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The Nexus between Inflation and Inflation Uncertainty of four South Asian Economies

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Abstract

This study data have been taken from World Bank side during the time span from 1989 to 2016. This study explores the relationship between inflation and inflation uncertainty in Pakistan, India, Sri Lanka, and Bangladesh. The EGARCH model is used to check the inflation uncertainty among four countries. The asymmetric behavior of inflation uncertainty has also been found by this method. The granger causality test is used to check the direction between inflation and inflation uncertainty. The result of this study showed that there were positive shocks among all the developing countries such as Pakistan, India, Sri Lanka, and Bangladesh. The results of Granger Causality test showed that bi-directional causality exists between inflation and inflation uncertainty in south Asian economies.

Keywords: Inflation, inflation uncertainty, EGARCH, Granger Causality.

Introduction

Inflation is the general increase in prices of goods and services. Inflation is the global issue for developing countries. While, Inflation uncertainty is a scenario of unpredictable prices and the future prices besides the public don't know about the inflation whether it will be increased or decreased in the coming days or in the future. Thus we can say that inflation comes in an unpredictable manner (Asghar, Ahmad et al., 2011).

Inflation uncertainty is created due to inflation. According to Friedman's the higher inflation gets uncertainty of inflation, its result was the loss of welfare over distortion in price mechanism. So there were many studies examined the relation of inflation and inflation uncertainty of which the majority depended on time series analysis. Higher inflation rates generate higher uncertainty in future policy so about future inflation rates. According to (Ungar & Zilberfarb, 1993) wherever great allocation of resources to understand inflation uncertainty in the presence of high inflation decreases the future uncertainty. A feedback of inflation uncertainty was affecting the inflation rates. By the model of fed behavior the argument that inflation uncertainty increased the level of inflation (Cukierman & Meltzer, 1986).

The higher rate of inflation is due to the following factors like poverty, unemployment, illiteracy rate etc. and it also harms the developing economies compared to the developed ones. The monetary policy is the challenge for economist due to the curse of inflation and also for all the above present factors. So, in this scenario this study examined the relationship between inflation and inflation uncertainty in the four south Asian economies like Pakistan, India, Sri Lanka and Bangladesh. All four economies are facing same type of problem like inflation, their economy is decreasing and inflation is increasing. So, government of all economies should take necessary steps for the stable economy.

The main purpose of this study is to make the comparative analysis among Pakistan, India, Sri Lanka and Bangladesh due to the situation of inflation and inflation uncertainty.

In the next section two is Literature review, section three is methodology which is comprised of ARCH/GARCH formulas. Section four explains results and discussion and in fifth section conclusion and recommendations are given.

Literature Review

(Muhammad, 2016) explained the relationship between uncertainty inflation and inflation in case of Nigeria and used GARCH model. The monthly data of 1960 to 2014 was used, and also EGARCH frame work was used for inflation uncertainty. That was complemented by seasonal ARIMA used for model of uncertainty inflation. The Bivariate Granger was performed on inflation and uncertainty that showed that inflation caused inflation uncertainty in Nigeria,

(Javed et al., 2012) highlight the link between inflation uncertainty and inflation in case of Pakistan. The consumer price index monthly data was used from 1957 to 2007. The source of the data is International Financial Statistics from Pakistan. The ARMAGARCH frame work was used to estimate the conditional volatility of inflation. The result showed that inflation effected inflation uncertainty in Pakistan and supported Friedman ball hypothesis.

(Hassan Heidari et al., 2013) investigated in case of Iran uncertainty of inflation and inflation by using MGARCH and FIML technique. The monthly data was used from 1979 to 2007. The CPI is a proxy of inflation was used and source of data was central bank of Iran. The result showed that inflation had positive relation of mean and variance. The set of specification suggested that inflation Granger causes inflation uncertainty was supported by the Friedman hypothesis.

Nas & Perry, (2000) explained the link uncertainty of inflation and monetary policy in case of Turkey by using GARCH and Granger technique. The time period was 1960-1998 and source of data was international financial statistical. The finding showed of inflation was significantly raise the uncertainty of the inflation in case of Turkeys. These analyzed of political condition and also record macroeconomics policy makers in turkey among 1960 and 1998 reveal institutional and political factors that can be explained the empirical result.

(Berument et al., 2001) highlight the uncertainty of inflation in case of Turkey. The time period was 1986-2000 and EGARCH method was used to estimate the CPI. This paper showed that monthly seasonally have significant impact on uncertainty of inflation. The result showed that uncertainty of inflation has positive shocks on inflation was higher than of negative shocks to inflation.

Hassan Heidari et al., (2014) explained the link among shocks of inflation and inflation uncertainty in case of Iran. The monthly data was used from 1990 to 2011 and technique was applied of TGARCH and EGARCH models. The CPI was used and the source of data was central bank. These finding show that negative shocks have less effect on uncertainty of inflation as compared to positive ones. This paper provides new statistical explanation of Iran economic asymmetric.

Davis & Kanago, (2000) examined the inflation of uncertainty and level by using across countries. The OECD 30 years data of published forecasting of inflation was used and other variable economic outlook. There was evidence of positive and significant relation from studies by using measure of survey and other evidence comes mostly from studies of regression errors. A measure of uncertainty is the squared forecast error of organization for economic cooperation and development of forcasting.

Holland, (1993) investigated the high uncertainty of inflation and inflation rate in the period of postwar. The time span was 1948 to 1987. The result showed that uncertainty of inflation and inflation is linked of forecaster's uncertainty and the impact of the money growth on the price level.

In case of the long run growth of money also effect of price level rests random and growth of money will cause inflation uncertainty of associated adverse effects on the employment and the output.

Hassan Heidari & Bashiri, (2010) explained the link of uncertainty of inflation and inflation. They monthly CPI data was inflation was used over the time was 1990 to 2009 in the Iranian economy. The source of data was central bank of Iran. This paper used FIML model to solve this issue. This estimate showed that new set of specification and inflation causes uncertainty of inflation by supporting Friedman ball hypothesis.

H Heidari, (2011) examined the case of Iran link of uncertainty of inflation and inflation by using the period of 1988 to 2008. The consumer price index and GDP of Iran has proxy of price level and output. The Generalized Autoregressive conditional Heteroscedasticity in mean technique was used. The empirical result showed that growth uncertainty effects the level of inflation.

Lahiri & Liu, (2006) explained the uncertainty of inflation by using the panel density of forecasts by multiperiod. The source of data was survey of professional forecasters and other macro variable collected from Federal Reserve Bank of Philadelphia. The result showed that there is relationship between past forecast errors and current forecast uncertainty. There was strong relationship between inflation and inflation uncertainty.

Conrad & Karanasos, (2005) investigate the Japan and UK hypothesis of the inflation uncertainty by using the period of 1962 to 2001. The used parameter model in the long run memory of both mean of conditional and the variance of conditional of inflation. They show that inflation significantly high rate of inflation uncertainty of all countries by Friedman.

Methodology

The variables used in the study are inflation and inflation uncertainty. There were used south Asian countries such as Pakistan, India, Bangladesh and Sri Lanka. India used the wholesale price index of measuring inflation but Pakistan, Bangladesh and Sri Lanka used the consumer price index. The annual data of consumer price index and wholesale price index have been used. The time series data are used. The data of inflation were collected from world development indicators. The data are used over the period of 1989 to 2016. The data will be analyzed by the EViews 9 and ARCH/GARCH and EGARCH model was used. This paper test of heteroscedasticity and is proposed by Brown and Forythe 1974. This test shows that the variance of data is different of across different period of time or not. Augmented Dickey Fuller test is used to check the stationary of the data.

Modeling

The model of ARCH was proposed by Engle (1982) and extension has generated vast literature of the modeling in conditional volatility of empirical literature. The Generalized Autoregressive Conditional Heteroscedasticity was also proposed by Engle in 1982. It is used to detect the problem of ARCH/GARCH effect in south Asian countries. There are two parts of ARCH model. First is mean equation and the second is variance equation. This model is used to find conditional variance equation.

Mean equation

$$\pi_t = \mu + \sum_{j=1}^{p} \theta j \pi_{t-j} + \varepsilon_t$$

$\varepsilon_t \sim D(0, h_t)$

π_t Denotes the inflation and it simply an AR (p) process.

Variance equation

$$h_t = \omega_o + \sum_{j=1}^{q} \alpha j \varepsilon^2{}_{t-j}$$

h_t Denotes the variance. The model of GARCH was independly developed by Bollerslev in 1986. In this model the conditional variance are dependent previous lag and squared residual terms of lags. The complete general equation is used for inflation series h_t is given below.

$$h_t = \omega_o + \sum_{j=1}^{p} \beta i h_{t-i} + \sum_{j=1}^{q} \alpha j \varepsilon^2{}_{t-j}$$

Inflation Uncertainty

The exponential generalized Autoregressive conditional Heteroskedasticity proposed by Nelson at 1991 and is used to the model of inflation Uncertainty. It does not impose the non-negativity constraints on the parameters by modeling the logarithm of the conditional variance as compared to conventional GARCH models

The EGARCH model is used to testing the asymmetries in the terms of negative and positive shocks. The variance equation of this model is given below:

$$\ln(\boldsymbol{h_t}) = \boldsymbol{\omega_o} + \sum_{j=1}^{p} \boldsymbol{\beta} i \ln(\boldsymbol{h_{t-i}}) + \sum_{j=1}^{q} \boldsymbol{\alpha} j \left| \frac{\boldsymbol{\varepsilon_{t-j}}}{\sqrt{\boldsymbol{h_{t-j}}}} \right| + \sum_{j=1}^{q} \boldsymbol{\gamma} j \frac{\boldsymbol{\varepsilon_{t-j}}}{\sqrt{\boldsymbol{h_{t-j}}}}$$

Hence the estimated parameters are $\omega, \beta\ \alpha\ and\ \gamma$.

When γ is non-zero, the impact of inflation on inflation uncertainty is asymmetric. But when γ becomes positive then increase inflation indicated more inflation uncertainty.

The Granger Causality test

This test is proposed by Granger in 1969. This test is used to check the existence of the causality between the inflation and inflation uncertainty. This technique is used to test for forecasting of one variable on the other.

Results and Discussion

Table 1. Summary of inflation (1989-2016)

	BCPI	PCPI	IWHI	SCPI
Mean	6.178550	8.619262	72.55724	9.630980
Median	6.160499	8.486608	65.20236	8.906478
Maximum	11.39517	20.28612	129.9643	22.56450
Minimum	2.007174	2.529328	25.77386	3.179002
Std. Dev.	2.353286	4.103066	32.80630	4.958489
Skewness	0.054295	0.565337	0.434925	1.010618
Kurtosis	2.722396	3.533979	2.002154	3.682372
Jarque-Bera	0.103665	1.824152	2.044393	5.309531
Probability	0.949488	0.401689	0.359804	0.070315

Unit test for inflation

The result showed that inflation of all countries is stationary. The Augmented Dickey Fuller test of unit root showed by comparing the probability values in the level of significance at 1% 5% and 10%. Pakistan and India are stationary at integrated order I(1) but Bangladesh and Sri Lanka are stationary at integrated order at I(0).

Table 2. Augumented Dickey Fuller (ADF)

Variables	Intercept	Intercept and trend
Pakistan	-2.976263 (0.2140)	-3.5950 (0.4778)
Δ Pakistan	-2.981038** (0.0000)	---
India	-2.9762 (0.9953)	-3.5950 (0.7318)
Δ India	-2.9810** (0.0262)	---
Bangladesh	-2.9762** (0.0087)	---
Sri Lanka	-2.9762*** (0.0134)	---

Note: * significance at the level of 10%; ** Significance at the level of 5%; ** *significance at the level of 1%, 5% and 10%

The implementation of ARCH/GARCG AND EGARCH MODELS

The ARCH model is used to measure the volatility of inflation and the EGARCH model is used to measure the effect in asymmetric shocks of variance on inflation. There are following tables showed the conditional mean and variance equations designed for south Asian countries such as Pakistan Bangladesh India and Sri Lanka. The ARCH and GARCH models is ranked by minimized the AIC and SBC. This model suggested that minimum value of AIC and SBC is significant model explained heteroscedasticity. The ARCH model is applied in E-views and one by one obtain the best fitted model on the basis of AIC and SBC. The estimated results is presented the separate tables of the each country estimated of coefficients and p-values and minimum value of AIC SBC values of ARCH/GARCH model. The AR (1) process is used to test the autoregressive order of inflation of mean equation series. The EGARCH model is used to testing the asymmetries in the terms of positive and negative shocks of inflation uncertainty of all these countries model.

Pakistan

Table 3 showed the results of ARCH/GARCH effects in case of Pakistan. The estimated results of mean equation and variance equations are based on the ARCH (1, 1) and EGARCH (1, 1) described in the Table 3. The clearly show from Table 3 that current period of inflation depends on the pervious value is indicated by the positive value of coefficient on lagged inflation 0.51. The table of ARCH (1) value of α is positive and significant show that effects of ARCH is present of the residuals inflation series. The inflation uncertainty of EGARCH (1, 1) has been modeled. In EGARCH the value of γ = 0.4392 show that presence of the asymmetric information and also it is non zero. The value of γ is positive and significant showed that has positive shocks of inflation and create in Pakistan has more inflation uncertainty.

India

In table 4 below the result for India on the basis of the minimum values of the AIC and SBC suggested that the GARCH (1, 1) effects are present in the series of inflation because the β value is positive and significant. In EGARCH model value of the γ = 1.0516 shows the presence of the asymmetric information and also it is non zero. The positive and significant value of γ shows that positive shocks to inflation produce more inflation uncertainty in India.

Table 3. The Estimated coefficient of inflation in case of Pakistan

ARCH (1)					**EGARCH (1,1)**			
Mean equation								
Variables	Coefficient	SE	Z – statistics	p-value	Coefficient	SE	Z – statistics	p-value
Constant	3.3071	3.0243	1.0935	0.0042	3.0200	0.1391	21.7110	0.0000
Inf (-1)	0.5103	0.3238	1.5760	0.0011	0.5254	0.0148	35.3220	0.0000
Variance equation								
ω	11.553	2.4910	4.6381	0.0000	2.9440	2.5101	1.2101	0.0000
α	0.0673	0.0098	6.8454	0.0000	-2.5409	0.0176	-143.6191	0.0000
β					-0.2342	0.3875	-0.6043	0.5456
γ					0.4392	0.1234	3.5572	0.0004
AIC	5.1439				4.4703			
SBC	5.3359				4.7685			

Table 4. The Estimated coefficient of inflation in case of India

GRCH (1 , 1))					**EGARCH (1,1)**			
Mean equation								
Variables	Coefficient	SE	Z – statistics	p-value	Coefficient	SE	Z – statistics	p-value
Constant	2.4015	0.3153	7.6148	0.0000	2.8847	0.2440	11.8190	0.0000
Inf (-1)	1.0177	0.0018	535.7793	0.0000	1.0083	0.0011	914.7205	0.0000
Variance equation								
ω	-0.2107	0.0154	-13.6711	0.0000	0.759281	0.0418	18.14570	0.0000
α	-0.0263	0.0203	-12.9720	0.0000	-0.811827	0.1315	-6.16902	0.0000
β	1.0594	0.0067	235.5269	0.0000	0.174575	0.5489	0.3180	0.7505
γ					1.051651	0.1695	6.2013	0.0000
AIC	4.0206				3.9840			
SBC	4.2606				4.2720			

Bangladesh

The minimum values of the AIC and SBC suggest the GARCH (1, 1) effects are present of the series in inflation because the value of β is positive and significant. In EGARCH the value of the γ = 0.6388 show that the presence of asymmetric information and also it is non zero. The value of γ is positive and significant, it shows that positive shocks to inflation and create more inflation uncertainty.

Table 5. The Estimated coefficient of inflation in case of Bangladesh

GRCH (1 , 1))					**EGARCH (1,1)**			
Mean equation								
Variables	Coefficient	SE	Z – statistics	p-value	Coefficient	SE	Z – statistics	p-value
Constant	4.8113	0.7099	6.7771	0.0000	3.5943	0.9182	3.9142	0.0001
Inf (-1)	0.1993	0.1067	1.8672	0.0619	0.3913	0.1638	2.3884	0.0169

Variance equation								
ω	2.3729	1.3868	1.7109	0.0871	1.8397	1.0114	1.8188	0.0689
α	-0.2614	0.0886	-2.9481	0.0032	0.4585	0.7552	0.6071	0.5437
β	0.8244	0.2079	3.9649	0.0001	0.5780	0.5018	1.1518	0.2494
γ					0.6388	0.3025	2.1113	0.0347
AIC	4.5952				4.6969			
SBC	4.8352				4.9849			

Sri Lanka

The estimated results of mean and variance equation of Sri Lanka are given below. The minimum values of the AIC and SBC suggest that the GARCH (1, 1) effects are present in the series of inflation because the β value is positive and significant. In EGARCH the value of $\gamma = 0.4874$ show that the presence of asymmetric information and also it is non zero. The value of γ is positive and significant, it shows positive shocks to inflation and create more inflation uncertainty in Sri Lanka.

Table 6. Estimated coefficient of inflation in case of Sri Lanka

GRCH (1 , 1))					**EGARCH (1,1)**			
Mean equation								
Variables	Coefficient	SE	Z – statistics	p-value	Coefficient	SE	Z – statistics	p-value
Constant	6.7454	1.1280	5.9799	0.0000	3.2739	0.1337	24.4699	0.0000
Inf (-1)	0.2736	0.0947	2.8871	0.0039	0.6824	0.0229	29.7706	0.0000
Variance equation								
ω	19.4292	8.5355	2.2762	0.0228	3.0145	0.1778	16.9487	0.0000
α	0.3438	0.1284	2.6773	0.0074	-2.0486	0.0150	-135.761	0.0000
β	0.6830	0.2833	2.4103	0.0159	0.9134	0.2933	3.1140	0.0018
γ					0.4874	2.1305	22900.4	0.0000
AIC	5.6485				5.4929			
SBC	5.8964				5.7809			

The results of Granger Causality test

The results of Granger Causality test help to determine that one variable is forecasting of another or not. This study uses GARCH variances of inflation series as a proxy of inflation uncertainty and checked the causality between them through this test.

Granger Causality test the p-values has less 0.05 that means reject the null hypothesis at the significant at level of 5%. So the result showed that of all South Asian countries has bi-directional link among the inflation and inflation uncertainty.

Table 7. Pakistan

Null hypothesis:	F-Statistics	P-value
INF does not Granger causes INFUNE	0.74016	0.0497
INFUNE does not Granger causes INF	0.25920	0.7742

Table 8. India

Null hypothesis:	F-Statistics	P-value
INF does not Granger causes INFUNE	3.2843	0.0484
INFUNE does not Granger causes INF	1.0129	0.3810

Table 9. Bangladesh

Null hypothesis:	F-Statistics	P-value
INF does not Granger causes INFUNE	7.05306	0.0048
INFUNE does not Granger causes INF	0.03052	0.9700

Table 10. Sri Lanka

Null hypothesis:	F-Statistics	P-value
INF does not Granger causes INFUNE	3.8538	0.0384
INFUNE does not Granger causes INF	0.1909	0.8277

Conclusion and recommendation

In making economic agents inflation uncertainty played a vital role for cost of high inflation because it has negative impact on economic variables such as investment consumption growth etc. In South Asian countries the link among inflation and inflation uncertainty is badly affected. The EGARCH model is used to inflation uncertainty of each country.

In Pakistan the ARCH effects are present on the other hand the GARCH effects are present in India Bangladesh and Sri Lanka on the basis of AIC and SBC. The EGARCH asymmetry has also been found in the inflation series. The results showed that of all countries such as Pakistan, India, Bangladesh and also Sri Lanka have positive shocks on inflation that caused more inflation uncertainty in future. The Granger Causality test suggests that the bi-directional causality exists between inflation and inflation uncertainty. These results are fully supported by both Friedman 1977 and Cukierman 1986 hypothesis. This study recommended that the economic policy maker take strategies against inflation to control the negative effects of inflation so that can increase the economic development. Inflation can be decreased by making the monetary the South Asian countries, this will not only decrease the print money but also increase the economic integration by which economic advantages will be achieved.

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