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Inflation and Investment in the United States

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Introduction

There is a widely held belief that inflation hampers investment and economic growth. The negative relation between inflation and growth of real GDP and the complementary view that there is a negative relation between inflation and investment are key arguments for the dominant macroeconomic policy view that advocates central bankers target inflation at low levels. This macroeconomic policy view, for example, is promoted by Taylor (2001, p. 88) in his modern textbook.

There is a large literature investigating the effects of inflation on the growth rate of real GDP. In most of these studies the cross-section estimation

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approach is employed.[1] In a recent article Ericsson, Irons, and Tryon (2001) has shown that there is a positive cointegration relation between inflation and real GDP in the United States and most of the other G7 countries. The Ericsson *et al.* findings are derived from time-series data and they demand rejection of earlier results obtained from cross-section studies demonstrating a negative relation between inflation and growth of real GDP. Ericsson *et al.* spell out problems and misleading conclusions associated with examining the relation between inflation and the growth of real GDP using cross-section techniques. They discuss why a more general specification, examining the relation between inflation and real GDP using time-series techniques, is preferable. The Ericsson *et al.* article provides strong support for rejecting one of the key arguments of the low-inflation rate targeting view.

Although there are several empirical studies of the relation between inflation and growth of real GDP, studies investigating effects of inflation on capital stock and investment of the United States are rare. A recent contribution to this subject is by Crosby and Otto (2000). Their findings obtained by employing time-series techniques –a structural VAR (Vector Autoregression) modeling approach– and data from thirty-four countries indicate that for most countries, including the United States, there is no significant long-run effect of inflation on capital stock and investment. And, for those countries where there is a significant effect of inflation on capital stock and investment, the relation is positive.

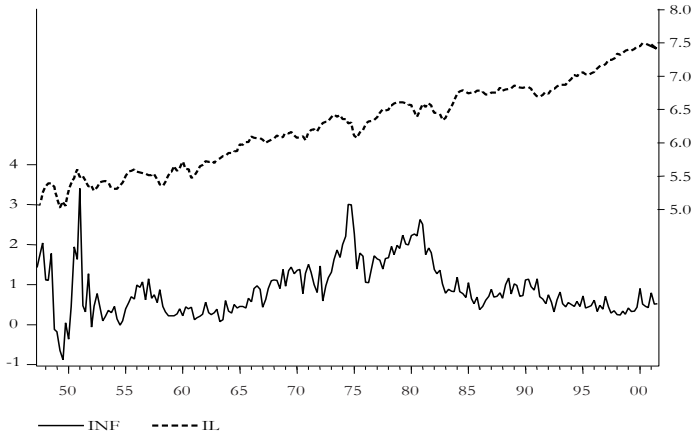
In this article the empirical relation between inflation and investment spending is examined following the cointegration modeling approach of Ericsson *et al.,* using quarterly United States data. The findings detailed below indicate that there is a positive cointegration relation between inflation and investment spending. This result leads to rejection of another key argument of the policy view that advocates central bankers target inflation at low levels and corroborates the findings of Crosby and Otto and is consistent with those of Ericsson *et al.*

[1] Crosby and Otto (2000), and Ericsson, Irons, and Tryon (2001) summarize these studies. In addition, see earlier findings by Atesoglu (1998) and McClain and Nichols (1993-1994).

Inflation and investment

In figure 1, the path of the inflation rate and real investment are depicted.[2] Two observations stand out. First, for most of the sample period starting from the early 1950s through the 1980s inflation and investment in broad trend terms move together. After that period these variables tend to trend in opposite directions. Second, while investment exhibits an upward trend, inflation does not. Ericsson *et al.* make an observation similar to the second point for the relation between inflation and real GDP.

Figure **1**
Inflation and Real Investment



Note: INF is the rate of inflation. IL is real investment spending stated in natural logarithms.

Two observations concerning inflation and investment are important. The first observation suggests that inflation and investment may be cointegrated.[3]

[2] The source of quarterly data is FRED (December, 2002), the Federal Reserve Bank of St. Louis. Empirical measures are: real investment = real Gross Private Domestic Investment; the rate inflation = the rate of change in Gross Domestic Product: Chain-type Price Index (Seasonally Adjusted).

[3] ADF (Augmented Dickey-Fuller) test results, which are not reported here, suggest that IL and INF can both be assumed to contain a unit root.

The second implies that for examining cointegration between these variables a trend variable should be included in the cointegration space to allow for the trend in investment spending. This trend variable provides a balance for the cointegration equation and can be interpreted as representing the long-term effects of variables other than inflation in determining the path of investment.[4]

As a first approximation, the relation between investment and inflation is estimated using the OLS (Ordinary Least Squares).[5] These results are reported in table 1.

TABLE **1**
OLS and Johansen Estimates, Real Investment as the Dependent Variable

	Sample period	*Intercept*	*INF*	*Trend*	R^2	*Error correction term*
OLS	1947:2-2001:3	5.083	0.046	0.010	0.972	
Johansen	1949:1-2001:3	5.047	0.054 (1.467)	0.010 (32.071)		
ΔIL						-0.106 (-2.610)
ΔINF						0.933 (3.190)

Note: INF is the rate of inflation. IL is real investment spending stated in natural logarithms. Values in parentheses are t-statistics. Johansen cointegration test assumes linear deterministic trend, lag interval (in first differences): 1 to 6. Eigenvalue: 0.083, Trace Statistic: 28.429 (5 percent critical value: 25.32). Trace test indicates one cointegration equation at the 5% level.

They suggest that after allowing for trend in investment there may be a small and positive relation between investment and inflation. Table 1, also includes estimates for this relation employing the Johansen procedure.[6]

[4] The importance of maintaining a balance in estimation is discussed by Granger (1999).

[5] Estimations, calculations, and figures were made by using *EViews4*, by Quantitative Micro Software.

[6] The Johansen procedure is considered to be superior to alternative cointegration techniques, see Gonzalo (1994). For a discussion of the Johansen procedure, see Johansen (1991) and *EViews4*, *User's Guide*, Quantitative Micro Software.

These results, consistent with the OLS findings, reveal a small and a positive cointegration relation between inflation and investment. Error-correction terms are both significant, revealing that both inflation and real GDP adjust to maintain the cointegration relation depicted in table 1. The significance of error-correction terms suggests that there is a bi-directional causality between inflation and investment.

It is well known that Johansen results may be sensitive to the particular lag-length selected for estimation. Granger (1997) emphasized this practical difficulty with the Johansen procedure. A widespread practice is to employ an Information Criterion measure such as AIC (Akaike Information Criterion) in selecting the lag-length. The mechanical use of these criteria usually leads to selection of very short lag-lengths, such as one or two-quarter lags when macroeconomic variables are analyzed.[7] But such short lags do not allow for sufficient time for adjustment of most macroeconomic variables. Note that the relatively longer lag-length reported in Table 1 above is likely to allow for the required adjustments, and yields Johansen parameter estimates which are similar to OLS estimates.

Concluding remarks

The findings discussed above do not support the view that inflation hampers investment. Rather, the results suggest that, in the long run, lowering of inflation may lead to a small reduction in real investment in the United States. The results presented above, together with those of Ericsson *et al.* and Crosby and Otto, raise doubts on arguments for low- inflation-targeting policy view for the United States that are based on a negative relation between inflation and real GDP or between inflation and real investment.

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[7] Maddala and Kim (1998, pp. 77-78) discuss shortcomings of AIC in selecting lag lengths.

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