Specifically, Figure 2 depicts the correlation coefficients of S&P 500 closing prices with the “same

day” closing prices of the Nikkei, FTSE, CAC, DAX and STOXX indexes. These correlation values reveal that the closing prices of the Nikkei 500 have relatively little influence on the performance of U.S. equity market, while the European equity markets have a moderate influence on U.S. the equity market.

Figure 2 (2000-2014)
Daily Correlation Coefficients between S&P 500 and the Same Day Values of Global Equity Markets Indexes

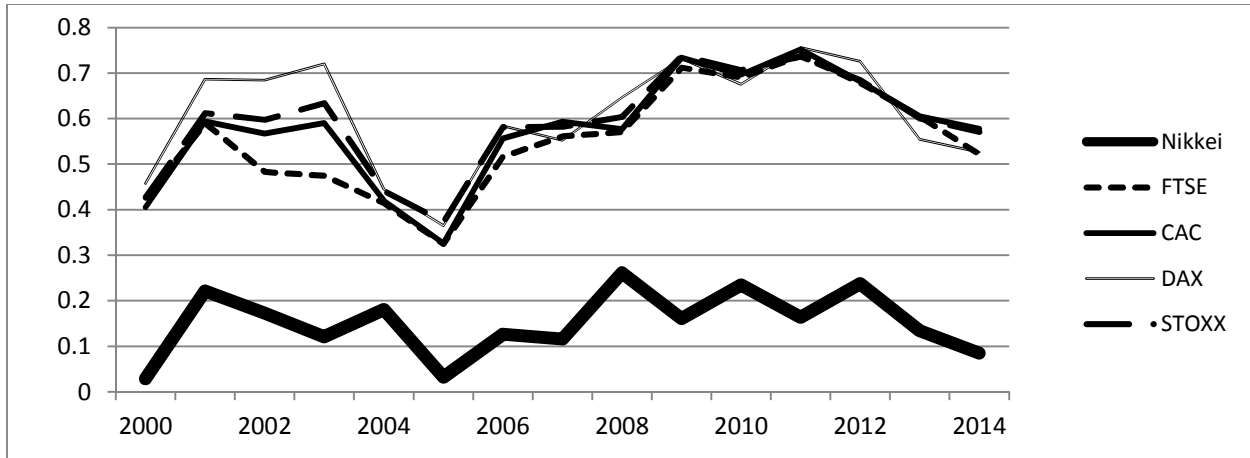
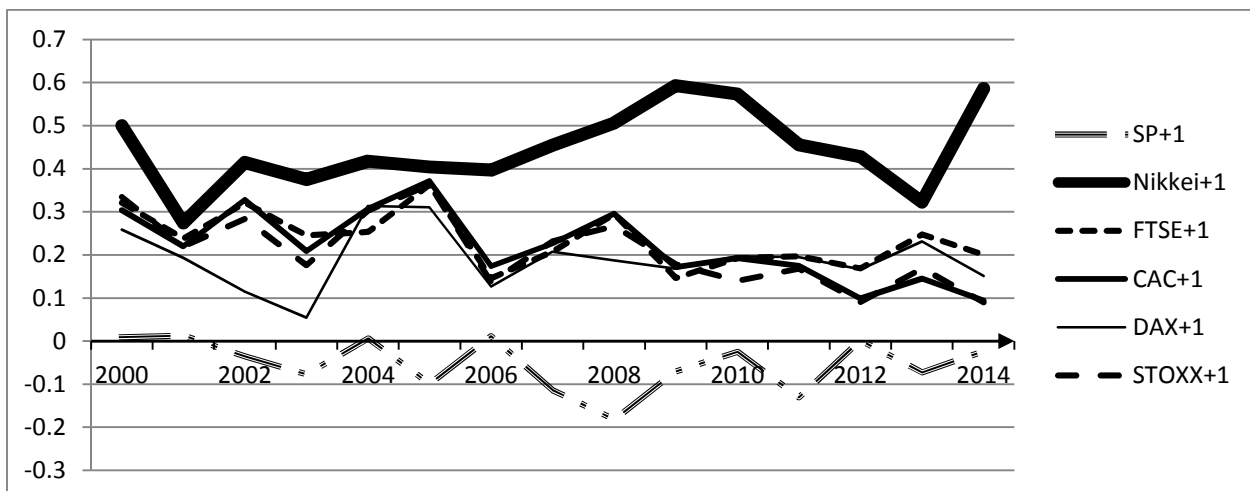


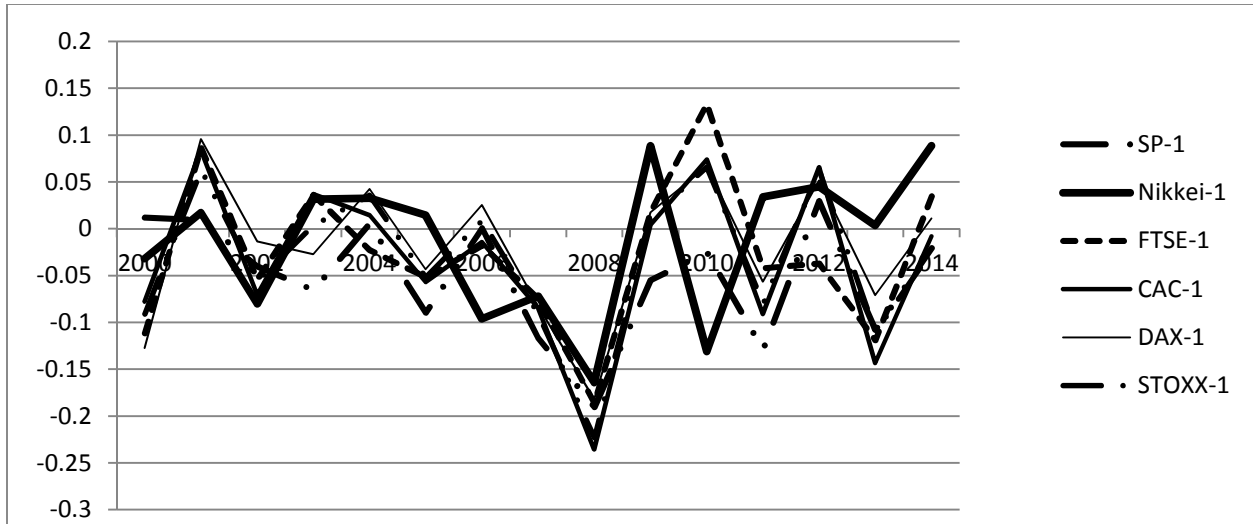
Figure 3 (below) depicts the correlation of the S&P 500 closing prices with the “next day” closing prices of the Nikkei, FTSE, CAC, DAX and STOXX indexes. These correlation values reveal that the closing prices of the S&P 500 index have a moderate influence on the performance of Nikkei 500 index. At the same time, it has a weak, but positive influence on next day European equity markets.

Figure 3 (2000-2014)
Daily Correlation Coefficients between the S&P 500 and the Next Day Values of the Global Equity Markets



Finally, Figure 4 (below) shows the correlation of S&P 500 closing prices with the “previous day” closing prices of the Nikkei, FTSE, CAC, DAX and STOXX indexes. These correlation values reveal that the closing price of S&P 500 is not influenced by the European or Japanese Equity markets’ previous day closing prices.

Figure 4 (2000-2014)
Daily Correlation Coefficients between the S&P 500 and the Previous Day Values of the Global Equity Markets Indexes



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