The Orthogonal Response of Stock Returns to Dividend Yield and Price-to-Earnings Innovations

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Abstract

This study investigates how returns on the S&P 500 index respond orthogonally to dividend yield and price-to-earnings innovations.The unrestricted vector autoregressive (VAR) analysis of monthly data from 1871 to 2012 shows that the response of returns on the S&P 500 index to dividend yield innovation, based on the 12-month horizon, is positive in the first three months, negative in the 4th through 7th months and positive again after that. The returns on the S&P 500 index are negative in the first five months following price-to-earnings shock. The results of the Granger causality tests indicate that dividend yield and price-to-earnings cause the movement in stock returns.

Keywords: S&P 500 returns, Dividend yield, Price-to-earnings ratio

1. Introduction

Dividend yield and price-to-earnings ratio, among other factors, have been shown to have a predictive power in explaining stock returns. Many studies have reported a positive association between stock returns and dividend yields despite the claim made by Black and Scholes (1974) and Miller and Scholes (1982) that there is no relation between equilibrium returns and dividend yields. Blume (1980) empirically documents a positive and significant relationship between stock returns and dividend yields.In addition, Litzenberger and Ramaswamy (1982) and Morgan (1982) provide evidence of a positive and nonlinear relationship between stock returns and expected dividend yields.Kiem (1985) reports the association between stock returns and dividend yields; the relationship is due to a nonlinear association between returns in the month of January and dividend yields.Campbell and Shiller (1988) examine the relationship between dividend yields and stock returns in the introduction of the dividend yield model.Fama and French (1988) show that stock returns can be predicted by dividend yields.Hodrick (1992) reports that changes in dividend yields significantly forecast expected stock returns. The relationship between returns and dividend yield is also documented in a study conducted by Naranjo, Nimalendran and Ryngaert (1998). Jiang and Lee (2007) also show excess stock returns can be predicted by a linear combination of log book-to-market ratio and log dividend yields. The relationship between stock returns and price-to-earning (P/E) ratio has also been studied. Basu (1977) empirically shows that lower P/E stock portfolios generate higher risk-adjusted returns than portfolios of high P/E stocks. A similar finding is reported in a study conducted by Peavy and Goodman (1983). Campbell and Shiller (1998) show the increase in P/E ratio are followed by the lower growth in stock price.

Due to the empirical establishment in the literature that stock returns can be predicted by dividend yield and price-to-earnings among many other factors, the current study is to add to current discussion by investigating how returns on the S&P 500 index respond orthogonally to dividend yield and price-to-earning innovations and to determine if dividend yield and price-to-earning cause the movement in stock returns. This study is important because it contributes to furthering the understanding of the dynamic effects of dividend yields and price-to-earnings on stock returns. The strength of this study is a richer dataset spanning from 1871 to 2012 and the use of vector autoregressive framework to forecast the behavior of future stock returns following dividend yield and price-to-earnings shocks.

2. Method and Data

The paper investigates how returns on the S&P 500 index respond orthogonally to dividend yield and price-to-earning innovations and to conduct a causality test among these variables.The vector autoregressive (VAR) analysis, a system of equations (1), (2), (3), is employed to investigate how stock returns respond to dividend yield

and price-to-earnings shocks; then the Granger Causality Walt Tests are conducted to determine the causal linkage among these variables. In addition, based on the results of the Augmented Dickey-Fuller and Phillips-Perron unit root tests reported in Table 1, the variables included in the VAR do not have unit roots, so they are stationary. The monthly data spanning from 1871 to 2012 of the total returns on the S&P 500 and dividend yield and price-to-earnings ratio of the S&P 500 are obtained from the Global Financial Data. "All earnings data are based upon the trailing 12 months. The monthly file takes the reported earnings for each quarter then calculates the P/E based upon the closing price for each month. Since it takes a few months to get the earnings figures for the previous quarter, this data is only available a few months after the fact," Global Financial Data, 2012.

$$R_t = \alpha + \sum_{i=1}^{n} \lambda_i R_{t-i} + \sum_{i=1}^{n} \delta_i DY_{t-i} + \sum_{i=1}^{n} \varphi_i PE_{t-i} + \varepsilon_t \quad (1)$$

$$DY_t = \alpha + \sum_{i=1}^{n} \lambda_i R_{t-i} + \sum_{i=1}^{n} \delta_i DY_{t-i} + \sum_{i=1}^{n} \varphi_i PE_{t-i} + \varepsilon_t \quad (2)$$

$$PE_t = \alpha + \sum_{i=1}^{n} \lambda_i R_{t-i} + \sum_{i=1}^{n} \delta_i DY_{t-i} + \sum_{i=1}^{n} \varphi_i PE_{t-i} + \varepsilon_t \quad (3)$$

Where:

R_t = total return on the S&P 500 index in month t

R_{t-i} = total return on the S&P 500 index in month t-i

DY_t = dividend yield of the S&P 500 index in month t

DY_{t-i} = dividend yield of the S&P 500 index in month t-i

PE_t = price-to-earnings ratio of the S&P 500 index in month t

PE_t = price-to-earnings ratio of the S&P 500 index in month t-i

3. Results

Descriptive statistics and correlations of the variables are reported in Table 2 and 3. Before running the vector autoregressive analysis, the Schwarz's Bayesian information criterion (SBIC), the Akaike's information criterion (AIC), and the Hannan and Quinn information criterion (HQIC) tests are conducted to determine the appropriate length of lags to be included.Ten lags are suggested by the tests. First of all, the response of returns on the S&P 500 index to dividend yield innovation, based on the 12-month horizon, is positive in the first three months, negative in the 4th through 7th months and positive again after that (See Figure 4 and Table 4). The returns on the S&P 500 index are negative in the first five months following price-to-earning shock (See Figure 5 and Table 5). The results of the Granger causality tests reported in Table 6 indicate that dividend yield and price-to-earnings cause the movement in stock returns. Based on the stability condition check (not reported here), the VAR estimates satisfy stability condition because all the eigenvalues lie inside the unit circle.

4. Conclusion

This study investigates how returns on the S&P 500 index respond orthogonally to dividend yield and price-to-earning innovations. The unrestricted vector autoregressive (VAR) analysis of monthly data from 1871 to 2012 shows that the response of returns on the S&P 500 index to dividend yield innovation, based on the 12-month horizon, is positive in the first three months, negative in the 4th through 7th months and positive again after that. The returns on the S&P 500 index are negative in the first five months following price-to-earning shock. The Granger causality tests indicate a causal link between returns on the S&P 500 index, dividend yield and price-to-earnings. This study is important because it contributes to furthering the understanding of the dynamic effects of dividend yields and price-to-earnings on stock returns. This study uses a richer dataset spanning from 1871 to 2012 and employs the vector autoregressive framework to forecast the behavior of future stock returns following dividend yield and price-to-earnings shocks.

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Table 1. Augmented Dickey-Fuller and Phillips-Perron Unit Root Tests

	Augmented Dickey-Fuller Unit Root Test (10 Lags)			Phillips-Perron Unit Root Test		
Variable	R	PE	DY	R	PE	DY
Z(t)	-11.11	-6.17	-4.74	-36.545	-7.722	-42.659
Z(rho)				-1449.18	-116.741	-4.631
MacKinnon p-value	0.0000	0.0000	0.0006	0.0000	0.0000	0.0009
Trend Term Included	NO	NO	YES	NO	NO	YES
Unit Root	NO	NO	NO	NO	NO	NO

Table 2. Descriptive Statistics

	R	**DY**	**PE**
Number of Observations	1699	1699	1699
Mean	0.81	4.27	15.98
Maximum	42.89	9.63	122.41
Minimum	-29.63	1.08	5.21
Standard Deviation	4.81	1.51	8.93
Skewness	0.34	0.25	6.43
Kurtosis	13.55	2.95	67.38

Table 3. Correlations

	R	DY	PE
R	1.000		
DIV	-0.083	1.000	
PE	0.013	-0.440	1.000

Table 4. The Orthogonal Impulse Response Function (OIRF) of the Returns on the S&P 500 Index to Dividend Yield Shock

Horizon (In Month)	OIRF	Standard Error
1	0.064	0.113
2	0.232	0.114
3	0.108	0.113
4	-0.083	0.114
5	-0.212	0.113
6	-0.029	0.114
7	-0.144	0.114
8	0.063	0.114
9	0.201	0.113
10	0.029	0.032
11	0.038	0.032
12	0.017	0.031

Table 5. The Orthogonal Impulse Response Function (OIRF) of the Returns on the S&P 500 Index to Price-to-Earnings Shock

Horizon (In Month)	OIRF	Standard Error
1	-0.116	0.113
2	-0.025	0.113
3	-0.261	0.113
4	-0.291	0.108
5	0.057	0.108
6	0.314	0.108
7	0.126	0.093
8	0.006	0.093
9	-0.093	0.092
10	0.130	0.064
11	-0.019	0.062
12	-0.153	0.062

Table 6. Granger Causality Walt Tests

Regressors	Dependent Variables		
	R	***DY***	**PE**
R	0.001	0.000	0.000
DY	0.050	0.000	0.003
PE	0.011	0.067	0.000

The p-values for F-statistics for joint tests on lags are reported here

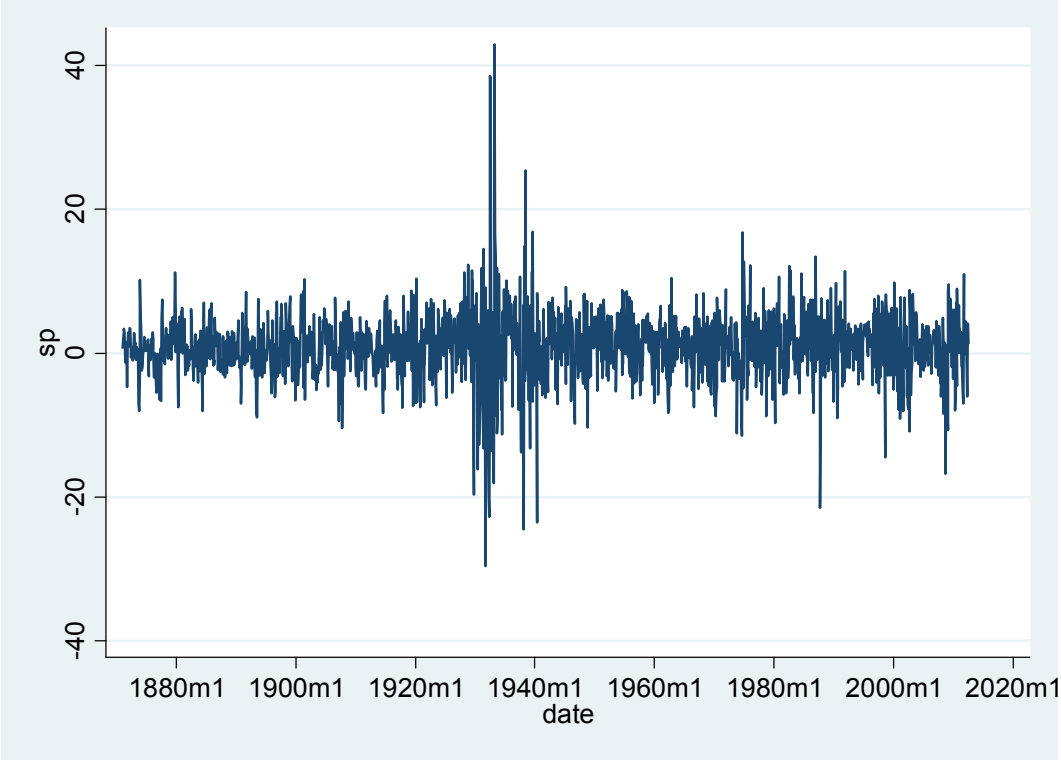

Figure 1. Returns on the S&P 500 Index

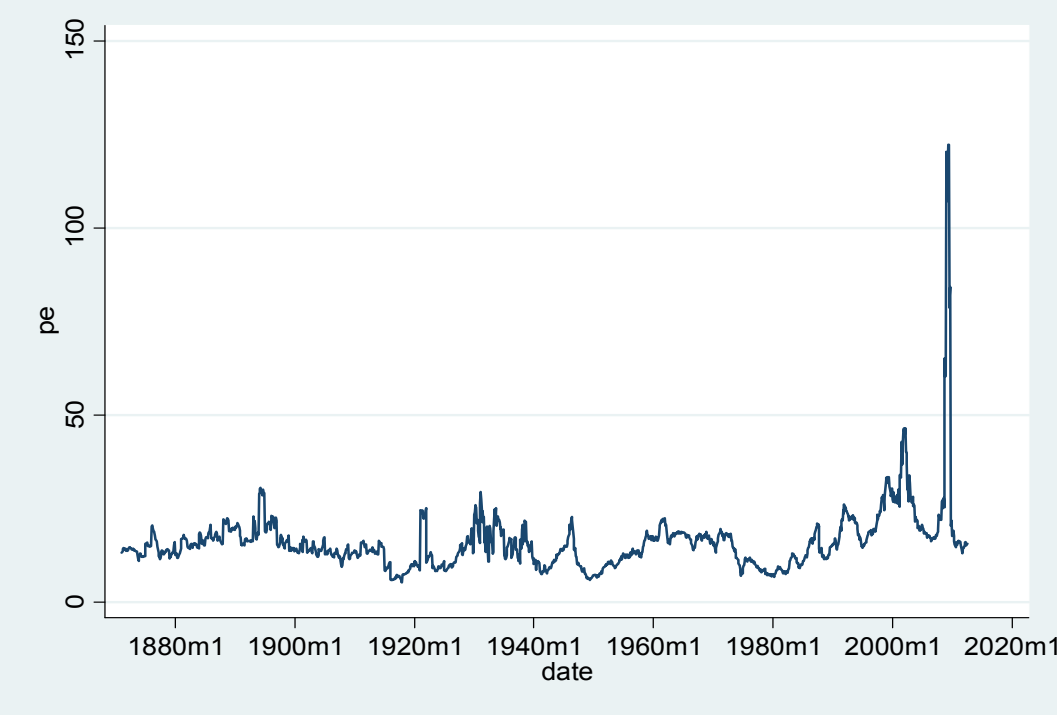

Figure 2.S&P 500 Price-Earnings Ratio

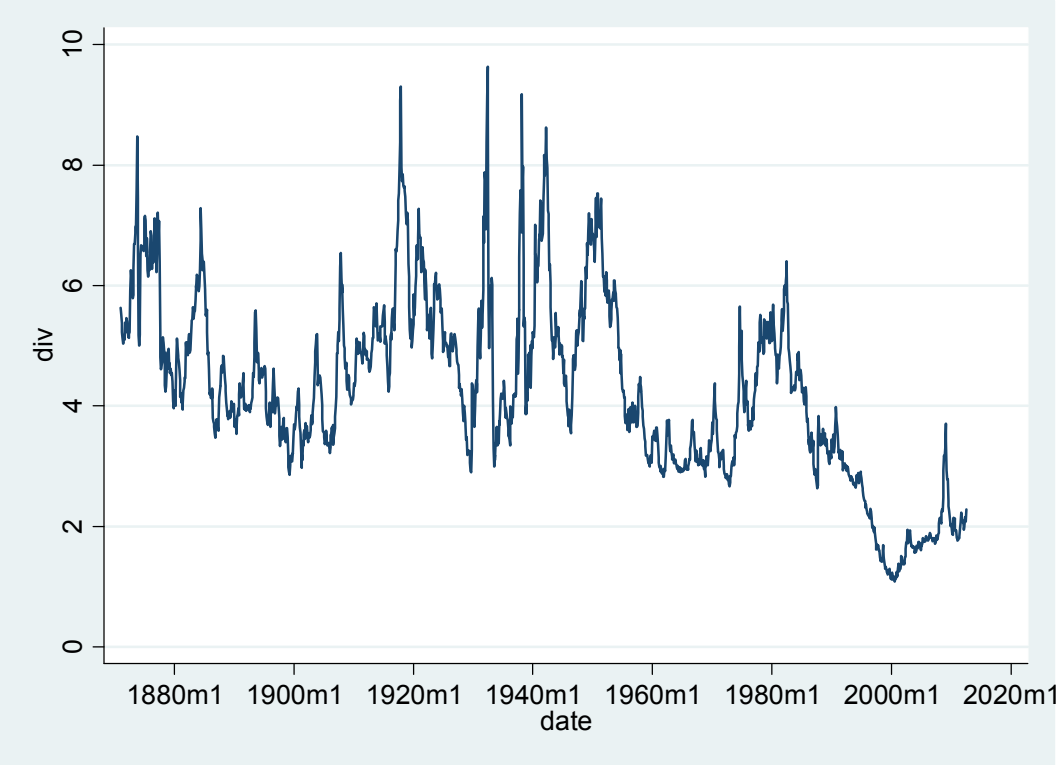

Figure 3.S&P 500 Dividend Yield

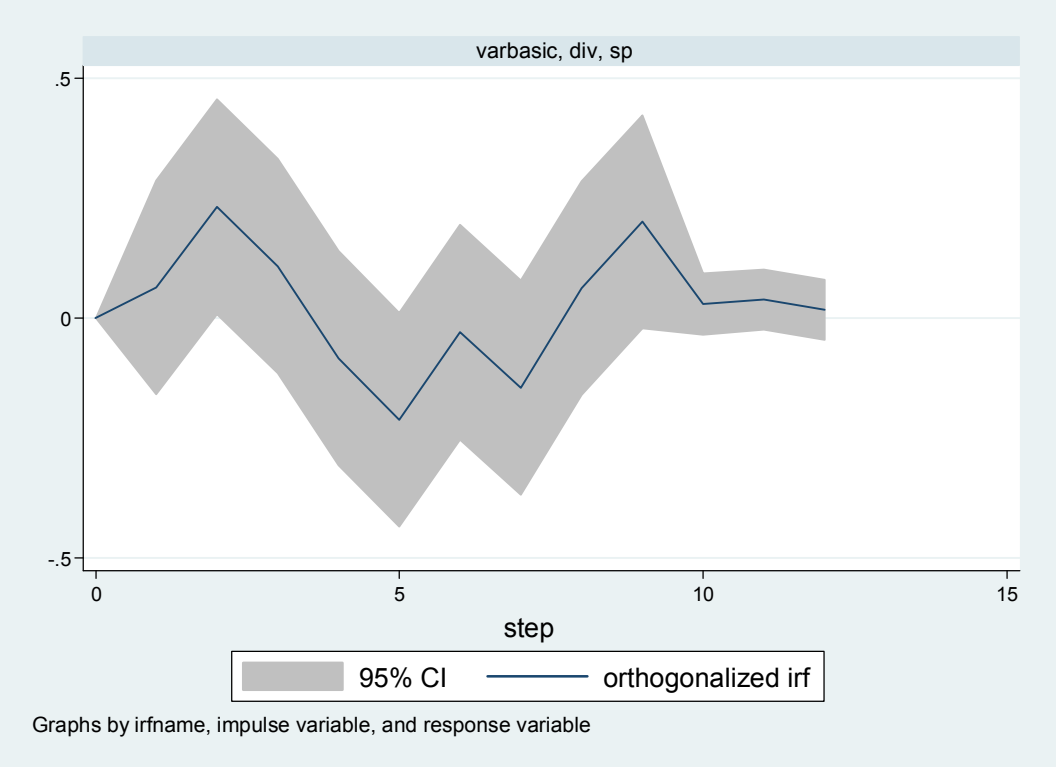

Figure 4. The Orthogonal Impulse Response Function (OIRF) of the Returns on the S&P 500 Index to Dividend Yield Shock

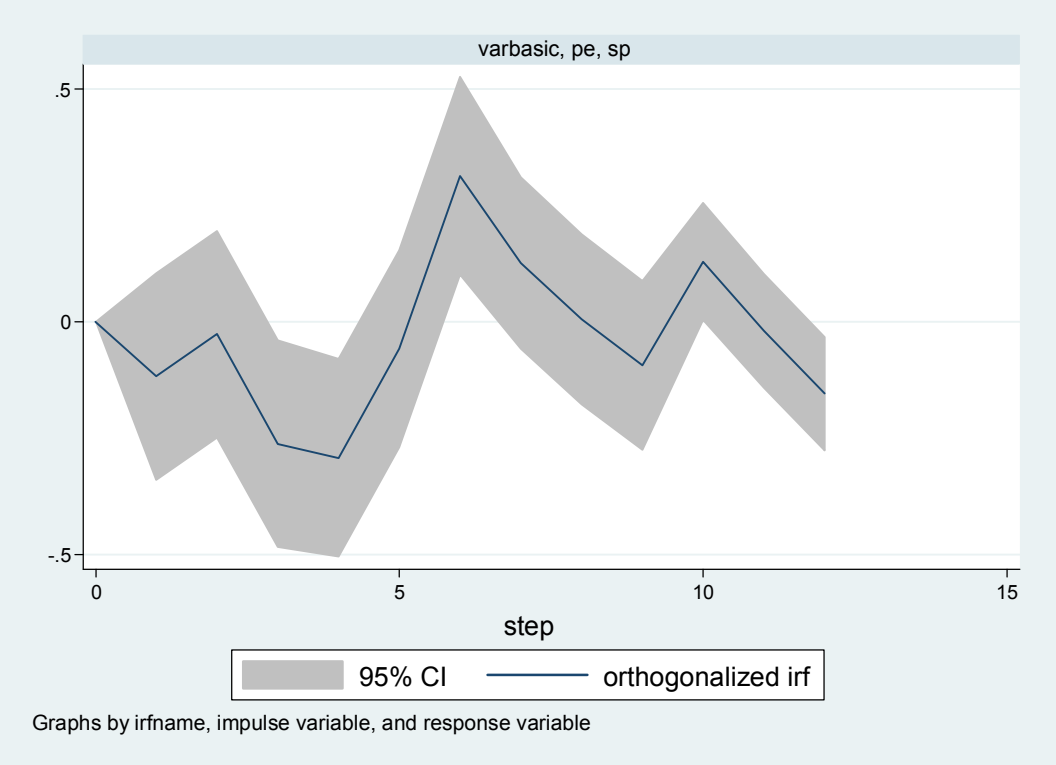

Figure 5. The Orthogonal Impulse Response Function (OIRF) of the Returns on the S&P 500 Index to Price-to-Earning Shock