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The Relationship between Inflation and Inflation Uncertainty in the UK: 1885-1998

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Abstract

Using a long series of UK inflation data, I have provided strong evidence in favour of the hypothesis that inflationary periods are associated with high inflation uncertainty. This result supports the Friedman-Ball hypothesis and has important implications for the inflation-output relationship provided that more inflation uncertainty leads to lower output.

JEL Classification: C22, E31

Keywords: Inflation, Inflation Uncertainty, Conditional Variance.

1. Introduction

The relationship between the inflation rate and inflation uncertainty has attracted considerable interest by theoretical and empirical macroeconomists since the publication of Milton Friedman's (1977) Nobel lecture. Friedman (1977) analysed the causal effect of inflation on inflation uncertainty and output growth while subsequent theoretical research looked also at the opposite direction of causality, running from inflation uncertainty to the rate of inflation. Despite the considerable volume of primarily empirical research on the relationship between inflation and inflation uncertainty, the empirical literature to date has supplied contradictory evidence regarding the impact of the inflation rate on inflation uncertainty. To this end, this study purports to pursue an empirical analysis by looking at a long period of data for the UK that has been characterised by significant variations in the rate of inflation and inflation uncertainty.

Economists have appealed to the uncertainty about the future rate of inflation in order to account for the welfare loss that monetary economics has associated with inflation. Predictable inflation should not lead to welfare loss since indexation will allow agents to minimize the costs of inflation. However, uncertainty about future inflation distorts the efficient allocation of resources that is based on the price mechanism. This distortion, according to Friedman (1977) will lead to lower output. Furthermore, high inflation rates might result in more variable inflation and, hence, create more uncertainty about future inflation. Combining the link of inflation to inflation uncertainty and the link of inflation uncertainty to output, we have the testable hypothesis that higher inflation leads to lower output, i.e. a positively-sloped Phillips curve.

Friedman's intuitive result has also been subsequently derived formally by Ball (1992) in an asymmetric information game where the public faces uncertainty about the type of the policymaker. The two types of policymaker differ in terms of their willingness to bear the economic costs of reducing inflation. In periods of low inflation, the tough type will apply contractionary monetary policy. Ball assumes that the two types of policymakers alternate in office in a stochastic manner. Therefore, a

higher current inflation rate creates more uncertainty about the level of future inflation since it is not known whether the tough type will gain power and fight inflation.

Okun (1971) is one of the first studies to find that countries experiencing a high inflation rate are also countries where the standard deviation of inflation is large. The empirical approach to the inflation-uncertainty relationship faces the issue of measuring uncertainty. Two measures of uncertainty that have been used widely in empirical studies are the dispersion of survey-based individual forecasts and the moving standard deviation of inflation. The major disadvantage of these measures lies in their inability to distinguish between variability and uncertainty. In other words, they include both predictable and unpredictable variability, even though the former does not imply any uncertainty. In contrast, the use of the autoregressive conditional heteroskedasticity (ARCH) and generalised ARCH (GARCH) approaches introduced by Engle (1982) and Bollerslev (1986), respectively, allow us to proxy uncertainty using the conditional variance of unpredictable shocks to the inflation rate. Engle (1983) and Bollerslev (1986), making use of the ARCH techniques, did not perform a statistical test of the Friedman-Ball hypothesis but only compared the estimated conditional variance series with the US average inflation rate over various time periods. They found no significant relation between the two series. Overall, the empirical evidence on the Friedman-Ball view is rather mixed. Ball and Cecchetti (1990), Cukierman and Wachtel (1979), Evans (1991), and Grier and Perry (1998), among others, provide evidence in support of a positive influence of the average rate of inflation on inflation uncertainty. On the other hand, Baillie et al. (1996), Cosimano and Jansen (1988) and Fischer (1981), among others, find no significant relationship between inflation and inflation uncertainty. A recent summary of this evidence is presented in Davis and Kanago (2000).

This study contributes to the literature on the inflation-uncertainty relationship by using a long series on UK inflation rates that span over 100 years, a period characterised by significant variability in the inflation rate. For this period, I find strong evidence in favour of the Friedman-Ball hypothesis. The rest of the letter is outlined as follows: Section 2 provides the model, and section 3 discusses the data and the results. Finally, section 4 summarizes the major conclusions.

2. The model

Consider an AR(p) model of inflation y_t with time-varying conditional variance:

$$y_t = \phi_0 + \phi_1 y_{t-1} + \dots + \phi_p y_{t-p} + \varepsilon_t$$

$$E(\varepsilon_t / \theta_{t-1}) = 0$$

$$\text{Var}(\varepsilon_t / \theta_{t-1}) = \sigma_t^2$$

$$\sigma_t^2 = \alpha + \alpha_1 \varepsilon_{t-1}^2 + \dots + \alpha_q \varepsilon_{t-q}^2 + \beta_1 \sigma_{t-1}^2 + \dots + \beta_v \sigma_{t-v}^2 + \delta y_t$$

where $\alpha > 0$, $\alpha_i \geq 0$, $i = 1, \dots, q$, $\beta_j \geq 0$, $j = 1, \dots, v$ and θ_t is the information set available at time t . According to the Friedman-Ball hypothesis, $\delta > 0$.

3. Data and results

I use annual data on UK consumer price index (CPI) for the period 1885-1998. The data for the 1885-1987 period are taken from Liesner (1989) and the data for the rest of the period are from the International Financial Statistics supplied by the IMF. The plot of the inflation series, constructed as the percentage change in the CPI is given in Figure 1. It is obvious that inflation has been quite volatile throughout the sample period.

Table 1 shows some descriptive statistics for the inflation series and the Box-Pierce Q statistics of autocorrelation of the deviations and the squared deviations of inflation from its sample mean. The results imply a deviation from normality and evidence in favour of ARCH effects. I, then, employ ADF and Phillips-Perron unit root tests (results not reported) and conclude that inflation is I(1). I, therefore, estimate various GARCH models where the inflation series follows an ARMA model. The best of these models, chosen in terms of the minimum value of the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (SBC) is a GARCH(1,1) model where the inflation series follows an AR(1) process. This model is presented in Table 2. The reported diagnostics indicate the lack of serial correlation in the estimated residuals and the squared residuals. The dummy variable in the inflation equation captures high-inflation periods in the sample. It takes the value one during the periods 1915-18, 1974-77 and 1979-80. The positive and strongly significant sign of

the estimated parameter δ in the conditional variance equation provides strong support to the Friedman-Ball hypothesis.

4. Conclusions.

Using a long series of UK inflation data, I have provided strong evidence in favour of the hypothesis that inflationary periods are associated with high inflation uncertainty. This result supports the Friedman-Ball hypothesis. It also has important implications for the inflation-output relationship provided that more inflation uncertainty leads to lower output.

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Table 1: UK Inflation: 1885-1998

Descriptive Statistics	Correlations of $y - \bar{y}$
Mean = 0.0366	Q(1)= 50.761 (0.00)
Maximum = 0.2278	Q(2)= 73.931 (0.00)
Minimum = -0.2053	Q(4)= 94.105 (0.00)
Standard deviation = 0.0608	Correlations of $(y - \bar{y})^2$
Skewness = 0.29546	Q ² (1)= 16.703 (0.00)
Kurtosis = 5.8757	Q ² (2)= 23.249 (0.00)
Jarque-Bera statistic = 40.5798(0.00)	Q ² (4)= 26.157 (0.00)

Note: p-values are given in parentheses.

Table 2: A GARCH(1,1) model for inflation

Inflation equation: AR(1)

Variable	coefficient	Standard error	p-value
intercept	0.012	0.004	0.006
y(-1)	0.491	0.084	0.000
Dummy	0.096	0.012	0.000

Variance equation

Variable	coefficient	Standard error	p-value
intercept	0.000	0.000	0.057
ARCH(1)	0.266	0.110	0.015
GARCH(1)	0.550	0.093	0.000
y	0.003	0.001	0.007

$$\bar{R}^2 = 0.550$$

Standard error of regression = 0.041

AIC = -3.851

SBC = -3.682

Q(1) = 0.04(0.837)

Q²(1) = 0.33 (0.564)

Q(2) = 0.11(0.947)

Q²(2) = 2.23 (0.327)

Q(4) = 4.58(0.333)

Q²(4) = 2.52 (0.641)

Note: Q(k) stands for the Box-Pierce statistic of order k of the estimated residuals. Q²(k) is the Box-Pierce statistic of the squared residuals. The numbers in parentheses following the statistics are p-values. AIC is the Akaike Information Criterion and SBC the Schwarz Bayesian Criterion.

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