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Interest rates, inflation, and stock prices: the case of the Athens Stock Exchange

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Abstract

This study undertakes an empirical effort to investigate the relationship between stock prices, inflation, and interest rates in Greece over the period 1988–1999. Considering that most of the period under examination has been characterised by declining inflation as well as interest rates, it is crucial for an investor to know whether stock prices follow inflation rather than interest rate movements. The results provide evidence in favour of the stock prices–inflation relationship.

JEL classification: G10; E31

Keywords: Interest rates; Inflation; Stock prices; Greece

1. Introduction

Shiller (1988) argues that changes in stock prices reflect changes in investor's expectations about future values of certain economic variables that affect directly the pricing of equities. Therefore, it seems worth undertaking an empirical effort that examines whether certain macroeconomic fundamentals are capable of driving the behaviour of financial aggregates.

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In financial theory it has been argued that both inflation and nominal interest rates seem to substantially affect the behaviour of financial aggregates, such as stock prices. At the same time, there have been different arguments on the manner that the two variables have an impact on stock prices. However, it has been extremely difficult for researchers to identify whether changes in stock prices may be attributed to either nominal interest rate changes or inflation movements or both. According to economic theory, nominal interest rate movements maintain a close track to inflation movements (*the Fisher effect*) in order to compensate lenders for changes in the real value of nominal interest rate payments. However, nominal interest rates do not move exactly with inflation (on a one for one response) because they reflect expectations of future inflation rather than current inflation.

The relationship between stock prices and nominal interest rates reflects the ability of an investor to change the structure of her portfolio between stocks and bonds. In particular, an interest rate increase (decrease) motivates our representative investor to change the structure of her portfolio in favour (against) of bonds. As a result, stock prices are expected to decrease (increase), since a decline in interest rates leads to an increase in the present value of future dividends (Hashemzadeh & Taylor, 1988). Malkiel (1982) and Modigliani and Cohn (1979) argue that interest rates seem to be one of the most important determinants of stock prices. However, there have been certain empirical attempts that provide evidence in favour of a positive rather than a negative relationship between interest rates and stock prices. Asprem (1989) argues that such a positive relationship is present in small illiquid and financial markets. The Athens Stock Exchange (ASE) can be characterised as a low liquidity financial market. In addition, Shiller and Beltratti (1992) argue in favour of such a positive relationship on the grounds that changes in interest rates could carry information about certain changes in future fundamentals, such as, dividends. Finally, Barsky (1989) explains the positive relationship between interest rates and stock prices in terms of a changing risk premium. For instance, a drop in interest rates could be the result of increased risk or/and precautionary saving as investors substitute away from risky assets, e.g., stocks, into less risky assets, e.g., bonds or real estate.

By contrast, inflation seems to affect stock prices first, through the impact on future earnings and second, through the manner that investors discount future earnings. According to the first channel, inflation reduces investments and, thus, economic growth and future earnings (Clark, 1993). Huizinga (1993), and Zion, Spiegel, and Yagil (1993), argue that inflation leads to lower stability of relative prices, resulting in higher uncertainty of investment and production. In other words, there exists a negative effect between inflation uncertainty and real economic activity (*the Friedman effect*, Friedman, 1977), which in turn, implies a negative association between inflation and stock prices. Inflation uncertainty leads to higher risks associated with the investment and production processes of the corporate sector. This uncertainty implies a non-optimal allocation of investment that leads to a stock price decline (Schwert, 1981). At the same time, higher inflation

tends to lead to higher taxes on corporate earnings (Feldstein & Summers, 1979) as well as to higher taxes paid by the shareholders.

According to the second channel, the discount factor consists of two components, the risk-free component and the risk premium component. The latter is due to the fact that investors require a positive return on their capital plus a risk premium to compensate them for the risk they undertake by investing in stocks. If inflation leads to a higher discount rate, then the present value of future earnings decline and stock prices are expected to decline as well (Malkiel, 1982).

The objective of this study is to identify for the first time whether it is inflation or interest rates that seem to influence the behaviour of stock prices in an economy with high inflationary pressures, such as the Greek economy. Consumer prices as well as interest rates have been constantly declining in most of the period under investigation, reflecting the attempts of the Greek economic authorities to satisfy two of the main criteria set by the Maastricht Treaty, while stock prices have been constantly increasing. To attribute the increase in stock prices to either inflation or to interest rates or to both seems to be crucial for investors in the ASE, considering the alternative and contradictory theories that have been put forward to explain the relationship between stock prices and interest rates.

2. Empirical analysis

The empirical analysis is carried out using monthly data on stock prices (S) measured by the ASE stock price general index (1990 = 100), prices (P) defined by the consumer price index (1990 = 100), income (Y) measured by the industrial production index (1990 = 100), and 3-month yields on treasury-bills (R). The availability of interest rate data selected for investigation is the period 1988–1996. Data on stock prices were obtained from the Research Department of the ASE, while commodity prices were obtained from various issues of the OECD Main Economic Indicators. Data on nominal interest rates were obtained from the Research Department of the Bank of Greece. Throughout the paper, lower case letters denote variables expressed in logarithms.

Appropriate tests have been developed by Dickey and Fuller (1981) to test whether a time series has a unit root. The results, reported in Table 1, indicated that the variables under study, e.g., s, Δp, and R, were $I(1)$ processes.

Table 2 reports results from regressing stock prices on inflation, a 3-month treasury-bill rate, and income strength, i.e., the deviation of output growth from its trend. Economic strength is used as a proxy for economic growth. The output trend (YTREND) is constructed using the Hodrick–Prescott filter. Unit root tests showed that the output trend variable is an $I(0)$ process. To avoid endogeneity problems, the instrumental variables (IV) methodology was used. As instruments we have used the second and the third lag of Δs, the second, the third, and the fourth lag of $\Delta^2 p$, and the third and the fourth lag of ΔR. Estimation results are shown.

Table 1
Unit root tests

Variable	ADF levels	ADF first differences
YTREND	−4.89* (5)	
Δp	−0.44 (6)	−5.21* (5)
s	−1.96 (7)	−4.30* (6)
R	−2.05 (6)	−5.78* (4)

The regression involved is:

$$\text{in levels}: \Delta X_t = a_1 + a_2\text{TIME} + a_3 X_{t-1} + \sum_{i=1}^{q} b_i \Delta X_{t-i} + u_{1t}$$

$$\text{in first difference}: \Delta^2 X_t = a_1 + a_2\text{TIME} + a_3 \Delta X_{t-1} + \sum_{i=1}^{W} b_i \Delta^2 X_{t-i} + u_{2t}$$

with TIME being a time variable and u_{1t} and u_{2t} random terms. Numbers in parentheses denote the number of lags that ensure white noise residuals. They were determined through the Akaike criterion.

* Denotes significance at 5%.

All insignificant lags were omitted. Sargan's instrument validity test accepted the null hypothesis of independence of the instruments. The estimated equation satisfied certain econometric criteria, namely absence of serial correlation (LM), absence of functional misspecification (RESET), presence of normality (NO), and

Table 2
IV regression results

	Coefficients	t statistics
a_0	0.0131	2.96*
a_1	0.3857	3.03*
a_2	−0.5078	−4.06*
a_3	−0.0993	−3.79*
a_4	0.1031	3.75*
a_5	0.0025	1.04
Adj R^2	0.68	
$a_2 + a_3$	0.6071	3.49*
LM	20.33 (.06)	
RESET	2.29 (.13)	
NO	1.62 (.45)	
HE	1.61 (.47)	
ARCH	2.50 (.12)	
Sargan's test	1.98 (.55)	

$\Delta^2 p$ denotes the growth of inflation. Numbers in parentheses denote P values. LM, RESET, NO, HE, and ARCH denote serial correlation, functional form, normality, heteroskedasticity, and ARCH tests, respectively. Finally, Sargan's test investigate the validity of the instruments used.

$$\Delta s = a_0 + a_1 \Delta s(-1) + a_2 \Delta^2 p + a_3 \Delta^2 p(-1) + a_4 \text{YTREND} + a_5 \Delta R(-2)$$

Instrument: $\Delta s\,(-2)$, $\Delta s\,(-3)$, $\Delta^2 p\,(-2)$, $\Delta^2 p\,(-3)$, $\Delta^2 p\,(-4)$, $\Delta R\,(-3)$, $\Delta R\,(-4)$.

* Denotes statistical significance at 5%.

absence of heteroskedasticity and ARCH effects, i.e., HE and ARCH, respectively. The sign of the coefficient on the 3-month yield is positive, but statistically insignificant. By contrast, the signs of both inflation coefficients as well as their sum are negative and statistically significant. That is, although interest rates are positively correlated to stock prices—a result similar to that reached by Asprem (1989), Barsky (1989), and Shiller and Beltratti (1992), this relationship is shown to be statistically insignificant. However, stock prices are reported to follow inflation movements. The results are similar to those reached by Blanchard (1993) for US stock prices. The decline in inflation (to the lowest point over the last 25 years in Greek economic history) indicates that risk premiums have decreased with inflation and, thus, stocks have become less risky assets. As a result, investors have responded by increasing their thesis in the stock market and, therefore, contributing to higher stock prices.

3. Conclusions

This study presented empirical evidence that stock prices in ASE follow inflation rather than nominal interest rate movements, despite the close relationship that the literature attributes between inflation and nominal interest rates. The results demonstrate that the continuous reduction of inflation in Greece is expected to contribute to a more substantial increase in stock prices and, thus, higher economic growth, since lower inflation implies lower inflation uncertainty and lower risking of the Greek economy.

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