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A Re-Examination of the Asymmetry between Interest Rates and Stock Returns

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Abstract

The purpose of this paper is to reconcile previous findings of prolonged asymmetrical relationships between interest rates and stock returns, where a reduction in interest rates in one month was shown to produce positive stock returns over a twelve-month period. This study provides evidence that the puzzling relationships suggested by a previous study are sample-dependent and cannot withstand further scrutiny. Test results presented in this study show that investors are not likely to earn abnormal returns through an investment strategy constructed on the expectation of long-term positivie returns following a reduction in interest rates.

Keywords: stock returns, interest rates, market efficiency, information asymmetry

1. Introduction

The relationships between interest rates and stock returns have been the subject of a considerable amount of research. There is compelling evidence that stock returns are inversely related to interest rates. Thus, investors assume that an increase in interest rates would result in a reduction in stock returns, while a reduction in interest rates would have the opposite effect. Various reasons have been given to explain why changes in interest rates affect stock returns. In dividend discount models, the price of a stock basically reflects the present value of all its future cash flows. Therefore, changes in interest rates would affect stock prices by altering the discount rates used in calculating their present value, even when all of the firm's cash flows remain the same.

Lobo (2000) points out that the stock market reacts to the actions and utterances of the Federal Reserve Bank and its officials. He notes that interest rates changes can impact equity prices through two channels. First, by affecting the rate at which the firm's cash flows will be capitalized, and second, by altering expectations of future cash flows. Higher interest rates imply that firms would see increased cost of financing. All things being equal, increased cost of funds would impact negatively on the firm's profitability and its stock prices; while reductions in interest rates would have the opposite effect. Lobo notes that announcements of interest rate changes convey new information to the stock market, and investors generally respond according to the perceived effects of the new information. Portfolio allocation rules are often shaped by monetary policies, and investment advisors rely on these policies as a major factor in the portfolio selection process.

While market efficiency does not rule out an inverse relationship between stock returns and interest rates, it does rule out situations where a change in interest rates in one month is followed by long-term effect on stock returns over many months. However, the study by Domian, Gilster, and Louton (1996) document long-lived asymmetric relationship between reductions in interest rates and future stock returns. They show that a reduction in interest rate in one month produces positive stock returns over the next twelve months. Studies that suggest long-term positive or negative returns following an event (change in interest rates, in this case) have enormous implications for the investment behavior of agents. Investors may be eager to construct their portfolios on the expectation that a reduction in interest rates in a given month would produce positive returns for many months in the future. Again, these types of return anomalies challenge the validity of the efficient market hypothesis, which posits that stock returns at any point reflect all publicly available information at that point.

This study uses new datasets to re-examine the puzzling result of long-lived positive stock returns following a reduction in interest rates, as documented in Domian, Glister, and Luoton (henceforth, DGL 1996). It is important to re-examine the long-lived asymmetrical relationship documented in DGL in order to confirm the

validity of that relationship. Results presented in this paper do not confirm the existence of long-term positive stock returns following a reduction in interest rates. Therefore, this study provides evidence that investors are not likely to achieve abnormal returns through an investment strategy predicated on the expectation of a long-term positive stock return following a reduction in interest rates. The rest of this paper proceeds as follows: Section 2 provides a review of related literature. Section 3 describes the data and methodology used in this study. Test results are presented in Section 4, while concluding remarks are provided in Section 5.

2. Literature Review

The relationship between interest rates and stock returns has been a popular area of research over the years. Earlier studies such as those of Waud (1970), Nelsson (1976), Fama and Schwert (1977) and Fama (1981) provide evidence of a negative relationship between interest rates and stock returns. This pattern of relationship has also been corroborated by more recent studies, such as those by Chen and Chan (1989), Staikouras (2003), Ferrer, Bolos and Benitoz (2016), among others. However, what has also emerged in the literature is that the nature of the relationship between interest rates and stock returns varies over time and across different business cycles (Yourougou, 1990; Basistha & Kurov, 2008). Basistha and Kurov (2008) show that the stock market generally reacts more strongly to unexpected changes in interest rates in periods of recessions and unfriendly credti market, while Jansen and Tsai (2010) document stronger effects of rate changes on stock returns under a bear market than when the market is bullish. In addition, the stock returns response model is also not uniform across countries (Ferrer Bolos & Benitoz, 2016). These studies show that the nature of stock market reactions to changes in interest rates is affected by several other factors.

Geske and Roll (1983) show the existence of inverse relationship between stock returns and expected and unexpected inflation. However, they argue that this relationship does not indicate causality. According to them, stock returns may be negatively correlated with changes in Treasury bill rates (the proxy for expected inflation) even when there is no direct connection between stock returns and inflation. A change in the real rate of interest should be a true cause of ex-post stock returns, because an increase (decrease) in the real interest rate induces a reduction (increase) in all asset values. Thus, to the extent that changes in Treasury bill rates are due to changes in the real interest rates component, one would expect a contemporaneous stock return in the opposite sign.

Fama (1981) provides an explanation for the inverse stock return-interest rate relationship. He argues that the negative relation between stock returns and interest rates is a proxy for positive relationship between stock returns and real variables, which are fundamental determinants of equity values. In this case, an increase in interest rates affects a firm's performance by raising the firm's cost of borrowing, and in some cases, reducing aggregate demand for the firm' products as consumers avoid the credit market and in the process moderate consumption. An increase in interest rates could raise the firm's cost of fund or lead to redcutions in demand; or both. Given either of these situations, the firm's performance and profitability would reduce, and with it, its stock returns. In effect, one would say that the negative relationship between interest rates and real activities or firms' proftiability accounts for the negative relationship between interest rates and stock returns.

In an analysis of the nature of sensitivity of banks' stock returns to interest rates, Flannery and James (1984) show that the common stock returns of commercial banks and stock savings and loan associations are highly correlated with interest rates changes. However, they found that the degree of correlation is positively related to the size difference between the banks' assets and liabilities. Along the same lines, Chen and Chan (1989) study the asymmetry between interest rates and stock returns of financial institutions. They provide evidence of some asymmetrical interest rates sensitivities during various interest rates cycles, and argue that the nature of the sensitivity at any given point is dependent on the current interest rates cycle and existing monetary policy regime. Their study underscores the importance of taking into account the prevailing monetary policy regime in analyzing the relationship between interest rates and stock returns. The present study shares the wisdom in Chen and Chan (1989). The choice of the pre- and post-1979 sub-periods is due to the major shift in monetary policy of October 1979, which produced well-documented effects in the financial markets (Spindt & Tarhan, 1987; Vilasuso, 1999). Also, an examination of the relationship between interest rates and stock returns in the 1992 to 2015 subperiod is designed to document the nature of this relationship using an entirely new dataset, since the results in DGL are based on data from 1952 to 1991.

DGL estimate the relationship between changes in interest rates and stock returns for the periods 1952 to 1991, and 1953 to 1992 (two different models). They show that a reduction in interest rates in one month is followed by positive stock returns over the next 12 months. Although their results portend a major challenge to market efficiency, and potentially have enormous implications for investors' behavior, no attempt has been made to subject these abnormal results to further tests. Consequently, this paper provides evidence that the results

presented by DGL are dependent on their sample, and do not hold true when subjected to further scrutiny. One major factor that may account for the differences in the asymetric response to stock returns following interest rates changes is the 1979 change in Federal Reserve operating procedure. In October 1979, the Federal Reserve shifted from a policy of targeting interest rates to a reserve-oriented procedure. Axilrod and Lindsey (1981) show that the post-1979 operating procedure resulted in a large volatility in interest rates. They show that the standard deviation of monthly changes in the federal funds rate increased almost ten-fold from the year before the policy change to the year following the change. As would be expected, Friedman (1982), O'Brien (1984), and Walsh (1984) document various forms of structural changes within the capital markets following the shift in the Fed's operating procedure.

While several studies highlighted above provide evidence of an inverse relationship between interest rates and stock returns, the concern of this paper is with the long-lived asymmetrical relationship documented in DGL. The results of long-lived positive returns following a reduction in interes rates deserve further scrutiny for two major reasons. First, the results could have serious implications on the investment behavior of agents, and second, it questions the hypothesis of market efficiency, which postulates that stock returns fully reflect all available information at any given time. One of the many ways to test the validity of any research finding is to test the same data using a different methodology, or to conduct tests using new datasets. This paper re-examines the results documented in DGL using new datasets.

3. Data and Methodology

The data for this analysis consist of monthly stock returns on the S&P 500 index, and yields on three-month Treasury bills from January 1952 to December 2016. Changes in Treasury bill yields are good indicators of the direction of various interest rate series. Stock returns from January 1952 to December 1999 are obtained from the SBBI database; and data from 2000 to 2016 are obtained from the St. Louis Federal Reserve Bank. We denote this series by $STOCK_t$. Three-month Treasury bill yields are obtained from the St. Louis Federal Reserve Bank. Changes in yield are denoted by $TBILL_t$ computed from $(YIELD_t - YIELD_{t-1})/YIELD_{t-1}$.

3.1 Unit Root Tests

The stock returns and Treasury bill yields used in this paper are time series processes. Therefore, it is appropriate to test for stationarity of the series before carrying on with our tests. If the series are non-stationary, then the results of all conventional estimation would be invalid, and any conclusions drawn from the test results could be misleading. We test for non-stationarity of the processes using the augmented Dickey-Fuller (1979, 1981) unit root test. For any given series Y_t, the existence of a unit root can be tested using the Dickey-Fuller stationarity test equation thus:

$$Y_t = \beta + \delta_t + \rho Y_{t-1} + \sum \phi_t \Delta Y_{t-1} + \varepsilon_t \quad (1)$$

For both the $STOCK_t$ and $TBILL_t$ series, the null hypothesis of a unit root is rejected at the 1% level. These results indicate that the series are stationary; as such, the regression test statistics are valid.

3.2 Asymmetric Response Model

It has been noted (see DGL) that separating interest rate changes into negative (reduction) and positive (increase) is necessary to detect whether the magnitude of stock returns response depends on the direction of the interest rates change. Similarly, in his study of money supply changes and output, Cover (1992) created a series containing positive money supply shocks, and another series containing only negative shocks. Therefore, we define $TBILLPOS_t$ and $TBILLNEG_t$ thus:

$$\text{TBILLPOS}_t = \begin{cases} TBILL_t \ if \ TBILL_t \geq 0 \\ 0.0000 \ if \ TBILL_t < 0 \end{cases}$$

$$\text{TBILLNEG}_t = \begin{cases} TBILL_t \ if \ TBILL_t < 0 \\ 0.0000 \ if \ TBILL_t \geq 0 \end{cases}$$

$TBILLPOS_t$ represents increase in interest rates, while $TBILLNEG_t$ represents reduction in interest rates at time *t.*

Cumulative stock returns, $RETk_t$ for periods 1 to 12 are defined as follows:

$$RET1_t = STOCK_{t+1}$$

$$RET2_t = (1+STOCK_{t+2})(1+STOCK_{t+1}) - 1$$

$$RET12_t = (1 + STOCK_{t+12})(1 + STOCK_{t+11}) \ldots (1 + STOCK_{t+1}) - 1$$

where $STOCK_t$ is the total return on the S&P 500 at month *t*.

Each $RETk_t$ measures total return on the S&P 500 over k months following an interest rates change at time t. By estimating the following model,

$$RETk_t = \alpha + \beta_1 TBILLPOS_t + \beta_2 TBILLNEG_t + \varepsilon_t \quad (2)$$

This study evaluates the response of cumulative stock returns following a change in interest rates at time t.

In equation (2), for $k > 1$, the *RETk* series uses stock returns from overlapping months. Therefore, even though the sample period is from January 1952 to December 2016, the estimation period is from January 1952 to December 2015. Stock returns up to December 2016 are used to construct the December 2015 value for *RET*12. As in DGL, we use the Newey-West (1987) method to adjust the standard errors for autocorrelation induced by the overlaps.

4. Results

DGL used an estimation period from 1952 to 1991 and find evidence of a long-lived asymmetrical relationship between stock returns and interest rates. This paper extends the estimation period to 2015. In addition, tests are conducted on different subperiods.

Table 1. Cumulative stock responses to changes in interest rate, 1952 to 1991

k	$\hat{\alpha}$	$\hat{\beta}_1$	$\hat{\beta}_2$	R^2
1	0.009**	-0.023	-0.087*	0.013
	(0.000)	(0.553)	(0.015)	
2	0.015**	0.026	-0.189**	0.022
	(0.000)	(0.539)	(0.001)	
3	0.023**	0.062	-0.259**	0.027
	(0.000)	(0.278)	(0.001)	
4	0.030**	0.079	-0.344**	0.034
	(0.000)	(0.308)	(0.000)	
5	0.039**	0.051	-0.447**	0.045
	(0.000)	(0.581)	(0.000)	
6	0.047**	0.079	-0.548**	0.053
	(0.000)	(0.378)	(0.000)	
7	0.055**	0.114	-0.622**	0.056
	(0.000)	(0.248)	(0.000)	
8	0.063**	0.155	-0.673**	0.057
	(0.000)	(0.154)	(0.000)	
9	0.073**	0.148	-0.728**	0.058
	(0.000)	(0.223)	(0.000)	
10	0.081**	0.146	-0.849**	0.071
	(0.000)	(0.286)	(0.000)	
11	0.088**	0.197	-0.962**	0.082
	(0.000)	(0.241)	(0.000)	
12	0.098**	0.172	-1.016**	0.084
	(0.000)	(0.331)	(0.000)	

p-values are shown in parentheses.

* Significantly different from zero at the 5% level.

** Significantly different from zero at the 1% level.

Table 1 presents estimation results for the 1952 to 1991 period shown in DGL. As shown in the table, increases in interest rates (*TBILLPOS*) do not have significant effects on stock returns. However, the *TBILLNEG* coefficients are all significant, usually at the 1% level (p-values range from 0.00 to 0.015). This result would imply the existence of a long-term inverse relationships between interest rates and stock returns. In effect, investors may believe that a reduction in interest rates in one month would produce positive stock returns for the next twelve months.

Table 2. Cumulative stock responses to changes in interest rate, 1992 to 2015

k	$\hat{\alpha}$	$\hat{\beta}_1$	$\hat{\beta}_2$	R^2
1	0.023*	-0.061	-0.163	0.080
	(0.033)	(0.810)	(0.373)	
2	0.033*	-0.138	-0.179	0.012
	(0.032)	(0.931)	(0.621)	
3	0.025*	-0.167	-0.096	0.021
	(0.024)	(0.513)	(0.671)	
4	0.074**	-0.174	-0.139	0.011
	(0.001)	(0.431)	(0.832)	
5	0.095**	-0.183	-0.048	0.005
	(0.001)	(0.549)	(0.387)	
6	0.027*	-0.168	-0.243	0.008
	(0.022)	(0.480)	(0.698)	
7	0.095**	-0.438	-0.245	0.006
	(0.001)	(0.482)	(0.871)	
8	0.108**	-0.531	-0.278	0.011
	(0.004)	(0.435)	(0.871)	
9	0.156**	-0.627	0.174	0.024
	(0.002)	(0.274)	(0.791)	
10	0.178**	-0.683	0.394	0.013
	(0.003)	(0.842)	(0.895)	
11	0.273*	-0.364	0.492	0.009
	(0.018)	(0.499)	(0.862)	
12	0.171*	-0.502	0.468	0.008
	(0.015)	(0.472)	(0.859)	

Note. p-values are shown in parentheses. * Significantly different from zero at the 5% level. ** Significantly different from zero at the 1% level.

The estimation period used by DGL ended in 1991. In order to test the robustness of their results under current market conditions, we conduct out-of-sample tests, using the 1992 to 2015 estimation period. Test results are presented in Table 2 above. Contrary to the results for the 1952 to 1991 period, all the coefficients of *TBILLNEG* in Table 2 are statistically insignificant (*p*-values range from 0.39 to 0.97). This shows that a reduction in interest rates does not induce long-term positive stock returns documented in DGL. The recent evidence does not support the existence of a long-term asymmetrical relationship. Thus, it would be misleading if an investment strategy were constructed with the expectation of long-term positive stock returns following a reduction in interest rates.

Table 3. Cumulative stock responses to changes in interest rate, 1952-Sept. 1978

k	$\hat{\alpha}$	$\hat{\beta}_1$	$\hat{\beta}_2$	R^2
1	0.007*	-0.008	-0.073	0.009
	(0.012)	(0.827)	(0.071)	
2	0.011*	0.047	-0.160**	0.018
	(0.031)	(0.217)	(0.003)	
3	0.015*	0.095	-0.261**	0.034
	(0.038)	(0.065)	(0.000)	
4	0.020*	0.118	-0.388**	0.051
	(0.045)	(0.097)	(0.000)	
5	0.027*	0.099	-0.490**	0.058
	(0.031)	(0.246)	(0.000)	
6	0.033*	0.135	-0.589**	0.066
	(0.027)	(0.096)	(0.000)	
7	0.038*	0.177	-0.680**	0.074
	(0.023)	(0.583)	(0.000)	
8	0.043*	0.221*	-0.786**	0.086
	(0.023)	(0.030)	(0.000)	
9	0.050*	0.224*	-0.876**	0.092
	(0.017)	(0.049)	(0.000)	

10	0.055*	0.249	-1.016**	0.109
	(0.015)	(0.055)	(0.000)	
11	0.058*	0.328	-1.136**	0.125
	(0.015)	(0.058)	(0.000)	
12	0.067*	0.296	-1.210**	0.126
	(0.011)	(0.110)	(0.000)	

Note. p-values are shown in parentheses. * Significantly different from zero at the 5% level. ** Significantly different from zero at the 1% level.

In October 1979, the Federal Reserve shifted from a policy of targeting interest rates to a reserve-oriented procedure. As noted in Chen and Chan (1989), it is necessary to take into account prevailing monetary policy regimes in analyzing the relationship between interest rates and stock returns. To this end, we test for the existence of long-term asymmetry prior to the change in the Fed's operating policy. Estimation results for the January 1952 to September 1978 subperiod are presented in Table 3 above. Consistent with the results shown by DGL, a reduction in interest rates in a given month continues to induce large positive stock returns for the next 12 months. With most *p*-values approximately 0, the coefficients of *TBILLNEG* remain statistically significant for months 2 through 12.

Table 4. Cumulative stock responses to changes in interest rate, Oct. 1978-2015

k	$\hat{\alpha}$	$\hat{\beta}_1$	$\hat{\beta}_2$	R^2
1	0.172*	-0.087	-0.354	0.032
	(0.050)	(0.365)	(0.128)	
2	0.085**	-0.149	-0.472	0.047
	(0.000)	(0.812)	(0.084)	
3	0.019**	-0.141	-0.412	0.028
	(0.001)	(0.831)	(0.158)	
4	0.128*	-0.243	-0.863	0.056
	(0.041)	(0.921)	(0.197)	
5	0.095**	-0.095	-0.285	0.031
	(0.000)	(0.781)	(0.181)	
6	0.145**	-0.095	-0.542	0.082
	(0.001)	(0.839)	(0.143)	
7	0.137**	-0.167	-0.561	0.049
	(0.000)	(0.715)	(0.183)	
8	0.132**	-0.145	-0.541	0.021
	(0.000)	(0.975)	(0.185)	
9	0.097**	-0.457	-0.394	0.054
	(0.000)	(0.887)	(0.138)	
10	0.165**	-0.425	-0.532	0.038
	(0.001)	(0.670)	(0.195)	
11	0.137**	-0.327	-0.624	0.042
	(0.000)	(0.467)	(0.142)	
12	0.092**	-0.385	-0.314	0.065
	(0.000)	(0.491)	(0.318)	

Note. p-values are shown in parentheses. * Significantly different from zero at the 5% level. ** Significantly different from zero at the 1% level.

Many studies such as Friedman (1982), O'Brien (1984), and Walsh (1984) document various forms of structural changes in the capital markets following the shift in the Fed's operating procedure in October 1979. We investigate the relationship between interest rates and stock returns for the October 1979 to December 2015 subperiod. The results are presented in Table 4 above. As shown in the table, the *TBILLPOS* coefficients are all negative and statistically insignificant. Similarly, none of the *TBILLNEG* coefficients is significant at the 5% level. It is clear from this result that the long-term asymmetrical relationship between stock returns and interest rates suggested by DGL is sample-dependent, and does not reflect the nature of the relationship between interest rates and stock returns based on current data.

Fama (1998) notes that market efficiency continues to survive the challenge from the growing literature on long-term return anomalies. This study provides yet another confirmation that findings of return anomalies can be attributed to a number of factors, including the sample, methodology, economic cycle and chance. As such, studies that sometimes document return anomalies do not necessarily invalidate the hypothesis of market efficiency.

5. Conclusion

Recent studies suggest the existence of long-term return anomalies, thus questioning the validity of the market efficiency hypothesis. This paper subjects one of such studies to further scrutiny by considering more recent data. This study provides evidence that findings of long-term excess stock returns following a reduction in interest rates are sample-dependent. When tested with new datasets, the long-term abnormal returns disappear, suggesting that the reported return anomalies are only a chance occurrence and do not reflect the true relationship between interest rates and stock returns.

As noted by Chen and Chan (1989), it is necessary to take existing monetary policy regimes into account in analyzing interest rate asymmetries. Therefore, this study conducts similar tests for two periods coinciding with the change in Federal Reserve operating procedure of October 1979. While the results for the pre-1979 period confirm the puzzling results documented in DGL, tests for the post-1979 period could not reveal any form of long-term relationship.

Based on these findings, this study concludes that it would be inappropriate to assume that a reduction in interest rates in a given month will be followed by 12 months of positive stock returns. Results presented in this study provide evidence that investors are not likely to earn abnormal returns by embarking on an investment strategy predicated on a long-term asymmetrical relationship between interest rates and stock returns. Therefore, this paper provides another victory for market efficiency.

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