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The Fisher effect: Evidence from the Romanian Stock Market

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Abstract

This paper tests the Fisher effect in the case of Romanian stock market. According to the Fisher effect, the expected nominal return on stocks move in one to one correspondence with the expected rate of inflation. The relationship between nominal stock return and inflation is examined for four stock indices. The empirical results suggest that the Fisher effect holds mainly for the index that reflects the price movements of the most ten liquid companies listed on the Romanian stock market and for the investment fund index.

Key words: Fisher effect, stock returns, inflation, Romania, GARCH
JEL Classification: G10, E31

Introduction

The Fisher effect (Fisher, 1930) tries to explain the relationship between nominal interest rates and inflation. According to the Fisher effect, the nominal interest rates reflect all the available information regarding the future levels of the rate of inflation. Therefore, the nominal interest rates should have a direct one to one relationship with the expected rate of inflation, under the assumption that real interest rates are independent of movements in inflation. Over the years, the empirical analysis of the Fisher effect has been generalized to the stock market. Intuitively, because stocks represent claims against real assets, their returns should compensate the expected and, also, the unexpected change in inflation (Sellin, 2001).

The investigation of Fisher effect has been realized for short run relationship between stock return and inflation[1]. Also, other studies use long periods of data[2] or test the cointegration between stock prices and consumer prices (Alagidede and Panagiotidis, 2010). However, the cointegration analysis needs a long span of data to preserve the power of test (Luiten and Paudyal, 2006).

[1] This studies use monthly data covering in general 10 to 15 years (see, Jaffe and Mandelker, 1976; Choudhry, 2001; Choudhry and Pimentel, 2010)
[2] One example is Boudoukh and Richardson (1993) which use long time intervals over which rates of return and inflation are measured (5 years horizon) and a long period of time.

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Since for the Romanian case we have in general statistical data for a short period, in this paper I examine the relationship between monthly stock returns and monthly inflation using the linear regression analysis. The relationship between nominal stock returns and inflation is examined for four stock indices. The results show that the inflation has no impact on the nominal return of Romanian composite index and energy index. At the same time, the nominal return of the index that reflects the price movements of the most ten liquid companies listed on the Romanian stock market and the nominal return of the investment fund index move in one to one correspondence with inflation.

The rest of the paper is structured as follows. In Section 2, the related literature is presented. Section 3 presents the methodology. Section 4 describes the database. In Section 5 the main results are interpreted. Section 6 concludes.

Literature review

Earlier studies such as those by Bodie (1976), Jaffe and Mandelker (1976), Nelson (1976), Fama and Schwert (1977) and others showed that the relationship between stock returns and rate of inflation is negative in the U.S. and stated that the Fisher effect does not hold in the stock market. All of this studies use observed inflation and realized stock returns in order to test the Fisher hypothesis[3]. However, the Fisher effect in its pure form is a model that links the expected nominal stock returns to expected inflation. In this respect, Gultekin (1983b) shows that the Fisher effect holds much better, for U.S. stock market, when the analysis is conducted for the relationship between expected nominal stock returns and expected inflation, where the expectations for stock returns and rate of inflation are obtained from survey data.

On the other hand, some studies find a positive or a weakly positive correlation between nominal stock returns and inflation rate (Boudoukh and Richardson, 1993; Solnik and Solnik, 1997; Madsen, 2005). Boudoukh and Richardson (1993) show that the time intervals over which the rate of returns and inflation are measured have an impact on the empirical results. More specifically, they provide support for a positive relation between nominal returns and inflation at a 5 year horizon. In another study, Engsted and Tanggaard (2002) remark that the relationship between expected U.S. stock returns and expected rate of inflation is positive but weak at short and long horizons. More than that, they observe that the expected Danish stock returns move closely with expected inflation as at long horizons but not at short horizons. In a recent paper, Alagidede and Panagiotidis (2010), using cointegration approach, examine the long run relationship between stock prices and consumer prices in six African markets[4]. The results of cointegration test support the long run relationship between stock prices and consumer prices in Egypt, Nigeria and South Africa. More recently, Rushdi et al. (2012) show that the expected inflation has no significant effect on the real stock returns in the case of Australia. Also, Alagidede and Panagiotidis (2012), using monthly (annualised) stock returns and inflation and GARCH filter, find evidence to suggest that indeed, the nominal stock returns and

[3] One exception is Fama and Shcwert (1977) which estimate expected inflation from T-Bills and consider that the observed stock returns are good estimates of expected stock returns.
[4] The stock markets are from Egypt, Kenya, Morocco, Nigeria, South Africa and Tunisia.

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inflation are positively linked. Furthermore, they observe that the nominal stock returns tend to move one to one with the inflation rate in G7 countries[5].

Methodology

Fama and Schwert (1977) assert that the Fisher effect can be generalized to rates of return on common stocks and other assets. If the market is efficient and reflects all the available information at time $t-1$, it will set the price of a common stock such that the expected nominal return from $t-1$ to t is the sum of the appropriate equilibrium expected real return and the market's evaluation of expected rate of inflation for the same period:

$$E(R_{it} / I_{t-1}) = E(r_{it} / I_{t-1}) + E(\pi_t / I_{t-1}) \quad (1)$$

where R_{it} is the nominal return of stock i from $t-1$ to t, r_{it} is the real rate of return of stock i from $t-1$ to t, π_t is the rate of inflation from $t-1$ to t, I_{t-1} is the set of available information a time $t-1$ and E is the mathematical expectation operator.

The test of the joint hypothesis that the market is efficient and that the expected nominal return of stocks and the expected rate of inflation have a direct one to one relationship can be obtained from estimates of the following regression:

$$R_{it} = \alpha + \beta_i E(\pi_t / I_{t-1}) + \varepsilon_{it} \quad (2)$$

where ε_{it} captures the prediction error of the nominal return on stock i.

An estimate of the regression coefficient β_i which is statistically indistinguishable from 1 is consistent with the hypothesis that the expected nominal return of stock i moves in one to one correspondence with the expected rate of inflation. Also, since the expected real rate of return is equal to the expected nominal return minus the expected rate of inflation, an estimate of β_i which is statistically indistinguishable from 1 is consistent with the hypothesis that the expected real return of stock i and the expected rate of inflation are unrelated.

To test the Fisher effect we need a measure of expected rate of inflation. Following the rational expectation hypothesis, it is often assumed that the observed rate of inflation is a good proxy for the expected rate of inflation (Gultekin, 1983a; Rushdi et al., 2012). Moreover, because the expected inflation is not available in general, estimation of equation (2) has to rely on a regression of the form (Alagidede and Panagiotidis, 2010):

$$R_{it} = \alpha + \beta_i \pi_t + u_{it} \quad (3)$$

where u_{it} is the residual term of stock i.

Further, Boudoukh and Richardson (1993) state that though the Fisher effect is an ex ante relation, equation (3) can be interpreted in the context of the Fisher effect.

The use of least squares method to estimate the coefficients of equation (3) can be problematic. Firstly, the residuals of the above model could be autocorrelated. To eliminate this possibility, we have to include lag values of the dependent variable (see, Kutan and Aksoy,

[5] The G7 countries are: Canada, France, Germany, Italy, Japan, U.K. and U.S.

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2003). Moreover, according to the least squares method, the variance of residuals must be constant over time. However, the variance may be time dependent. In these conditions, the least squares estimates of coefficients are often distorted (see, Hamilton, 2010). Thus, if heteroscedasticity is present, we have to use GARCH models to examine the effect of inflation on nominal stock returns.

Database

To investigate the Fisher effect, I used monthly data of four stock indices of the Bucharest Stock Exchange (BSE) and the Consumer Price Index (CPI). The stock indices are: Bucharest Exchange Trading- Composite Index (BET-C), Bucharest Exchange Trading Index (BET), Bucharest Exchange Trading – Investment Funds Index (BET-FI) and Bucharest Exchange Trading Energy & Related Utilities Index (BET-NG). BET-C is the composite index of BSE market. It is a market capitalization weighted index and reflects the price movements of all companies listed on the BSE regulated market, Ist and IInd category, excepting the five SIFs[6]. BET is the first index developed by BSE and is considered to be the reference index for the BSE market. BET reflects the price movements of the most ten liquid companies listed on the BSE regulated market. BET-FI is the first sectorial index launched by BSE and reflects the price movements of the investment funds (SIFs) traded on the BSE regulated market. BET-NG is a sectorial index and reflects the price movements of the companies traded on the BSE regulated market, which have the main business activity located in the energy sector and the related utilities. Data for composite index (BET-C) are available from April 1998. For the reference index (BET), data are available from September 1997. Further, data for investment fund index (BET-FI) are available from October 2000 and for energy index (BET-NG) from December 2006. As such, the data range from April 1998 to January 2014 for BET-C, from September 1997 to January 2014 for BET, from October 2000 to January 2014 for BET-FI and from December 2006 to January 2014 for BET-NG. The source of closing prices for all indices was the BSE website (www.bvb.ro). The return of stock indices is computed as follow:

$$R_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \quad (4)$$

where R_{it} represent the nominal return of stock index i in month t, P_{it} is the last level of index i in month t and P_{it-1} is the last level of index i in month $t-1$.

The inflation rate is calculated as follow:

$$\pi_t = CPI_t - 100\% \quad (5)$$

where CPI_t is the Consumer Price Index in month t and reflects the price changes from month to month. Data for CPI are available from January 1991 and were obtained from the website of the Romanian Institute of Statistic (www.insse.ro).

[6] Investment funds

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Because I use a regression analysis which employs time series, it is necessary that the variables to be stationary (not contain unit roots). For my purpose, the index returns and the rate of inflation need to be stationary in level. I tested the stationary hypothesis using the Phillips-Perron (PP) (Phillips and Perron, 1988) test. The PP test is implemented with a constant, respectively with a constant and trend. Table 1 presents the results of the PP test and confirm that all the time series do not contain unit roots.

Table 1: PP test results

Variables	Period	Intercept	Intercept and Trend
R_{BET-C}	May 1998 - January 2014	-10.4721***	-10.4427***
R_{BET}	October 1997 - January 2014	-11.5304***	-11.5037***
R_{BET-FI}	November 2000 - January 2014	-11.2753***	-11.5172***
R_{BET-NG}	January 2007 - January 2014	-7.0742***	-7.0568***
π	May 1998 - January 2014	-4.4666***	-7.8955***
	October 1997 - January 2014	-5.3151***	-7.9942***
	November 2000 - January 2014	-5.8017***	-8.0147***
	January 2007 - January 2014	-7.1127***	-7.2799***

Notes: R_{BET-C} represents the monthly nominal return of BET-C index. R_{BET} is the monthly nominal return of BET index. R_{BET-FI} represents the monthly nominal return of BET-FI index. R_{BET-NG} is the monthly nominal return of BET-NG index). π is the monthly rate of inflation. ***, ** and * indicates significance at the 1%, 5% and 10% levels, respectively.

Empirical results

The test of Fisher effect is conducted by means of equation (3). This equation is estimated for each stock index. Based on the Fisher hypothesis, a positive unit coefficient on the rate of inflation is expected. Table 2 presents the results obtained after the estimation of regression between stock index returns and rate of inflation. As I mentioned before, the use of least squares method to estimate the coefficients of equation (3) could be inappropriate if the residuals are autocorrelated and the variance of the residuals changes over time. Indeed, using the Ljung Box Q test, I observed that the residuals are autocorrelated and I identified the presence of heteroscedasticity in the case of all stock indices. To remove the autocorrelation in residuals I included the first lag of the dependent variable. Further, using a GARCH (1, 1) model I observed that the standardised residuals show no remaining heteroscedasticity. The reported Ljung Box Q statistics, in Table 2 (Panel C), indicate that the estimated models perform satisfactorily since there is no evidence of serial correlation or ARCH effects.

Table 2: Stock returns and inflation

	BET-C (composite index)	BET (reference index)	BET-FI (investment fund index)	BET-NG (energy index)
A: Mean equation				
α	0.01 (0.23)	0.01 (0.50)	0.00 (0.99)	0.00 (0.64)
β_i	0.43 (0.46)	1.35 (0.05)**	5.98 (0.05)*	1.52 (0.17)
δ_i	0.25 (0.00)***	0.18 (0.02)**	0.14 (0.16)	0.25 (0.03)**
B: Variance equation				
θ_0	0.00 (0.58)	0.00 (0.16)	0.00 (0.15)	0.00 (0.27)
θ_1	0.23 (0.01)**	0.20 (0.02)**	0.21 (0.03)**	0.35 (0.05)**
θ_2	0.71 (0.00)***	0.74 (0.00)***	0.78 (0.00)***	0.64 (0.00)***
C: Ljung Box test				
$Q(12)$	9.93 (0.62)	10.88 (0.54)	7.68 (0.81)	7.27 (0.84)
$Q(24)$	17.91 (0.81)	18.29 (0.79)	21.63 (0.60)	27.03 (0.30)
$Q^2(12)$	12.21(0.43)	6.94 (0.86)	2.54 (0.99)	17.44 (0.13)
$Q^2(24)$	19.97 (0.70)	16.00 (0.89)	10.96 (0.99)	22.99 (0.52)

Notes: The GARCH (1, 1) model:

$$R_{it} = \alpha + \beta_i \pi_t + \delta_i R_{it-1} + \varepsilon_{it},$$

$$\varepsilon_{it} \sim N(0, h_{it}),$$

$$h_{it} = \theta_0 + \theta_1 \varepsilon_{it-1}^2 + \theta_2 h_{it-1},$$

where R_{it} represents the nominal return of stock index i in month t (i =BET-C, BET, BET-FI, BET-NG), π_t is the rate of inflation in month t, R_{it-1} is the first lag of the dependent variable and h_{it} is the variance of residuals in month t. BET-C is the composite index of the Bucharest Stock Exchange (BSE). BET is the reference index of the BSE and reflects the price changes of the most ten liquid stocks. BET-FI is a sectorial index that reflects the price movements of the investment funds. BET-NG is a sectorial index that reflects the price movements of the companies which have the main business activity located in the energy sector and the related utilities. The sample period for BET-C returns runs from May 1998 to January 2014 and for BET the data begin in October 1997 and end in January 2014. Also, the data for BET-FI returns begin in November 2000 and end in January 2014 and the sample period for BET-NG returns is from January 2007 to January 2014. P-values are in parentheses. Since the standardised residuals are not normally distributed I used the procedure of Bollerslev and Wooldridge (1992) to obtained robust standard errors for my estimates. ***, ** and * indicates significance at the 1%, 5% and 10% levels, respectively.

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The results, presented in Table 2 (Panel A), show some interesting implication for the Fisher effect in the case of Romanian stock market. On the one hand, the inflation has no impact on the return of BET-C and BET-NG. On the other hand, the rate of inflation has a positive and significant impact on the return of BET and BET-FI stock index. The results show that a 1% increase in inflation raises BET return by 1.35% and BET-FI return by 5.98%. However, according to the Fisher hypothesis, the coefficient on the rate of inflation should be equal with unity. Testing this hypothesis, I observed that the coefficient on inflation for BET and BET-FI index is not significantly different from unity by means of the Wald test.

These results suggest that Fisher effect holds mainly for the most liquid stocks listed on the Romanian stock market and, also, for the stocks of investment funds. Moreover, some stocks listed on the Romanian market appear to act as a hedging tool against inflation but in the same time other stocks do not seem to provide a shelter against rising consumer prices.

1. Conclusions

To the best of my knowledge, this is the first paper that investigates the Fisher effect in the case of Romanian stock market. According to the Fisher effect, the expected nominal stock returns should move one to one with the expected rate of inflation.

In this regard, I examine the relationship between nominal returns of four stock indices and inflation rate. The results show that the effect of inflation on the nominal return of composite index (BET-C) and energy index (BET-NG) is nonexistent. On the other hand, the impact of inflation on the nominal return of the index that reflects the price movements of the most ten liquid companies listed on the Romanian stock market (BET) and on the nominal return of the investment funds index (BET-FI) is positive. Also, the estimated coefficients of inflation are not significantly different from unity. Therefore, the Fisher effect holds mainly for the most liquid stocks listed on the Romanian stock market and also for the investment fund sector. It appears that the most liquid stocks and the investment fund sector act as a hedge against inflation.

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