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A GARCH Approach with Long-memory to Explaining Inflation, Inflation Volatility and Persistence

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Abstract

This paper employs a univariate ARFIMA-EGARCH-in-mean approach to examine the dynamics of inflation, and to explore the links between aggregate inflation rates, inflation persistence and uncertainty for three subsamples in the postwar period. Results provide new evidence that the correlation between inflation and its uncertainty varies, and that these changes are dependent on the level of aggregate inflation rate. In a high inflation environment, inflation rate and its volatility are involved in more active interaction, whereas less or little related when the inflation rate is lower.

Keywords: GARCH; Long-memeory; Inflation; Volatility; Persistence

1. Introduction

Since the Second World War, high inflation level has led central banks over time to adopt their primary objective as that of price stability. For example, the European Central Bank aims to keep inflation "below, but close to, 2% over the medium term"; the Bank of England's monetary policy targets an inflation rate of 2%; while for the Fed, price stability is part of a dual goal (which is to create the conditions for maximum employment consistent with price stability).

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During the postwar period as shown in figure 1, the US inflation rates was not stable at all time, which fell and rose. From the end of 1940s to the middle of 1960s, the monthly US inflation averaged 0.14%. This period is described as postwar prosperity. In the following period until the early 1980s, the average monthly inflation rate quadrupled to a peak of 0.51%. What has become known as the Great Inflation [32, 9, 36] had several causes included the successive oil price shocks of 1973-1974 and 1979. Then the US inflation rates experienced a dramatic drop to 0.19% in January 1985, and the average monthly rates have since remained at 0.25%.

The first issue discussed in this paper is the relation between the rate of inflation and its uncertainty. As Friedman [19] argued, high inflation may result in irregular policy responses to curb it, and thus increase uncertainty. This positive correlation between inflation and its variability has been supported by [33, 25, 2]. Cukierman and Meltzer [16] added that higher inflation uncertainty raises the level of inflation. However, more complex evidence has been provided in empirical studies: the inflation rate and its uncertainty are either positively, negatively correlated, or even uncorrelated. For instance, Holland [25] argues that there is a negative impact of inflation uncertainty on inflation, since policymakers recognize an increase in inflation as a cost, and will take action to reduce inflation in the future.

The next concern in this paper is inflation persistence; that is the speed of the responses of inflation to shock. Empirical studies have shown that postwar US inflation appears to be highly persistent. It has been widely agreed that inflation persistence was very high from 1965 to the early 1980s (see, for example, [10, 37, 29, 12]. Evidence of low inflation persistence in the 1947-1959 period and the 1960s has also been found by Barsky [5]. In addition, low inflation persistence during the Volcker-Greenspan era is reported by among others, [10, 37, 29, 12, 31, 39]. These authors favour the view that inflation tends to return to its mean after a quick adjusting shift following a shock, which means that therefore inflation is less persistent. In sharp contrast, Fuhrer and Moore [21] documented extremely high inflation persistence during the postwar period, approaching that of a random walk process. This implies that the best forecast of next year's inflation is the most recently observed inflation rate, and it is unlikely to converge to its mean after a shock. Also Pivetta and Reis [34] find that US inflation is best described as high and time invariant since 1965 using the three following different measures: largest autoregressive root (LAR), the sum of the coefficients (SUM) and half-life (HL).

If changes in inflation persistence are observed, are they associated with the level of the inflation rate, with inflation volatility or with a mixture of the two? Following a microeconomic approach, Taylor [37] finds that inflation level is positively correlated with inflation persistence. In Taylor's study, he examines this correlation through a microeconomic model. Similarly, Cogley and Sargent [12] point to the combination of high inflation volatility and persistence in the late 1960s and 1970s, and lower persistence and volatility in the 1980s and 1990s. Therefore, this leads to conjecture that some links may exist between inflation, inflation persistence and uncertainties. These contradicting findings on inflation persistence are summarized in table 1.

In this study, the above issues are addressed by employing a univariate ARFIMA-GARCH type model [1], which I apply to three postwar subperiods. In the literature, the Phillips curve or a VAR model are variously applied to examine the extrinsic sources of persistence such as real marginal cost, or adaptive/rational expectations-driven source [39].

Table 1: Previous findings on inflation persistence

Authors	Year	Sample	Persistence	Causality between inflation/volatility and persistence
Barsky	1987	1947-1959	Low	
		1960-1979	Very high	
Fuhrer and Moore	1995	1965-1993	Very high	
Brainard and Perry	2000	1960-1978	High	
		Volcker-Greenspan era	Low	
Taylor	2000	1960-1978	High	Higher inflation and more persistent
		Volcker-Greenspan era	Low	
Kim et al.	2001	1960-1978	High	
		Volcker-Greenspan era	Low	
Cogley and Sargent	2001	Late 1960s-1970s	High	More variable and more persistent
				Less variable and less persistent
		Late 1970s-1980s	High	
				Less variable and less persistent
		1990s	Low	
Levin and Piger	2003	1984-2003	Low and changed	
Williams	2006	1980-2006	Low and changed	
Pivetta and Reis	2007	1965-2001	High and unchanged	
Widely agreed		1965-early 1980s	Very high	
		Before 1965	Changed	
Disputed		Since early 1980s	High or low	
		Since 1965	Changed/unchanged	

Univariate autoregressive (AR) procedure with error component is often used as a simple approach to evaluate inflation persistence resulting from past inflation rates, which is the intrinsic and dominant source of the persistence [20]. The sum of autoregressive coefficients is a standard measure of inflation persistence (for example, Andrews and Chen 1994). Compared to those methodologies, the ARFIMA-EGARCH-in-mean model employed in this paper is able to capture the degree of persistence. At the same time, it allows for inflation and its volatility to affect each other, and thereby allows for the examination of the links between inflation, inflation persistence and volatility. The estimated results imply that inflation and its volatility are involved in more active interaction in a high inflation environment. Moreover the degree of inflation persistence is time-varying, and positively related with the rate of inflation and its volatility.

In section 2, the empirical approaches are outlined to model inflation, inflation persistence and stochastic variance. Then section 3 presents the estimation results for the subsamples and section 4 discusses the changes of the correlation between inflation and its volatility, the degree of persistence as well as links between inflation, volatility and inflation persistence. Finally section 5 draws conclusions.

2. Empirical Approaches

2.1. The measure of inflation persistence

Batini and Nelson [6] identify three different types of inflation persistence: "positive serial correlation in inflation", "lags between systematic monetary policy actions and their (peak) effect on inflation", and "lagged responses of inflation to non-systematic policy action (i.e. policy shocks)". While Willis [40] considers inflation persistence as "the speed with which inflation returns to baseline after a shock". The latter definition is the most widely accepted or modified. In this paper, I used the Willis' definition of inflation persistence, which concerns the speed of the responses of inflation to shock. As Willis [40] noted " Such shifts in the behavior or dynamics of inflation would necessitate changes in the economic relationships used by policymakers and economists to assess current conditions, forecast key economic indicators, and determine the implications of policy changes for future economic activity."

An empirical model of univariate AR(*n*) process is possible to capture inflation persistence, which is expressed as follows:

$$\pi_t = \mu_0 + \sum_{i=1}^{n} \phi_i \pi_{t-i} + \varepsilon_t \qquad (1)$$

where π_t stands for inflation, μ_0 is the intercept, n and ϕ_i are the order and the coefficients of AR terms, and ε_t is the disturbance term, which is serially uncorrelated and follows a Gaussian distribution with mean zero and σ_i^2.

Furthermore, the reaction of a series to shocks can be categorized into three types: (i) the persistence decays at an exponential rate (short memory), (ii) it decreases at a hyperbolic rate (long memory), or (iii) infinitely (perfect memory). The three categories corresponded to different degrees of integration of a time series. A process with short memory is stationary (integrated with degree zero), a series with perfect memory is integrated with degree 1 and a series with long memory is integrated to a fraction. To characterise the significant autocorrelation between observations of a time series dynamic, Granger [22] and Granger and Joyeux [23] develop an ARFIMA model with the flexibility of allowing fractional orders of integration. Equation (2) has been modelled combining autoregressive and moving average (ARMA). The ARMA (*n*, *m*) is the following:

$$\phi(L)\pi_t = \mu + \theta(L)\varepsilon_t \qquad (2)$$

where L is the lag operator, μ is the regressor, $\phi(L) = 1 - \sum_{i=1}^{n} \phi_i L^i$, $\theta(L) = 1 + \sum_{i=1}^{m} \theta_i L^i$, and both $\phi(L)$'s and $\theta(L)$'s roots lie outside the unit circle. A time series π_t follows an ARFIMA (*n, d, m*) process, which can be expressed as:

$$\phi(L)(1-L)^d(\pi_t - \mu) = \theta(L)\varepsilon_t \qquad (3)$$

where $(1-L)^d$ accounts for the long memory and is defined as:

$$(1-L)^d = \sum_{k=0}^{\infty} \frac{\Gamma(d+1)}{\Gamma(k+1)\Gamma(d-k+1)} L^k$$

With Γ denoting the Gamma function. The parameter of *d*, lying between zero and unity, measures the speed of that inflation's convergence to equilibrium after a shock to an I (*d*) process.

Baillie et al. [1] explain the general properties of an ARFIMA process. When d=0, the series is an I (0) process with short-run behavior, in which the effects of shocks fade at an exponential rate of decay; that is, the series quickly regains its equilibrium. In the case of an I (1) process (when d=1), following a shock, the series does not revert to its mean and the persistence of shocks is infinite. Between the distinctive I (0) and I (1), an I (*d*) process with long-run dependence, when $0<d<1$, in which persistence dies out hyperbolically. In this case, the series takes a considerable time to reach mean reversion aftershocks. Specifically, when $d>0.5$, the series is non-staionary. [13, 14, 27, 28, 41]

2.2. Modelling stochastic variances

Given the assumption of ε_t in equation (3), the disturbance term, if $\sigma_i^2 = \sigma^2$, then ε_t is homoskedastic. If, on the other hand, the variance of ε_t is time varying σ_t^2 , then the process is heteroskedastic and heteroskedasticity should be modelled to obtain more efficient estimates.

To model heteroskedasticity, Bollerslev [8] extended AutoRegressive Conditional Heteroskedasticity (ARCH) developed by Engle [17], and suggested the GARCH model which allows the conditional variance to behave as an ARMA:

$$\sigma_t^2 = \omega + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 \qquad (4)$$

where ω , α_i and β_j are assumed to be positive, and $\sum_{i=1}^{q} \alpha_i + \sum_{j=1}^{p} \beta_j < 1$ satisfies the positivity constraint; the disturbance term of ε_t (innovation) follows a Gaussian distribution with mean zero, and the standard deviation, σ_t , is conditional on information set at time t-1.

To detect ARCH effects in the residuals, Engle [17] proposed a Lagrange multiplier (LM) test, which regresses the squared ordinary least squares (OLS) residuals on lagged residuals:

$$\varepsilon_t^2 = \lambda_0 + \sum_{i=1}^{q} \lambda_i \varepsilon_{t-i}^2 + u_t$$

The null hypothesis of a constant variance, that is homoskedasticity, implies λ_i =0 (i=1,2,3,…q). When the null hypothesis is rejected, there is heteroskedasticity and the process exhibits time varying variance.

2.3. The model

The general model in this paper of ARFIMA (n, *d*, m)-EGARCH (p, q) of Daniel Nelson [29] is written as:

$$\phi(L)(1-L)^d (\pi_t - \mu) = \delta(L) h_t^{1/2} + \varepsilon_t \qquad (5)$$

$$\ln h_t = \omega_0 + \alpha(L) g(z_t) + \beta(L) \ln h_t + \gamma(L) \pi_{t-1} \qquad (6)$$

$$g(z_t) = \theta_1 z_t + \theta_2 \left[|z_t| - E|z_t| \right] \qquad (7)$$

where π_t is inflation, h_t is the variances, μ is the intercept, $z_t \sim iid$ (0,1), L is the lag operator, the inflation persistence driving factor d is between zero and unity, $\phi(L) = 1 - \sum_{i=1}^{n} \phi_i L^i$, $\alpha(L) = \sum_{i=1}^{q} \alpha_i L^i$, $\beta(L) = \sum_{i=1}^{p} \beta_i L^i$, and all the roots of $\phi(L)$, $\beta(L)$ and $\alpha(L)$ lie outside the unit circle. δ captures the in-mean effects implying how the level of the inflation rate is affected by its volatilities, and γ reflects the impacts of inflation on its volatility. The innovations ε_t are assumed Gaussian with mean zero and standard deviation $h_t^{1/2}$ conditional on information set up to time t-1, following an EGARCH process.

The standard GARCH process has positivity restrictions, which is not able to consider negative effects of inflation on its volatility. Here h_t in equation 6 will be almost surely covariance stationary if θ_1 and θ_2 do not both equal zero, and positive definite for all t allowing γ to reflect positive/negative influences of inflation and on its variances. The parameter θ_1 captures the leverage effects when $\theta_1 < 0$ and $\ln h_t$ responds symmetrically to z_t when $\theta_1 = 0$. Note, $E|z| = \sqrt{\frac{2}{\pi}}$ under the assumption that ε_t is normally distributed and the MLE is computed by the following logarithm likelihood function

$$L(\mu, d, \phi, \delta, \theta, \omega, \alpha, \beta, \gamma) = -\frac{T}{2}\log 2\pi - \frac{1}{2}\sum_{t=1}^{T}(\log h_t + \frac{\varepsilon_t}{h_t})$$

3. Data Description and Estimation

3.1. The data

Given that inflation has no significant seasonality as evidenced by the results of the F-tests show in table 2 and exhibits slow decay and persistence, to measure inflation I use monthly aggregate not seasonally adjusted CPI for all urban consumers in the postwar period (1948:01-2009:12) taken from the U.S. Bureau of Labor Statistics. Inflation is defined as the natural log difference of CPI:

$$\pi_t = 100 * (\log CPI_t - \log CPI_{t-1})$$

Table 2: F-tests for the presence of seasonality assuming stability

Sample	H_0: Stability F-value	H_0: Stability Probability (Nonparametric)	Moving Seasonality F-value	Seasonality presence
1948:01-1964:12	2.402*	1.000	5.145**	No
1965:01-1984:12	3.986$^{\#}$	0.000	1.307	Probably No
1985:01-2009:12	12.405$^{\#}$	0.000	6.168**	No

Notes:

*No evidence of stable seasonality at the 0.1 per cent level.

**Moving seasonality present at the one percent level.

#Seasonality present at the 0.1 per cent level.

Figure 1 shows the inflation rates and volatilities in the US. Up to the middle of 1960s, inflation was relatively stable. By contrast, throughout the 1970s and the early 1980s, the monthly inflation rate was around 1% with peaks in 1974, 1975 and 1979. Then the US experienced a dramatic drop in inflation and even disinflation by the end of 1982 and first quarter of 1986. During the last two decades, inflation has remained low and stable.

Given the dynamics of inflation described above, I divided the series into three subsamples to examine the links between inflation, inflation persistence and volatility: 1948:01-1964:12, 1965:01-1984:12 and 1985:01-2009:12.

Table 3 presents the data descriptive statistics including ARCH_LM, which shows the existence of ARCH effects in the series in the residuals – that is, heteroskedasticity.

Table 4 presents the autocorrelation up to 12th order for each sample. It is observed that inflation exhibits persistence. Notably, inflation rates are strongly autocorrelated during the Great Inflation period. In the whole period after World War II, inflation persists with slow decays.

To identify such a stylized fact of the persistence of inflation dynamics, several unit root tests are employed. The Phillips-Perron (PP) test is used for the null hypothesis of a unit root against the alternative of stationarity. In contrast, the null hypothesis in the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test is that the series is stationary, that is I(0), which is based on the statistic $\eta = \sum_{t=1}^{T} S_t^2 /(T^2 s_0)$. Unlike the two threshold tests, the HML (Harris et al., 2008) test is for the null hypothesis of short memory against long memory alternatives, that is the test of I(0) against I(d).

Table 3: US inflation descriptive statistics

	Sample		
	1948:01-1964:12	1965:01-1984:12	1985:01-2009:12
Obs.	204	240	300
Mean	0.141	0.507	0.239
Std. Dev	0.398	0.354	0.321
ARCH_LM(2)	14.435	64.571	22.556
	[0.000]	[0.000]	[0.000]

Notes: Obs. and Std. Dev denote the number of observations and standard deviations respectively. The numbers in brackets are p-values.

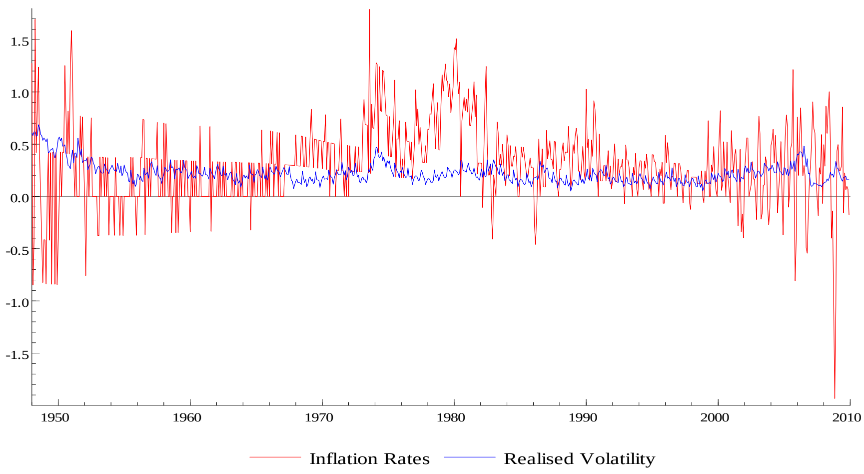

Figure 1: US inflation rates and realized inflation volatility. Source: Bureau of Labor Statistics.

Table 5 reports the statistics of PP, KPSS and the HML tests for the three subsamples. Results corresponding to the PP test allow rejecting the null of non-stationarity at 5% in all periods Three subsamples are at 1% significance level, rejecting that US inflation is an I(1) process. At the same time, the statistics for KPSS test imply that the test fails to reject the inflation following I(0) at 10% significance level. Finally HML tests only fail to reject the inflation following I(0) at 5% significance level for the subperiod of 1948:01-1964:12, suggesting that the inflation process is best described as I (d), rather than I (1) or I (0).

Table 4: Autocorrelations of US inflation rates

Lag	Sample		
	1948:01-1964:12	1965:01-1984:12	1985:01-2009:12
1	0.198	0.551	0.459
2	0.224	0.533	0.053
3	0.230	0.431	-0.088
4	-0.001	0.431	-0.094
5	0.036	0.363	-0.115
6	0.015	0.357	-0.114
7	-0.017	0.366	-0.055
8	0.089	0.391	-0.088
9	0.070	0.435	-0.093
10	0.011	0.398	0.068
11	0.095	0.393	0.214
12	-0.029	0.390	0.236

Table 5: Unit root tests

Sample	PP	KPSS	HML
	H_0: I(1)	H_0: I(0)	H_0: I(0)
	$Z(t_{\hat{\alpha}})$	η_μ	$\hat{S}_k$
1948:01-1964:12	-11.196	0.081***	1.324**
1965:01-1984:12	-3.332	0.177***	4.453
1985:01-2009:12	-7.750	0.131***	4.892

Notes: $Z(t_{\hat{\alpha}})$ and η_μ are Phillips-Perron adjusted statistic, LM statistic respectively, using Parzen Kernel estimation method with Newey-West Bandwidth and drift. $\hat{S}_k$ is HML statistic with c=1 and L=0.66.The statistics are all significant at 1% level except for those with asterisks.

**Significant at 5% level.

***Significant at 10% level.

Table 6: ARFIMA (n, *d*, 0)-EGARCH (1, 1) estimation results

	Sample		
	1948:01-1964:12	1965:01-1984:12	1985:01-2009:12
d	0.159	0.337	0.176
	(0.079)	(0.068)	(0.092)
ϕ_m	$0.144^{(11)}$	$0.137^{(12)}$	$0.219^{(12)}$
	(0.070)	(0.061)	(0.063)
δ	$0.125^{(6)}$	$0.243^{(0)}$	$0.243^{(0)}$
	(0.087)	(0.110)	(0.125)
α_1	0.472	0.571	0.243
	(0.174)	(0.315)	(0.056)
β_1	–	–	0.981
			(0.020)
γ	$0.454^{(4)}$	$0.703^{(4)}$	$0.187^{(1)}$
	(0.326)	(0.383)	(0.129)
Q(12)	13.578	9.295	6.976
	[0.328]	[0.678]	[0.859]
$Q^2(12)$	43.228	7.550	10.950
	[0.000]	[0.819]	[0.533]
AIC	-59.551	-22.889	-13.990
Log (*L*)	-53.551	-15.889	-3.990
		Wald test	
$\delta = 0$	2.073	4.897	3.792
	[0.150]	[0.027]	[0.051]
$\gamma = 0$	1.942	3.379	2.109
	[0.163]	[0.066]	[0.146]

Notes: Standard errors and *t* probabilities are given respectively in parentheses and brackets. Q (12) and Q^2 (12) are the Box Pierce tests based on residuals and squared residuals. ϕ only reports the most significant cross AR term. Wald test reports the statistics of χ^2 (1), AIC is Akaike information criterion and Log (*L*) is log likelihood. The superscript denotes the number of lagged terms. In this formulation, θ_2 is set to be 1, and therefore only α is reported. _ represents that β_1 is 0, and thus conditional variances follow EGARCH(0,1) .

3.2. Estimates

The equations 5-7 for the US inflation series are estimated by maximizing the log-likelihood function of equation 8. For robustness of results are across alternative time periods, as well as alternative models with different lagged level rates of inflation and its volatilities well influenced. And the preferred specification is selected using the Akaike information criterion (AIC).

The estimation shows that the asymmetric coefficient, that is θ_1, is highly insignificant – suggesting that inflation volatilities respond symmetrically to shocks. Table 6 reports the MLE estimates of the selected ARFIMA(n, *d*, 0)-EGARCH(1,1) model.

The estimated values of *d* for all subsamples are between zero and 0.5, which implies that the inflation process is covariance stationary and that it has long memory. All the estimated standard errors of *d* are small, therefore the null hypothesis of $d = 0$ can be rejected, and the US inflation series is weakly stationary. The estimated values of *d* are 0.16, 0.34 and 0.20 for the 1948:01-1964:12, 1965:01-1984:12 and 1985:01-2009:12 samples respectively. They are relatively low but significantly different from zero, notably the estimated value of *d* for the 1965:01-1984:12 sample is 0.34, which is much higher than the other two subsamples. This provides evidence that US inflation does possess a long memory feature. The results also provide statistical evidence on the correlations between inflation rates and volatilities. For all the subsamples, inflation, as well as its uncertainty influence each other positively except for the last period, during which inflation does not affect its uncertainty significantly.

In the variance equation, all the conditional estimated parameters are significant at 1% level, demonstrating that heteroskedasticity is well described by GARCH approach. As for the sample autocorrelation functions of the residuals and squared residuals, there is no statistically significant evidence of mispecification of the estimated model. Particularly, the Wald tests in table 6 show more significant correlations between inflation and its volatilities during the Great Inflation period.

4. Discussion

The above analysis and estimation results indicate that the relations between inflation, uncertainty and inflation persistence changed in the course of the postwar period. As summarized in table 7, a rise in inflation uncertainty increases the inflation rate, which is in line with the theory of Cukierman and Meltzer [16]. Although the results show that inflation positively affects its uncertainty, it is significant when inflation is high, whereas it becomes less significant or insignificant when inflation rate is at a lower level as presented in table 6. One interpretation could be that the participants in the economy fear less for future purchasing power and therefore have well-anchored inflation expectations [39]. This adds empirical evidence to the insight that emerges from the literature that inflation could be positively related or unrelated to its uncertainty.

Table 7: Relations among inflation, persistence and volatility

	Sample		
	1948:01-1964:12	1965:01-1984:12	1985:01-2009:12
d	**0.159**	**0.337**	**0.176**
$h \to \pi$	+	+*	+*
$\pi \to h$	+	+*	+

Notes: + (-) indicates positive (negative) effect. The bold numbers and symbols with asterisk indicate significant values and effects respectively.

There is a clear evidence that inflation dynamics are more or less persistent as inflation rates increase or decrease down to relatively low levels, and that persistence is time-varying rather than immutable. Before the Great Inflation, the Fed achieved a remarkable record of price stability with the inflation rate averaging 0.14 and an estimated degree of persistence of 0.16. Since mid 1960s, inflation rates rose up to a level averaging around 0.51 and peaking at 1% per month in the 1970s, which is much higher than the previous decade's rates.

However the Fed's dual goal of maximum sustainable employment and price stability, prescribed by the 1977 amendment to the Federal Reserve Act, were challenged by this economic situation: high inflation induced high wage demands and expected inflation, which fed back into high inflation and high unemployment. According to the results, the estimated degree of persistence for the Great Inflation period was significantly higher at 0.34. Later, as a result of the successful disinflation policies initiated under the Fed chairmanship of Paul Volcker, and with lower inflation rates continuing under his successors, the inflation persistence decreases to an estimated degree of 0.18, close to its level of 1950s-1960s [18, 35].

Similarly, inflation uncertainty affects inflation persistence positively, supporting Cogley and Sargent's [12] view. Looking at the last two subsamples, inflation is more volatile and persistent in the Great Inflation episode. Notwithstanding inflation volatility is high in the first subperiod with a low degree of persistence. This could be explained by inflation being extremely high and volatile up to the beginning of 1950s; the whole US society was recovering from the war with fear of the subsequent drop in military spending and the pent-up consumer demand surpassing market supply (Conte and Karr, 2001), thereby increasing the average volatility of the inflation rates for the first sub period. Thereafter, the standard deviation of inflation for 1952:01-1964:12 is 0.26.

5. Conclusion

This paper has investigated US inflation in the postwar period. A powerful ARFIMA-EGARCH-in-mean model was estimated with MLE, analyzing the links between inflation, inflation persistence and stochastic variance for three subsamples. Results have shown that the correlation between inflation and its uncertainty varies, and that these changes are dependent on the level of aggregate inflation rate. In a high inflation environment, inflation rate and its volatility are involved in more active interaction.

Findings in this study have rejected that inflation possesses substantially high persistence, approaching a random walk. The highest value of the persistence parameter d is approximate to 0.34 for the Great Inflation time, which has climbed from a low to a higher level and then returned and remained at low since the middle of 1980s. This contrasts with Pivetta and Reis's [34] findings of a high and time-invariant persistence.

Another core finding in this paper is that inflation persistence is positively associated with the inflation rate. This is consistent with the finding of Taylor [37], that is, the positive relation between inflation and its persistence. Meanwhile, it has also demonstrated that inflation volatility has a positive effect on inflation persistence as Cogley and Sargent [12] concluded, especially during the period of Great Inflation.

This study of postwar US inflation has highlighted the importance of the role of aggregate inflation. It also implies that monetary policy authorities should keep a vigilant watch on inflation performance, which is the determinant of the links between inflation, volatility and inflation persistence, and may affect other economic and financial variables such as unemployment and stock returns.

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