Stock Prices And Inflation: Evidence From 12 Developed & Emerging Economies

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ABSTRACT

Using a dynamic model that allows direct estimation of short and long-run impacts of changes in goods prices on stock prices, we find that the long-run Fisher elasticities of stock prices with respect to goods prices exceed unity in 12 developed and emerging economies. Our results provide significant support for Darby's tax version of the Fisher effect. We also find that inflation and stock prices are negatively related in the short-run.

Keywords: Stock prices, Inflation, Investments

INTRODUCTION

Stocks represent ownership of real assets whose real value is assumed to be independent of the rate of inflation. Therefore, changes in the level of prices should be accompanied by an equal change in the nominal rate of return in equity.[1] However, many empirical studies have reported an inverse relationship between inflation and stock returns.[2] Fama (1981) argues that the negative stock return to inflation relationship is induced by negative relations between inflation and real activity. Gallagher and Taylor (2002) provide support for Fama's proxy effect hypothesis.

Given that the relationship between stock prices and goods prices is a long-run proposition, it should be tested within a dynamic framework which allows direct estimation of the long-run as well as short-run response coefficients. This is accomplished by modelling within an error correction framework that allows isolation of the long-run coefficient from the coefficients that are short-run in nature.

THE MODEL

The relationship between stock prices and goods prices can be expressed as:

$$S_t = \alpha + \beta\, E(P_t/\varphi_{t-1}) + \varepsilon_t \quad (1)$$

Where S_t and P_t are nominal stock and goods prices at time t, respectively. α is the expected real rate of stock prices. $E(P_t/\varphi_{t-1})$ is the price expectation based on the information set φ_{t-1} available at t-1, and ε_t is the error term at time t.

To allow for the presence of lags in the adjustment of the stock prices to changes in the expected level of prices, we respecify equation 1 as follows:

$$S_t = \alpha + \sum_{i=1}^{k} \xi_i S_{t-i} + \beta E(P/\varphi_{t-1}) + v_t \quad (2)$$

To estimate Equation 2, we need observations on the expected level of prices, which although not observable, can be systematically related to the past level of prices (Lahiri, 1976). Summers (1986, pp.83-85)

[1] Bodie (1976, p.460).
[2] See for example Kurz-Kim (2009), Anderson et al (2008) and Al-Rjoub (2005).

showed that if we assume a learning mechanism on the part of the economic agents, their expectations , which should satisfy a minimum rationality requirement, will have the property best approximated as weighted averages of past data with weights adding up to unity. Using the distributed lag of past prices as a proxy for the expected level of prices, Equation 2 can be written as follows:

$$S_t = \alpha + \sum_{i=1}^{k} \xi_i S_{t-i} + \sum_{i=0}^{m} \eta_i P_t + \Omega_t \tag{3}$$

If the coefficients of the lagged variables in Equation 3 are all set equal to zero, we obtain the conventional model estimated under the implicit assumption of a steady-state equilibrium. Therein all expectations are realized and the stock prices adjust fully for the changes in the price levels. Based on the model of Equation 3, the long-run effect of goods prices on stock prices can be calculated as follows:

$$\theta = (\sum_{i=0}^{m} \eta_i) / (1 - \sum_{i=1}^{k} \xi_i) \tag{4}$$

To estimate the long-run coefficient θ, we first have to estimate Equation 3 and then calculate θ and its variance. It would be useful if we could estimate the long-run coefficient θ and its variance directly. This can be done by transforming Equation 3 into a model that allows direct estimation of long and short-run elasticities of stock prices with respect to goods prices.[3] Without imposing any restriction, Equation 3 can be transformed into the following:

$$\Delta S_i = \alpha - \sum_{i=1}^{k-1} (\sum_{j=i+1}^{k} \xi_j) \Delta S_{t-i} + \eta_0 \Delta P_t - \sum_{i=1}^{m-1} (\sum_{j=i+1}^{m} \eta_j) \Delta P_{t-i} - (1 - \sum_{i=1}^{k} \xi_i)(S_{t-1} - \theta P_{t-1}) + \Omega_t \tag{5}$$

Equation 5 is an extended version of the error correction model popularized by Hendry (1986), where the error correction term ($S_{t-1} - \theta P_{t-1}$), measures the long-run impact of price movements on stock prices. It is the vector of deviations from the long-run relationship between stock prices and goods prices. The coefficient θ in this equation shows the long-run impact of changes in goods prices on stock prices, otherwise known as the Fisher coefficient. The coefficient of ΔP_t measures the short-run impact of inflation on stock returns.

THE DATA AND ESTIMATION RESULT

The data used in this paper consist of monthly stock price indices and consumer price indices covering the sample period 1970:1-2007:12 for six developed economies, namely Canada, United States, United Kingdom, Italy, Germany and Japan. The data is obtained from the Organization for Economic Co-operation and Development (OECD) statistics portal. All variables are transformed into natural logarithms.

To estimate Equation 5, we should initially specify the lag length for the first differenced variables. For this, we first over-parameterized the model and then used a series of F-tests along with the Akaike's Final Prediction Error as our selection criterion. Tables 1 and 2 report the result of maximum likelihood (ML) estimation of Equation 5. The starting values for the ML iterations were set equal to the estimated parameters from the OLS regression of the unrestricted model.

To ensure the validity of the estimated results for statistical inference, the estimated models were subjected to a series of diagnostic tests. The Augmented Dickey-Fuller test is used to ascertain the presence of a unit root in the residuals. This would occur if S and P are non-stationary and not co-integrated. In this case, the Durbin Watson statistics would also be very low suggesting the presence of non-stationary residuals.

[3] Other transformations for estimating long-run coefficients are suggested by Wickens and Breusch (1988).

Table 1: ML Estimates of Model 5 for Developed Economies

	CANADA	**US**	**UK**	**JAPAN**	**GERMANY**	**ITALY**
CONSTANT	-0.0146 (-0.5377)	-0.0286 (-1.2512)	-0.0405 (-2.1304)	0.0052 (0.1427)	-0.12614 (-2.2287)	-0.0225 (-1.2320)
ΔS_{t-1}	0.1043 (2.1032)	0.2550 (5.4082)	0.3366 (7.2054)	0.3194 (7.2906)	0.0696 (1.4859)	0.2822 (6.1057)
ΔS_{t-2}	-0.0774 (-1.5030)	-0.1017 (-2.0693)	-0.1184 (-2.556)			-0.0903 (-1.8820)
ΔS_{t-3}	0.0508 (0.9635)					0.1411 (3.0550)
ΔP_t	-0.4762 (-0.8195)	-0.7869 (-1.5048)	0.1966 (0.5259)	-0.0607 (-0.1931)	-0.2516 (-0.3192)	0.5265 (0.8172)
ΔP_{t-1}	-0.3702 (-0.6268)	-1.2519 (-2.3347)	0.3017 (0.8185)	-0.3376 (-1.0724)		-1.2882 (-2.0018)
ΔP_{t-2}	0.39371 (0.6842)	-0.1993 (-0.3739)	-0.7002 (-1.8570)			0.7518 (1.1889)
ΔP_{t-3}	-1.2352 (-2.1140)					-0.9069 (-1.4211)
$S_{t-1} - \Theta P_{t-1}$	-0.0172 (-2.2323)	-0.0123 (-2.8455)	-0.0171 (-2.9157)	-0.0100 (-1.9824)	-0.0187 (-2.4550)	-0.0206 (-3.2024)
Θ	1.1984 (4.0787)	1.6074 (5.4337)	1.525 (7.1253)	0.9421 (2.1276)	2.4961 (5.3480)	1.2304 (6.1181)
H_0: $\Theta = 1$	0.67	2.05	2.45	0.13	3.21	1.14
DW	2.0175	1.9889	1.9619	1.9862	2.0082	1.9870
R^2	0.379	0.2049	0.2290	0.1227	0.381	0.2206
ADF	-21.39	-21.11	-20.85	-20.98	-21.28	-21.05

Table 2: ML Estimates of Model 5 for Emerging Economies

	INDIA	**CHINA**	**BRAZIL**	**MEXICO**	**S. AFRICA**	**RUSSIA**
CONSTANT	-0.0511 (-1.364)	0.2329 (0.1292)	0.0105 (0.1848)	-0.0571 (-2.2849)	0.0010 (0.0988)	-0.5169 (-3.5784)
ΔS_{t-1}	0.3370 (7.148)	0.1419 (1.4818)	0.0034 (0.0443)	0.2701 (5.8230)	0.3452 (7.4544)	0.1886 (2.2751)
ΔS_{t-2}	-0.0638 (-1.312)		-0.0168 (-0.2227)	-0.1054 (-2.0336)	-0.1312 (-2.7929)	0.0564 (0.6965)
ΔP_t	-0.5571 (-1.721)	3.3896 (2.7558)	0.3450 (2.5062)	0.0605 (0.5698)	0.0864 (0.2589)	0.5954 (1.8405)
ΔP_{t-1}	-0.3263 (-0.9045)	1.2133 (0.9346)	0.1648 (1.2991)	0.30118 (2.7384)	-0.2431 (-0.7327)	-0.5334 (-1.6147)
ΔP_{t-2}	0.7367 (2.282)		0.5005 (4.4057)	-0.1129 (-1.0237)	-0.53371 (-1.6103)	1.4846 (4.8756)
$S_{t-1} - \Theta P_{t-1}$	-0.0211 (-2.781)	-0.0046 (-0.1997)	-0.0122 (-0.6748)	-0.0305 (-3.3158)	-0.0198 (-2.0550)	-0.0541 (-2.2325)
Θ	2.1426 (6.5405)	9.2659 (6.286)	0.8148 (0.8397)	1.3908 (21.151)	1.0221 (9.7935)	2.7309 (5.1955)
H_0: $\theta=1$	3.4879	5.6314	0.1669	5.7959	0.2058	2.9950
DW	2.010	1.9985	1.9415	1.9908	1.9843	1.8865
R^2	0.1260	0.1005	0.4658	0.1282	0.1226	0.3565
DF	-21.23	-10.17	-13.56	-19.62	-21.07	-10.85

ADF tests reported in the last row of Table 1 clearly reject the presence of non-stationary residuals. Durbin Watson statistics suggest the absence of autocorrelation in the residuals. Tables 1 and 2 show that the long-run elasticities are significantly different from zero for all countries except Brazil. The coefficient of adjustment ($S_{t-1} - \Theta P_{t-1}$) have the correct sign for all countries suggesting that a part of the disequilibrium between stock prices and goods prices is adjusted for in each period. However, the adjustment coefficients are significantly different from zero for all of the developed countries and four of the emerging economies namely India, Mexico, S. Africa and

Russia. We have also tested the hypothesis H_0: $\theta = 1$ against the alternative of θ being different from unity. Results are shown in the row labelled H_0: $\theta = 1$. The results suggest that the hypothesis indicating that the long-run coefficient equals unity cannot be rejected for Canada, Japan, Italy, Brazil and South Africa. The long-run coefficient is significantly greater than unity for US, UK, Germany, India, China, Mexico and Russia. The short-run impact of inflation on stock returns appears to be negative but insignificant in most countries.

CONCLUSION

Are stocks a good hedge against inflation? Using monthly data for 12 developed and emerging economies, we find significant support for the proposition that stocks have been a good hedge against inflation in both developed and emerging economies during the past four decades.

The relationship between stock prices and goods prices is estimated within a dynamic framework that allows direct estimation of long-run elasticities along with short-run impacts of inflation on stock returns. Our results suggest that Fisher elasticities have been significantly greater than unity for the US, UK, Germany, India, China, Mexico and Russia. The short-run impacts of inflation on stock returns appear to be negative but insignificant in most countries.

AUTHOR INFORMATION

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