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Abstract

Inflation in India has been moderately high and volatile. In this paper we provide an estimate of the conditional mean and variance of CPI and WPI inflation rates with the help of a GARCH (1, 1) model. Under an environment of inflation uncertainty, rational risk-averse investors demand an inflation risk premium, defined as the difference between the expected real return on a nominal bond and the expected riskless real interest rate (often represented by the expected real return on an inflation-indexed bond). The sign of the inflation risk premium is a function of the inflation-hedging capability of alternative securities, such as gold, silver and stocks. Our estimated empirical models consistently find gold and silver to be effective hedges against expected WPI inflation rate, the predominant measure of Indian inflation. As for Indian equities, we find a strong negative correlation between the nominal returns and the conditional standard deviation of WPI inflation, providing empirical support of a positive inflation risk premium for Indian interest rates.

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Introduction

Moderately high inflation has been a constant companion of Indian investors in most parts of India's post-independence history. In fact, WPI inflation averaged around 7 per cent per annum and CPI inflation averaged around 7.4 per cent per annum for the period 1960-2013. Coping with this moderately high inflation along with tepid economic growth has been a persistent challenge for the Indian economy, and only in the post-1991 liberalization era has India seen economic growth rates able to match its inflation rates. Under such an environment, it is natural to expect Indian investors to look for assets to hedge against inflation. In this paper, we estimate the extent to which Indian assets, such as gold, silver and stocks have been successful in serving as hedges against expected and unexpected components of inflation for the sample period 1960-2013. Our findings indicate a positive inflation risk premium in Indian interest rates.

Some of the earliest work on inflation hedging can be found in the work of Fisher (1930), where he argues that nominal interest rate can be written as a sum of expected real interest rate and expected inflation. Fama and Schwert (1977) extend Fisher's analysis to a wider range of assets including US Government bonds and treasury bills, US private residential real estate and US stocks. They postulate that if financial markets are efficient, then asset prices will be set in such a way that the expected nominal return on assets between any two periods can be written as a sum of the corresponding expected real return and expected inflation rate. The authors then clearly delineate the method of formally testing these hypotheses for various assets and find that US Government bonds and treasury bills serve as effective hedges against expected inflation, while US private residential real estate provides hedges against expected inflation as well as unexpected inflation. US stocks, however, did not exhibit any empirical evidence of being an inflation hedge; indeed they turned out to be negatively correlated to expected and unexpected inflation rate. By first adopting the methodology put forward by Fama and Schwert (1977) and using Indian data, we find that gold and silver serve as effective hedges against expected WPI inflation. We, however, find no empirical evidence of inflation hedging properties of Indian stocks against expected inflation, positive or negative.

Literature suggests that if inflation is uncertain nominal interest rate is known to include an inflation risk premium; see Fischer (1975), Liviatan and Levhari (1977), Landskroner and Liviatan (1981) and Chu et al. (1995) for more details. These authors define the inflation risk premium as the difference between the expected real return on a nominal bond and the expected riskless real interest rate (often represented by the expected real return on an inflation-indexed bond). According to Fischer (1975) the sign of the inflation risk premium is a function of the inflation-hedging capability of alternative securities, such as equities. Using the model put forward by Fischer (1975), Chu et al. (1995) hypothesize that if the nominal returns on alternative assets are negatively correlated with unexpected inflation rate, then these assets are a poor hedge against uncertain inflation and that in turn will result in risk-averse investors demanding a positive inflation risk premium.

In order to test the presence of inflation risk premium for the Indian market, following Fama and Schwert (1977), we first use an augmented nominal return model to include unexpected inflation (inflation forecast error); however, we no found statistical significance of unexpected inflation in any of the nominal models we tested. Using Fischer (1975) and under the assumption of no correlation between the nominal return of an asset and that on an inflation-indexed bond, we are able to express the expected nominal return of an asset as the sum of the expected real return and the expected inflation rate, minus the inflation variance. Using this derivation and in order to maintain parity of units, we then test the augmented model of nominal return for various assets with standard deviation of inflation instead of its variance, where the inflation variance is estimated by a GARCH model. We again find gold and silver to be effective hedges against expected WPI inflation; however, the statistical significance of inflation uncertainty on the expected nominal return of these two assets is not very strong (negative in sign and significant only at a 10% level). Although for the nominal equity returns equation we find no evidence of hedging against expected inflation, we find strong empirical evidence of a negative influence of inflation uncertainty on expected nominal equity returns. Hence, our paper points to the presence of a positive inflation risk premium in Indian interest rates.

We believe that our paper fills an important research gap in applying established methodologies to test the degree of inflation hedging properties of various assets in the Indian context. Moreover, using Fischer (1975), we are able to generate novel testable implications that enable us to establish a link between inflation variability and expected nominal returns of various assets, such as gold, silver and equities. Doing so, we empirically validate the presence of a positive inflation risk premium in Indian interest rates.

Even though we could only uncover a positive sign of the inflation risk premium in Indian interest rates, given the current deficiencies of the Indian bond market, we are unable to provide a direct measure of the inflation risk premium. In a future work, as we expect to see the Indian bond market and, more specifically, the Indian inflation-indexed bond market mature, we propose to extend this study to directly measure the inflation risk premium in Indian interest rates.

Data

The data for our study is primarily from two sources – International Monetary Fund (IMF) *International Financial Statistics* (*IFS*) and Reserve Bank of India (RBI) *Database on Indian Economy*. The data on Consumer Price Index (CPI), Wholesale Price Index (WPI) and Stock Price Index is obtained from *IFS* at monthly frequency for a period between 1960 January and 2013 December. The RBI database provides monthly data on gold and silver prices from 1990 April to 2013 December. The CPI data represent the cost of living of the entire Indian population, rural and urban combined with a base year of 2010. Similarly, the WPI data that we use is a pan-India cost of living index at the wholesale level with a base year of 2010. The Stock Price Index is the Bombay Stock Exchange Index (BSE Sensex), which is a 'Market Capitalization-Weighted' index of 30 component stocks representing a sample of large, well-established and financially sound companies. The gold price data from RBI database is the monthly average price in rupees for 10 grams of gold at Mumbai. The silver price is the monthly average price in rupees for 1 kilogram of silver at Mumbai. The returns on all assets – gold, silver, and stocks as well as the CPI and WPI inflation rates are calculated as the difference between the natural logarithm of a period's value and its value 12 months prior.

Model and Results

One of the earliest works on the links between inflation and asset returns is the treatise on interest rates by Fisher (1930). A deeper exploration of this link and its extension to other risky assets can be found in the works of Fama (1975, 1976), Lintner (1975), Body (1976), Jaffe and Mandelker (1976), Nelson (1976), and Fama and Schwert (1977). On a related work in the Indian context see Mayya (1977) and Prabhakaran (1989). Fama and Schwert (1977) hypothesize that if the market is efficient, then at period $t-1$ it will set the price of an asset in such a way that the expected nominal return on the asset between $t-1$ and t is the sum of the appropriate real return on the asset between t – 1 and t and the expected inflation rate from t – 1 to t. In other orders,

$$E(R_{it}|\varphi_{t-1}) = E(r_{it}|\varphi_{t-1}) + E(\pi_t|\varphi_{t-1}) \quad (1)$$

where R_{it} is the nominal return on asset i between t – 1 and t, $E(r_{it}|\varphi_{t-1})$ is the expected real return of the asset from t -1 to t as implied by the information set φ_{t-1} available at t – 1, and $E(\pi_t|\varphi_{t-1})$ is the expected inflation rate at t – 1.

Under the assumption that since the expected real return on an asset is determined by real factors, such as productivity of capital, discount factor, and risk preference, it would not be affected by nominal variables such as the expected rate of inflation, Fama and Schwert put forward the following empirical model from equation (1):

$$R_{it} = \alpha_i + \beta_i E(\pi_t|\varphi_{t-1}) + \varepsilon_{it} \quad (2)$$

where α_i and β_i are the regression coefficients and ε_{it} is a white noise error term. Using equation (2), the authors suggest that when we fail to reject the hypothesis that $\beta_i = 1$, we may conclude that the asset in question is a complete hedge against expected inflation.

Before we estimate equation (2) and test hypotheses regarding the inflation hedging properties of various assets, we need to ensure that all variables in the regression are stationary. Table 1 through Table 5 in the Appendix of the paper show the results of both the Augmented Dickey-Fuller tests and the Phillips-Perron tests. The unit root test results reject the null hypotheses of a unit root in CPI and WPI inflation rates and in the nominal rate of the returns on gold, silver and stocks.

In order to estimate equation (2), we first need an empirical measure of the expected inflation rate. Following Gultekin (1983), we forecast the CPI and WPI inflation rates using an appropriate empirical model and then use the forecasted value as an empirical measure of the expected inflation rate. For the purpose of arriving at the appropriate empirical model to forecast inflation rates, we generate the correlograms of the two series. Figures 6 and 7 in the Appendix show the correlograms of CPI and WPI inflation rates respectively. The two figures point towards an ARMA model with seasonality. We experimented with various seasonal ARMA models for the CPI and WPI inflation rates and the final models, as shown in Tables 6 and 8 in the Appendix, were arrived at by simultaneously satisfying three model selection criteria – parsimony, lowest value of AIC (Akaike Information Criterion) and no serial correlation in residuals. The Q-statistics (Figures 8 and 9) and the Breusch-Godfrey LM test statistics (Tables 7 and 9) show no significant serial correlations in the residuals up to 36 lags for both the inflation rate models. The inflation forecasting model is generally given by the following:

$$\pi_t = E(\pi_t|\varphi_{t-1}) + \varepsilon_t \quad (3)$$

where ε_t is a white noise error term. The CPI inflation model is specified as

$$(1 - \rho_1 L - \rho_2 L^2)\pi_t = c_0 + (1 + \theta_1 L + \theta_2 L^2 + \theta_3 L^3)(1 + \gamma L^{12})\epsilon_t \quad (4)$$

where ρ's, θ's and γ are the regression coefficients, c_0 is the constant term and L is a lag operator, such that, $L^n x_t = x_{t-n}$. Table 6 in the Appendix shows the estimates of the regression coefficients c_0, ρ's, θ's and γ respectively. Similarly, the WPI inflation the model is specified as

$$(1 - \alpha_1 L - \alpha_2 L^2)(1 - \tau L^7)\pi_t = c_1 + (1 + \pi_1 L + \pi_2 L^2)(1 + \delta L^{12})\epsilon_t \quad (5)$$

where α's, τ, π's and δ are the regression coefficients, c_1 is the constant term and L is the lag operator. Table 8 in the Appendix shows the estimates of the regression coefficients c_1, α's, τ, π's and δ respectively.

Using the estimates of equations (4) and (5), we forecast CPI and WPI inflation rates and those inflation forecasts are used for estimating equation (2). Tables 10.0, 12.0, 14.0, 15.0, 17.0 and 19.0 show the estimates of equation (2) for gold, silver and equity returns using forecasted values of CPI and WPI inflation rates as regressors. For proper inference from these estimations, we use robust standard errors. The results show that none of the assets under consideration are effective hedges against expected CPI inflation. The result is unsurprising given that in India the WPI instead of the CPI has been the dominant measure of inflation during our sample period. However, the estimated values of β_i for gold and silver nominal returns equations with WPI inflation forecasts as regressors are 1.006 and 1.383 respectively. Both these estimates are significant and in both cases we fail to reject the hypothesis that $\beta_i = 1$. Although we could not reject several hypotheses regarding β_i around the value of 1, given its estimated values, we conclude that gold and silver do serve as effective hedges against expected WPI inflation. We found Indian stocks to be an ineffective hedge against expected WPI inflation.

When inflation is uncertain, rational risk-averse investors would expect nominal asset returns to compensate them for facing such an uncertainty. Fama and Schwert (1977) extended their model beyond the traditional Fisher equation to reflect this inflation uncertainty by adding an unanticipated inflation component. They intended to test the extent to which the asset returns in their sample compensated investors against expected as well as unexpected inflation. Their augmented model thus became

$$E(R_{it}|\varphi_{t-1}) = E(r_{it}|\varphi_{t-1}) + E(\pi_t|\varphi_{t-1}) + \mu_i[\pi_t - E(\pi_t|\varphi_{t-1})] \quad (6)$$

The empirical model from equation (6) became

$$R_{it} = \alpha_i + \beta_i E(\pi_t|\varphi_{t-1}) + \mu_i[\pi_t - E(\pi_t|\varphi_{t-1})] + u_{it} \quad (7)$$

Using equation (7), the authors suggest that when we fail to reject the hypothesis that $\beta_i = 1$, we may conclude that the asset in question is a complete hedge against expected inflation, when the tests suggest that $\mu_i = 1$, then the asset is a complete hedge against unexpected inflation, and when we fail to reject the hypothesis that $\beta_i = \mu_i = 1$, then we say that the asset is a complete hedge against inflation.

Following Gultekin (1983), we use seasonal ARMA forecasts from equations (4) and (5) for CPI and WPI expected inflation rates and the corresponding inflation forecast errors as regressors in equation (7). Tables 10.1, 12.1, 14.1, 15.1, 17.1 and 19.1 show the estimates of equation (7) for gold, silver and equity returns. Again, for proper inference from these estimations we use robust standard errors. As before, the results show that none of these assets are effective hedges against expected and unexpected CPI inflation. However for the WPI inflation model, the estimated values of β_i for gold and silver nominal returns equations are 1.048 and 1.444 respectively. These estimates are again significant and in both cases we fail to reject the hypothesis that $\beta_i = 1$. Even though we could not reject several hypotheses regarding β_i around the value of 1, given its estimated values, we again conclude that gold and silver do serve as effective hedges against expected WPI inflation in the augmented Fisher equation. There is, however, no empirical evidence of gold and silver being hedges against unanticipated inflation. We again found Indian stocks to be an ineffective hedge against expected and unexpected WPI inflation.

Under an environment of inflation uncertainty, the theoretical literature suggests that risk-averse investors will demand an inflation risk premium in order to be compensated for the uncertainty in future inflation rates [Fischer (1975), Liviatan and Levhari (1977) and Landskroner and Liviatan (1981)]. This inflation risk premium is defined as the difference between the expected real return on a nominal bond and the expected riskless real interest rate (often represented by the expected real return on an inflation-indexed bond). According to Fischer (1975) the sign of the inflation risk premium is a function of the inflation-hedging capability of alternative securities, such as equities.

Using the Fischer (1975) framework, Chu et al. (1995) hypothesize that if the nominal returns on alternative assets are negatively correlated with unexpected inflation rate, then these assets are a poor hedge against uncertain inflation and that in turn will imply a positive inflation risk premium. Under the assumption of no correlation between the nominal return of an asset and that on an inflation-indexed bond, we show using Fischer (1975) that the expected nominal return of an asset to be

$$E(R_{it}|\varphi_{t-1}) = E(r_{it}|\varphi_{t-1}) + E(\pi_t|\varphi_{t-1}) - Var(\pi_t|\varphi_{t-1}) \quad (8)$$

where $Var(\pi_t|\varphi_{t-1})$ is the conditional variance of inflation. In fact, given that the market for inflation-indexed bonds had not yet fully formed in India during our sample period, the assumption of no correlation between the nominal return of an asset and that on an inflation-indexed bond is indeed quite defensible. Moreover, in order to maintain parity of units we estimate the following empirical model using equation (8):

$$R_{it} = \alpha_i + \beta_i E(\pi_t|\varphi_{t-1}) + \vartheta_i sd(\pi_t|\varphi_{t-1})] + v_{it} \quad (9)$$

where $sd(\pi_t|\varphi_{t-1})$ is the conditional standard deviation of inflation. Following the methods pioneered by Engle (1982) and Bollerslev (1986) for estimating inflation uncertainty, we propose a GARCH model for getting an estimate of the conditional variance (and hence a conditional standard deviation) of inflation for our empirical model. For an application of GARCH model in the Indian inflation context, see Thornton (2006). However, before we specify a GARCH model we test the presence of conditional heteroskedasticity in the error terms of the inflation models put forward in equations (4) and (5). Both the Q-statistics and the ARCH LM tests for the residuals of the two models point to the presence of conditional heteroskedasticity in error terms (see Figures 10 and 11 and Tables 20 and 21 in the Appendix for the test results). We therefore proceed to parameterize the conditional variance of the error terms in equations (4) and (5) as a GARCH (1, 1) process, given by

$$Var(\pi_t|\varphi_{t-1}) = E(\epsilon_t^2|\varphi_{t-1}) = a + b\epsilon_{t-1}^2 + cVar(\pi_{t-1}|\varphi_{t-2}) \quad (10)$$

Using the GARCH (1, 1) specification, we estimate both the conditional mean and variance of the CPI and WPI inflation rates. Moreover, the correlograms of residuals, as shown in Figures 12, 13, 14 and 15, and the ARCH LM tests of Tables 23 and 25 testify to the goodness of fit of the GARCH (1, 1) model for the conditional variance of the inflation error terms.

Finally, using the estimated conditional means and standard deviations of CPI and WPI inflation rates as regressors, we estimate equation (9) for our chosen asset returns. Similar to the other nominal return regressions, the results in Tables 26, 28 and 29 show that none of these assets are effective hedges against expected and unexpected CPI inflation. However for the WPI inflation model, the estimated values of β_i for gold and silver nominal returns equations are 1.211 and 1.658 respectively. These estimates are again significant and in both cases we fail to reject the hypothesis that $\beta_i = 1$. Even though we could not reject several hypotheses regarding β_i around the value of 1, given its estimated values, we again conclude that gold and silver do serve as effective hedges against expected WPI inflation in the augmented Fisher equation. We indeed have a weak evidence of negative correlation between the nominal returns of gold and silver and the conditional standard deviation of WPI inflation. This provides a hint, though not a clear evidence of the presence of a positive inflation premium. Finally, Indian equities are found to be uncorrelated with the expected WPI inflation; however, they exhibit a strong negative correlation with our measure of the WPI inflation uncertainty. This shows that equities serve a very poor hedge against unexpected inflation and hence we expect investors in India demanding a positive inflation risk premium in interest rates.

Conclusions

Inflation in India has been moderately high and volatile. Given such an environment, inflation hedging is bound to gain importance among rational risk-averse investors. In this paper, we extend the long literature on inflation hedging to the Indian market. When inflation is uncertain, then the nominal interest rate is theoretically known to include an inflation risk premium. The sign of the inflation risk premium is a function of the inflation-hedging capability of alternative securities, such as gold, silver and stocks. Using multiple empirically methodologies for testing the inflation hedging properties of assets, we consistently find gold and silver to be effective hedges against expected WPI inflation rate, the predominant measure of Indian inflation. Indian stocks, on the other hand, exhibit no inflation hedging properties against expected inflation, positive or negative.

We also extend the empirical literature by using the Fischer (1975) model to derive a new testable implication relating nominal asset return, expected inflation and conditional standard deviation of inflation. By testing a new augmented Fisher (1930) hypothesis, we find a weak evidence of correlation between gold and silver nominal returns and the conditional standard deviation of WPI inflation, thus hinting towards a possibility, if not a clear evidence, of a positive inflation risk premium. As for Indian equities, we indeed find a strong negative correlation between the nominal returns and the conditional standard deviation of WPI inflation. Hence, we find that Indian stocks are a poor hedge against unexpected component of India's main inflation measure and hence we argue that Indian interest rates will include a positive inflation risk premium.

Bond market in India, corporate and Government, has yet to fully mature. More importantly, the inflation-indexed bonds have just been launched in India. Although we found empirical evidence of a positive inflation risk premium in Indian interest rates, given the current deficiencies of the Indian bond market, we could not provide a direct measure of the inflation risk premium. As an extension of this study, we propose to directly measure the inflation risk premium in Indian interest rates using the real return on India's inflation-indexed bond as the measure of the riskless real interest rate.

References

Bollerslev, T. P. (1986), 'Generalized Autoregressive Conditional Heteroscedasticity'. *Journal of Econometrics*, 31, 307-327.

Body, Z. (1976), 'Common Stocks as a Hedge against Inflation'. *Journal of Finance*, 31, 459-470.

Chu, Q., Lee, C. and Pittman, D. (1995), 'On the Inflation Risk Premium'. *Journal of Business Finance & Accounting*, 22, 881-892.

Engle, R.F. (1982), 'Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation'. *Econometrica*, 50, 987-1007.

Fama, E.F. (1975), 'Short-term Interest Rates as Predictors of Inflation'. *American Economic Review*, 65, 269-282.

Fama, E.F. (1976), 'Inflation Uncertainty and Expected Returns on Treasury Bills'. *Journal of Political Economy*, 84, 427-448.

Fama, E.F. and Schwert, G.W. (1977), 'Asset Returns and Inflation'. *Journal of Financial Economics*, 5, 115-146.

Fischer, S. (1975), 'The Demand for Index Bonds'. *Journal of Political Economy*, 83, 509-534.

Fisher, I. (1930), 'Theory of Interest Rates' (MacMillan, New York).

Gultekin, N.B. (1983), 'Stock Market Returns and Inflation: Evidence from Other Countries'. *Journal of Finance*, 38, 49-65.

Jaffe, J. and Mandelker, G. (1976), 'The 'Fisher Effect' for Risky Assets: An Empirical Investigation'. *Journal of Finance*, 31, 447-458.

Landskroner, Y. and Liviatan, N. (1981), 'Risk Premia and the Sources of Inflation', *Journal of Money, Credit, and Banking*, 13, 205-214.

Lintner, J. (1975), 'Inflation and Security Returns'. *Journal of Finance*, 30, 259-280.
Liviatan, N. and Levhari, D. (1977), 'Risk and the Theory of Indexed Bonds'. *American Economic Review*, 67, 366-375.
Mayya, M. R. (1977), 'Do Equities Act as a Hedge against Inflation'. *Economic and Political Weekly*, 12, 61-71.
Nelson, C.R. (1976), 'Inflation and Rates of Return on Common Stocks'. *Journal of Finance*, 31, 471-483.
Prabhakaran, M. (1989), 'Do Equities Act as a Hedge against Inflation?' *Economic and Political Weekly*, 24, 24-26.
Thornton, J. (2006), 'Inflation and Inflation Uncertainty in India, 1957-2005'. *Indian Economic Review*, 41, 1-8.

Appendix

Figure 1: WPI Inflation for India (1961 January to 2013 December)

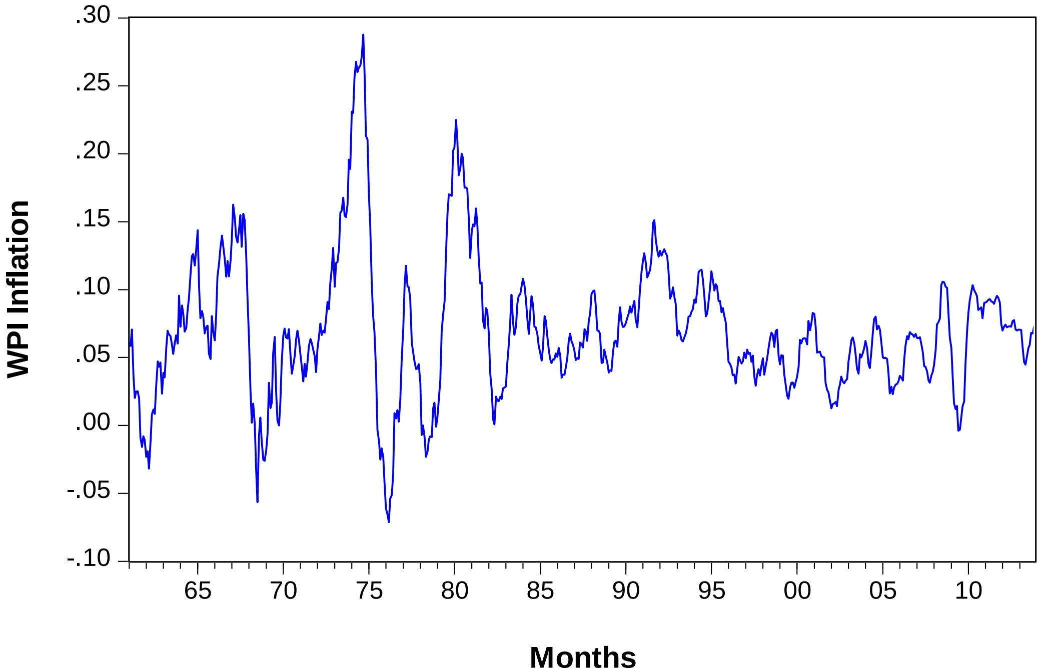


Figure 2: CPI Inflation for India (1961 January to 2013 December)

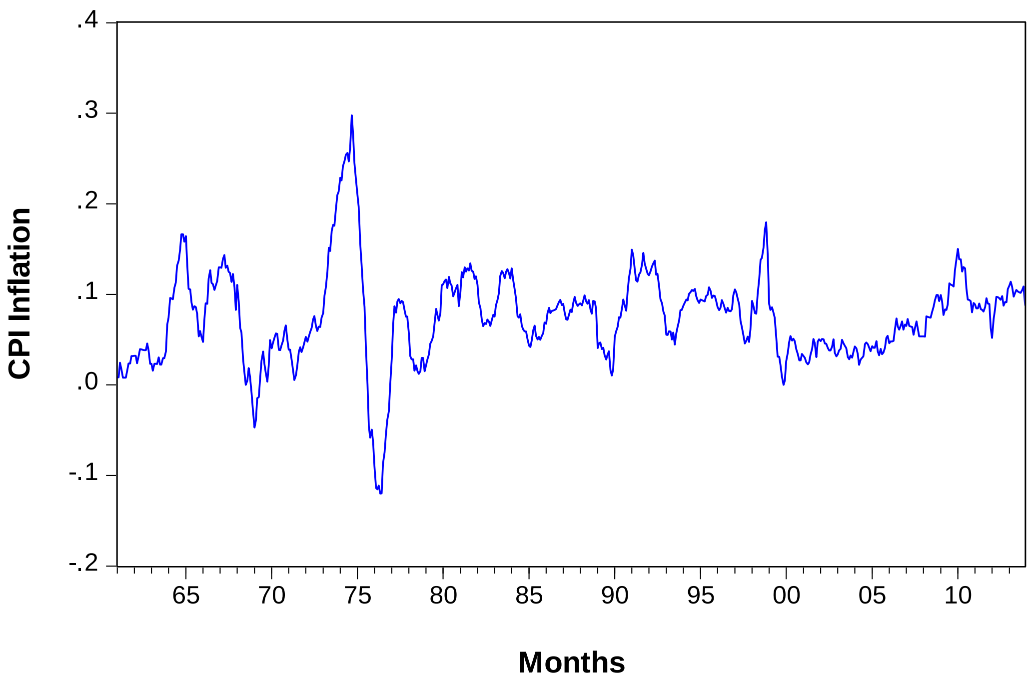


Figure 3: Return on Gold (1991 April to 2013 December)

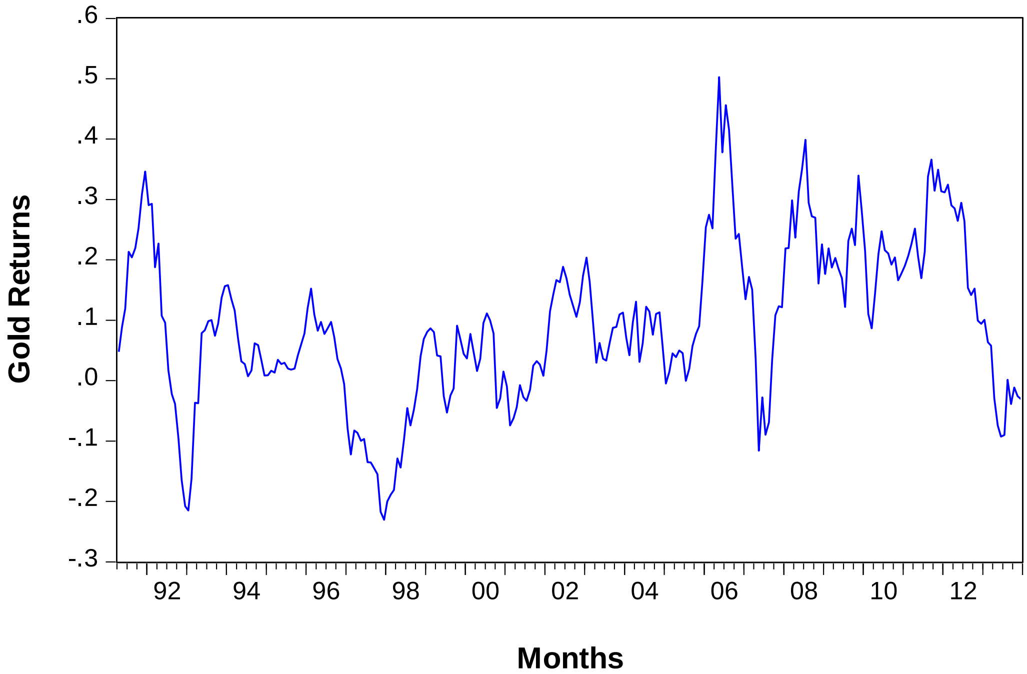


Figure 4: Return on Silver (1991 April to 2013 December)

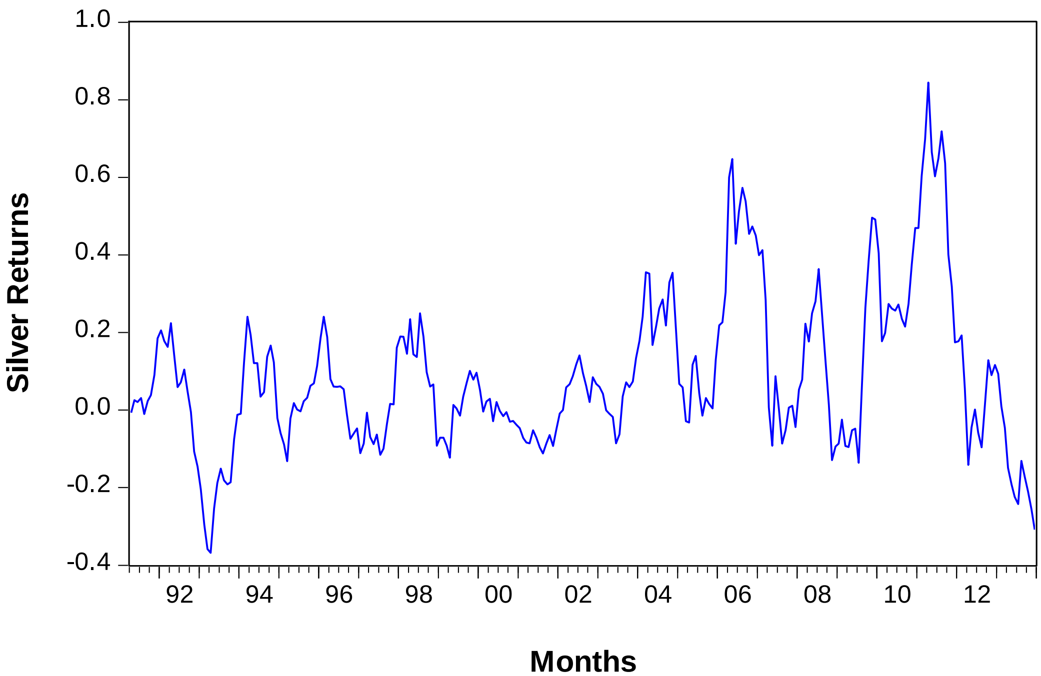


Figure 5: Return on Stock (1961 January to 2013 December)

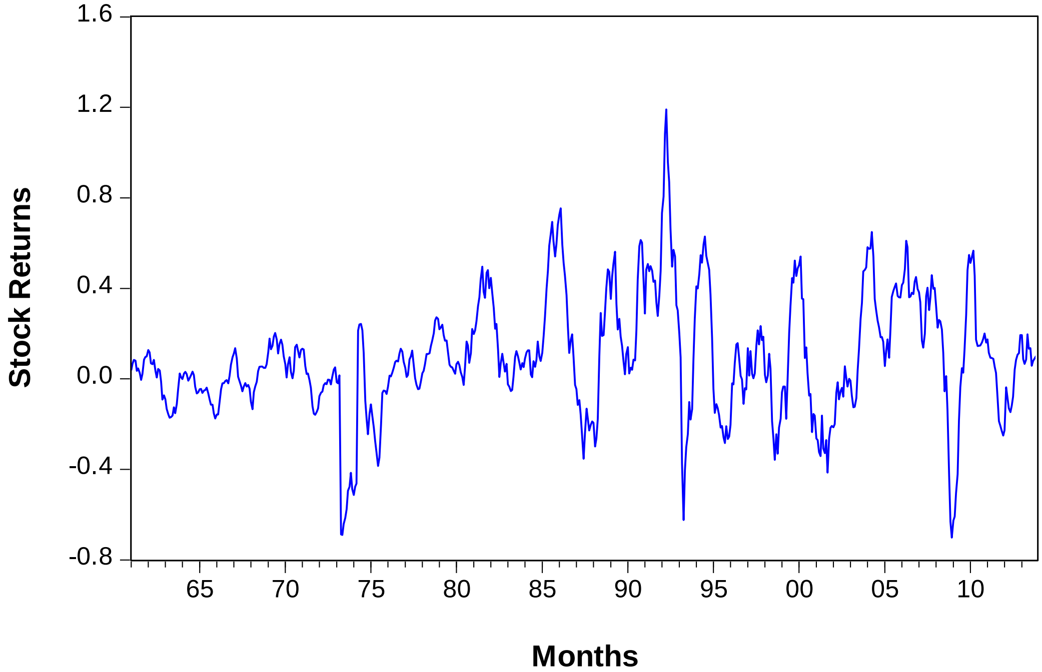


Table 1.1: CPI Inflation Unit Root Tests

Null Hypothesis: CPI Inflation has unit root
Exogenous: Constant

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.692412	0.0001
Test critical values:	1% level	-3.440634	
	5% level	-2.865969	
	10% level	-2.569187	

Table 1.2: CPI Inflation Unit Root Tests

Null Hypothesis: CPI Inflation has unit root
Exogenous: Constant

		Adj. t-Stat	Prob.
Phillips-Perron test statistic		-4.657930	0.0001
Test critical values:	1% level	-3.440419	
	5% level	-2.865874	
	10% level	-2.569136	

Table 2.1: WPI Inflation Unit Root Tests

Null Hypothesis: WPI Inflation has unit root
Exogenous: Constant

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.602654	0.0001
Test critical values:	1% level	-3.440634	
	5% level	-2.865969	
	10% level	-2.569187	

Table 2.2: WPI Inflation Unit Root Tests

Null Hypothesis: WPI Inflation has unit root
Exogenous: Constant

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-4.788778	0.0001
Test critical values:	1% level	-3.440419	
	5% level	-2.865874	
	10% level	-2.569136	

Table 3.1: Gold Returns Unit Root Tests

Null Hypothesis: Gold Returns has unit root
Exogenous: None

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-1.767149	0.0734
Test critical values:	1% level	-2.573886	
	5% level	-1.942050	
	10% level	-1.615885	

Table 3.2: Gold Returns Unit Root Tests

Null Hypothesis: Gold Returns has unit root
Exogenous: None

		Adj. t-Stat	Prob.
Phillips-Perron test statistic		-2.859838	0.0043
Test critical values:	1% level	-2.573491	
	5% level	-1.941995	
	10% level	-1.615920	

Table 4.1: Silver Returns Unit Root Tests

Null Hypothesis: Silver Returns has unit root
Exogenous: None

		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-1.890147	0.0562
Test critical values:	1% level	-2.573886	
	5% level	-1.942050	
	10% level	-1.615885	

Table 4.2: Silver Returns Unit Root Tests

Null Hypothesis: Silver Returns has a unit root
Exogenous: None

		Adj. t-Stat	Prob.
Phillips-Perron test statistic		-3.374215	0.0008
Test critical values:	1% level	-2.573491	
	5% level	-1.941995	
	10% level	-1.615920	

Table 5.1: Stock Returns Unit Root Tests

Null Hypothesis: Stock Returns has unit root
Exogenous: Constant

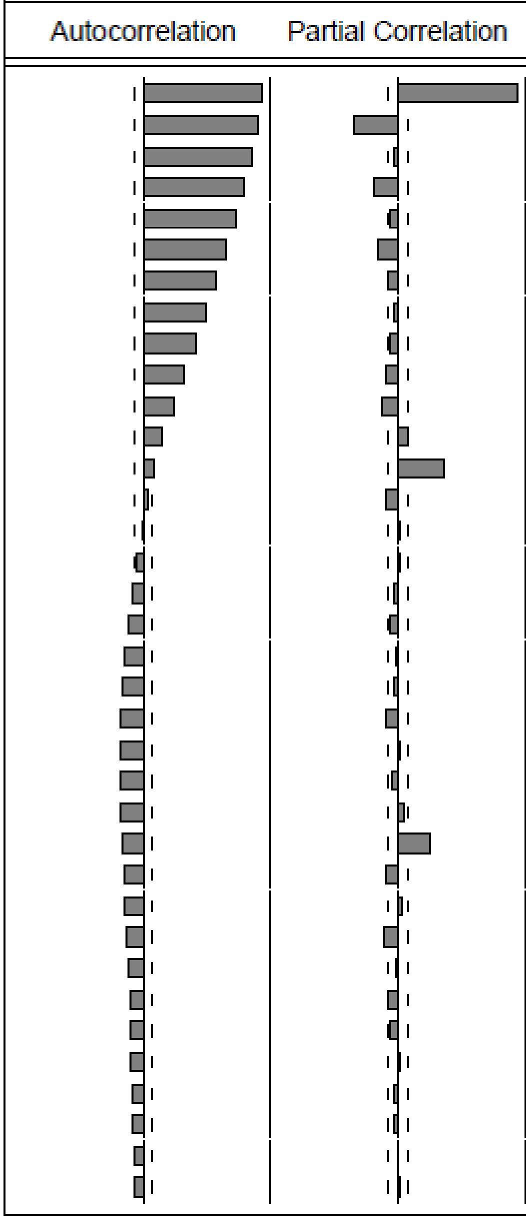
		t-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.288548	0.0005
Test critical values:	1% level	-3.440634	
	5% level	-2.865969	
	10% level	-2.569187	

Table 5.2: Stock Returns Unit Root Tests

Null Hypothesis: Stock Returns has unit root
Exogenous: Constant

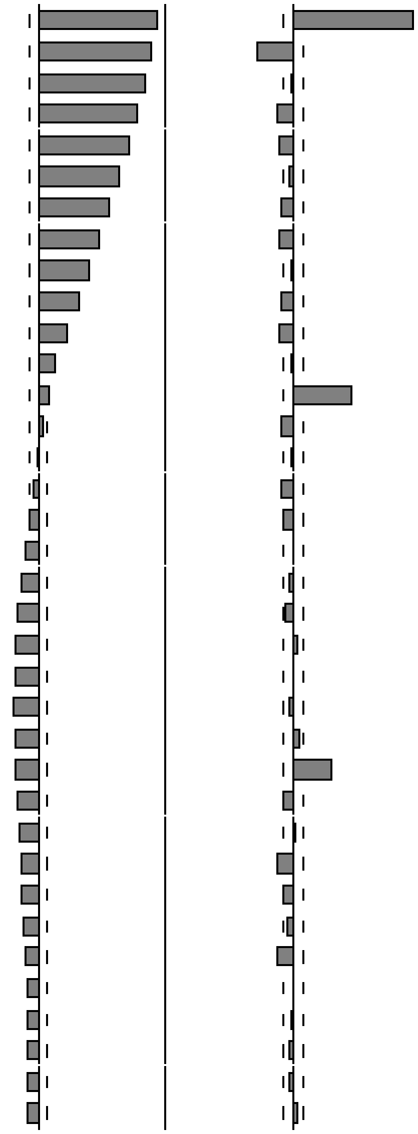
		Adj. t-Stat	Prob.
Phillips-Perron test statistic		-5.598838	0.0000
Test critical values:	1% level	-3.440419	
	5% level	-2.865874	
	10% level	-2.569136	

Figure 6: Correlogram of CPI Inflation



Lag	AC	PAC	Q-Stat	Prob
1	0.974	0.974	605.91	0.000
2	0.930	-0.356	1159.2	0.000
3	0.880	-0.031	1655.2	0.000
4	0.820	-0.193	2086.8	0.000
5	0.753	-0.065	2451.9	0.000
6	0.679	-0.157	2748.8	0.000
7	0.598	-0.079	2979.7	0.000
8	0.515	-0.032	3151.2	0.000
9	0.430	-0.069	3271.0	0.000
10	0.342	-0.092	3346.8	0.000
11	0.249	-0.127	3387.2	0.000
12	0.161	0.082	3404.2	0.000
13	0.095	0.380	3410.0	0.000
14	0.037	-0.094	3410.9	0.000
15	-0.015	0.024	3411.1	0.000
16	-0.058	0.009	3413.3	0.000
17	-0.095	-0.038	3419.2	0.000
18	-0.126	-0.071	3429.6	0.000
19	-0.149	-0.020	3444.2	0.000
20	-0.168	-0.027	3462.8	0.000
21	-0.184	-0.093	3485.0	0.000
22	-0.192	0.017	3509.3	0.000
23	-0.192	-0.048	3533.7	0.000
24	-0.188	0.053	3557.0	0.000
25	-0.176	0.261	3577.7	0.000
26	-0.163	-0.097	3595.4	0.000
27	-0.148	0.026	3610.0	0.000
28	-0.136	-0.119	3622.4	0.000
29	-0.125	-0.019	3632.9	0.000
30	-0.114	-0.075	3641.6	0.000
31	-0.106	-0.061	3649.2	0.000
32	-0.098	0.018	3655.7	0.000
33	-0.089	-0.040	3661.1	0.000
34	-0.083	-0.039	3665.7	0.000
35	-0.079	-0.003	3669.9	0.000
36	-0.077	0.010	3674.0	0.000

Figure 7: Correlogram of WPI Inflation



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.968	0.968	598.19	0.000
		2	0.917	-0.293	1136.9	0.000
		3	0.863	-0.024	1614.1	0.000
		4	0.801	-0.133	2026.1	0.000
		5	0.731	-0.116	2370.0	0.000
		6	0.659	-0.035	2649.4	0.000
		7	0.582	-0.099	2867.8	0.000
		8	0.498	-0.121	3028.3	0.000
		9	0.414	-0.016	3139.5	0.000
		10	0.328	-0.102	3209.3	0.000
		11	0.237	-0.122	3245.9	0.000
		12	0.147	-0.010	3260.0	0.000
		13	0.089	0.469	3265.2	0.000
		14	0.042	-0.097	3266.3	0.000
		15	-0.002	-0.013	3266.3	0.000
		16	-0.043	-0.101	3267.5	0.000
		17	-0.080	-0.074	3271.7	0.000
		18	-0.114	-0.006	3280.2	0.000
		19	-0.143	-0.038	3293.6	0.000
		20	-0.166	-0.058	3311.6	0.000
		21	-0.183	0.029	3333.8	0.000
		22	-0.195	-0.002	3358.8	0.000
		23	-0.198	-0.034	3384.7	0.000
		24	-0.192	0.042	3409.2	0.000
		25	-0.183	0.313	3431.4	0.000
		26	-0.173	-0.083	3451.2	0.000
		27	-0.160	0.013	3468.3	0.000
		28	-0.146	-0.132	3482.6	0.000
		29	-0.132	-0.083	3494.3	0.000
		30	-0.118	-0.048	3503.6	0.000
		31	-0.108	-0.132	3511.5	0.000
		32	-0.098	-0.004	3517.9	0.000
		33	-0.089	-0.014	3523.2	0.000
		34	-0.084	-0.036	3528.0	0.000
		35	-0.083	-0.026	3532.7	0.000
		36	-0.085	0.030	3537.6	0.000

Table 6: Sesonal ARMA (2, 3) Model Estimation Output

Dependent Variable: CPI Inflation
Method: Least Squares
Sample (adjusted): 1961M03 2013M12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.075689	0.001602	47.25527	0.0000
AR(1)	1.890631	0.040047	47.21034	0.0000
AR(2)	-0.894925	0.039479	-22.66832	0.0000
MA(1)	-0.591515	0.055555	-10.64732	0.0000
MA(2)	-0.205901	0.047821	-4.305654	0.0000
MA(3)	0.089554	0.042561	2.104109	0.0358
SMA(12)	-0.961524	0.008115	-118.4809	0.0000

R-squared	0.978334	Mean dependent var	0.074384
Adjusted R-squared	0.978126	S.D. dependent var	0.051674
S.E. of regression	0.007642	Akaike info criterion	-6.899220
Sum squared resid	0.036621	Schwarz criterion	-6.850065
Log likelihood	2194.053	Hannan-Quinn criter.	-6.880132
F-statistic	4718.639	Durbin-Watson stat	1.995638
Prob(F-statistic)	0.000000		

Figure 8: Correlogram of Residuals for SARMA (2, 3) Model of CPI Inflation

Q-statistic probabilities adjusted for 6 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.003	-0.003	0.0054	
		2	0.006	0.006	0.0305	
		3	-0.015	-0.015	0.1827	
		4	-0.044	-0.044	1.4165	
		5	0.032	0.032	2.0577	
		6	0.034	0.034	2.7860	
		7	-0.024	-0.026	3.1587	0.076
		8	0.018	0.017	3.3734	0.185
		9	0.033	0.037	4.0735	0.254
		10	0.086	0.088	8.8472	0.065
		11	-0.007	-0.011	8.8813	0.114
		12	0.002	0.003	8.8829	0.180
		13	-0.041	-0.035	9.9696	0.190
		14	-0.022	-0.019	10.292	0.245
		15	-0.054	-0.062	12.174	0.204
		16	-0.007	-0.013	12.209	0.271
		17	0.020	0.020	12.458	0.330
		18	-0.022	-0.028	12.767	0.386
		19	-0.018	-0.026	12.979	0.449
		20	0.044	0.042	14.256	0.431
		21	-0.036	-0.027	15.098	0.444
		22	-0.041	-0.047	16.218	0.438
		23	-0.026	-0.017	16.648	0.478
		24	-0.062	-0.048	19.210	0.379
		25	0.014	0.017	19.333	0.436
		26	0.020	0.013	19.591	0.484
		27	0.062	0.066	22.186	0.389
		28	0.020	0.020	22.448	0.433
		29	0.039	0.043	23.447	0.435
		30	0.008	0.008	23.492	0.491
		31	-0.020	-0.011	23.770	0.533
		32	-0.042	-0.037	24.975	0.520
		33	0.025	0.029	25.404	0.552
		34	0.003	0.007	25.411	0.605
		35	0.011	-0.000	25.494	0.652
		36	0.060	0.049	27.911	0.575

Table 7: Breusch-Godfrey Serial Correlation LM Test for SARMA (2, 3) Model of CPI Inflation

F-statistic	0.808423	Prob. F(36,591)	0.7810
Obs*R-squared	28.89240	Prob. Chi-Square(36)	0.7939

Table 8: Seasonal ARMA (2, 2) Model Estimation Output

Dependent Variable: WPI Inflation
Method: Least Squares
Sample (adjusted): 1961M10 2013M12

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.070241	0.003526	19.92283	0.0000
AR(1)	1.879827	0.067195	27.97559	0.0000
AR(2)	-0.882376	0.066437	-13.28138	0.0000
SAR(7)	0.082353	0.041925	1.964303	0.0499
MA(1)	-0.610439	0.080261	-7.605698	0.0000
MA(2)	-0.153839	0.050964	-3.018569	0.0026
SMA(12)	-0.934345	0.014697	-63.57385	0.0000

R-squared	0.971363	Mean dependent var	0.070285
Adjusted R-squared	0.971086	S.D. dependent var	0.051179
S.E. of regression	0.008703	Akaike info criterion	-6.639296
Sum squared resid	0.046956	Schwarz criterion	-6.589716
Log likelihood	2088.419	Hannan-Quinn criter.	-6.620034
F-statistic	3505.078	Durbin-Watson stat	2.002129
Prob(F-statistic)	0.000000		

Figure 9: Correlogram of Residuals for SARMA (2, 2) Model of WPI Inflation

Q-statistic probabilities adjusted for 6 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.004	-0.004	0.0107	
		2	-0.020	-0.020	0.2580	
		3	0.022	0.022	0.5747	
		4	0.012	0.012	0.6621	
		5	-0.009	-0.008	0.7135	
		6	0.027	0.027	1.1691	
		7	0.002	0.001	1.1708	0.279
		8	-0.048	-0.046	2.6184	0.270
		9	0.019	0.018	2.8505	0.415
		10	0.077	0.075	6.6809	0.154
		11	0.061	0.065	9.0259	0.108
		12	-0.060	-0.057	11.301	0.080
		13	-0.051	-0.055	12.951	0.073
		14	-0.029	-0.034	13.489	0.096
		15	0.020	0.021	13.756	0.131
		16	0.006	0.004	13.776	0.183
		17	-0.002	-0.001	13.778	0.246
		18	0.002	0.010	13.779	0.315
		19	-0.003	0.001	13.786	0.389
		20	-0.054	-0.067	15.677	0.333
		21	-0.031	-0.046	16.283	0.363
		22	-0.002	-0.000	16.287	0.433
		23	-0.050	-0.029	17.927	0.393
		24	-0.014	-0.004	18.051	0.452
		25	0.015	0.008	18.200	0.509
		26	-0.030	-0.036	18.792	0.535
		27	0.001	0.002	18.793	0.598
		28	-0.019	-0.027	19.038	0.643
		29	0.018	0.021	19.247	0.687
		30	0.025	0.040	19.675	0.715
		31	-0.027	-0.016	20.163	0.738
		32	-0.009	-0.010	20.220	0.781
		33	0.013	0.006	20.333	0.817
		34	0.083	0.083	24.907	0.633
		35	0.022	0.022	25.236	0.666
		36	0.075	0.077	29.026	0.516

Table 9: Breusch-Godfrey Serial Correlation LM Test for SARMA (2, 2) Model of WPI Inflation

F-statistic	0.826101	Prob. F(36,584)	0.7554
Obs*R-squared	30.03772	Prob. Chi-Square(36)	0.7473

Table 10.0: Gold Returns and Expected Inflation

Dependent Variable: Gold Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.044416	0.032571	1.363657	0.1738
CPI Inflation Forecast	0.656105	0.402034	1.631964	0.1038

R-squared	0.025813	Mean dependent var	0.093852
Adjusted R-squared	0.022218	S.D. dependent var	0.133672
S.E. of regression	0.132179	Akaike info criterion	-1.202018
Sum squared resid	4.734730	Schwarz criterion	-1.175575
Log likelihood	166.0755	Hannan-Quinn criter.	-1.191403
F-statistic	7.180540	Durbin-Watson stat	0.132774
Prob(F-statistic)	0.007821	Wald F-statistic	2.663307
Prob(Wald F-statistic)	0.103848		

Table 10.1: Gold Returns, Expected Inflation and Unexpected Inflation

Dependent Variable: Gold Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.045912	0.032543	1.410821	0.1594
CPI Inflation Forecast	0.638959	0.404426	1.579914	0.1153
Forecast Error	-1.174602	1.344123	-0.873880	0.3830

R-squared	0.029449	Mean dependent var	0.093852
Adjusted R-squared	0.022260	S.D. dependent var	0.133672
S.E. of regression	0.132176	Akaike info criterion	-1.198432
Sum squared resid	4.717056	Schwarz criterion	-1.158767
Log likelihood	166.5859	Hannan-Quinn criter.	-1.182510
F-statistic	4.096238	Durbin-Watson stat	0.143344
Prob(F-statistic)	0.017680	Wald F-statistic	2.240224
Prob(Wald F-statistic)	0.108409		

Table 11.0: Gold as a Hedge Against Expected Inflation

Wald Test:
Equation: Gold Returns

Test Statistic	Value	df	Probability
t-statistic	-0.855387	271	0.3931
F-statistic	0.731687	(1, 271)	0.3931
Chi-square	0.731687	1	0.3923

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	-0.343895	0.402034

Restrictions are linear in coefficients.

Table 11.1: Gold as a Hedge Against Expected Inflation

Wald Test:
Equation: Gold Returns

Test Statistic	Value	df	Probability
t-statistic	-0.892725	270	0.3728
F-statistic	0.796958	(1, 270)	0.3728
Chi-square	0.796958	1	0.3720

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	-0.361041	0.404426

Restrictions are linear in coefficients.

Table 12.0: Silver Returns and Expected Inflation

Dependent Variable: Silver Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.041440	0.045940	0.902065	0.3678
CPI Inflation Forecast	0.607535	0.549925	1.104758	0.2702

R-squared	0.009740	Mean dependent var	0.087217
Adjusted R-squared	0.006086	S.D. dependent var	0.201500
S.E. of regression	0.200886	Akaike info criterion	-0.364863
Sum squared resid	10.93622	Schwarz criterion	-0.338420
Log likelihood	51.80374	Hannan-Quinn criter.	-0.354248
F-statistic	2.665509	Durbin-Watson stat	0.147629
Prob(F-statistic)	0.103706	Wald F-statistic	1.220491
Prob(Wald F-statistic)	0.270244		

Table 12.1: Silver Returns, Expected Inflation and Unexpected Inflation

Dependent Variable: Silver Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.041902	0.046549	0.900155	0.3688
CPI Inflation Forecast	0.602252	0.552647	1.089760	0.2768
Forecast Error	-0.361853	1.692534	-0.213794	0.8309

R-squared	0.009892	Mean dependent var	0.087217
Adjusted R-squared	0.002558	S.D. dependent var	0.201500
S.E. of regression	0.201242	Akaike info criterion	-0.357690
Sum squared resid	10.93454	Schwarz criterion	-0.318025
Log likelihood	51.82468	Hannan-Quinn criter.	-0.341768
F-statistic	1.348748	Durbin-Watson stat	0.148654
Prob(F-statistic)	0.261308	Wald F-statistic	0.659931
Prob(Wald F-statistic)	0.517719		

Table 13.0: Silver as a Hedge Against Expected Inflation

Wald Test:			
Equation: Silver Returns			
Test Statistic	Value	df	Probability
t-statistic	-0.713670	271	0.4760
F-statistic	0.509325	(1, 271)	0.4760
Chi-square	0.509325	1	0.4754
Null Hypothesis: C(2) = 1			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
-1 + C(2)		-0.392465	0.549925
Restrictions are linear in coefficients.			

Table 13.1: Silver as a Hedge Against Expected Inflation

Wald Test:			
Equation: Silver Returns			
Test Statistic	Value	df	Probability
t-statistic	-0.719714	270	0.4723
F-statistic	0.517989	(1, 270)	0.4723
Chi-square	0.517989	1	0.4717
Null Hypothesis: C(2) = 1			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
-1 + C(2)		-0.397748	0.552647
Restrictions are linear in coefficients.			

Table 14.0: Stock Returns and Expected Inflation

Dependent Variable: Stock Returns
Method: Least Squares
Sample (adjusted): 1961M03 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 7.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.117310	0.035708	3.285247	0.0011
CPI Inflation Forecast	-0.355350	0.475161	-0.747852	0.4548

R-squared	0.004670	Mean dependent var	0.090979
Adjusted R-squared	0.003095	S.D. dependent var	0.265184
S.E. of regression	0.264774	Akaike info criterion	0.183266
Sum squared resid	44.30637	Schwarz criterion	0.197310
Log likelihood	-56.09523	Hannan-Quinn criter.	0.188719
F-statistic	2.965461	Durbin-Watson stat	0.115283
Prob(F-statistic)	0.085549	Wald F-statistic	0.559282
Prob(Wald F-statistic)	0.454828		

Table 14.1: Stock Returns, Expected Inflation and Unexpected Inflation

Dependent Variable: Stock Returns
Method: Least Squares
Sample (adjusted): 1961M03 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 7.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.117396	0.035789	3.280251	0.0011
CPI Inflation Forecast	-0.353805	0.474088	-0.746285	0.4558
Forecast Error	-0.698738	1.332069	-0.524551	0.6001

R-squared	0.005071	Mean dependent var	0.090979
Adjusted R-squared	0.001918	S.D. dependent var	0.265184
S.E. of regression	0.264930	Akaike info criterion	0.186017
Sum squared resid	44.28852	Schwarz criterion	0.207084
Log likelihood	-55.96749	Hannan-Quinn criter.	0.194198
F-statistic	1.608142	Durbin-Watson stat	0.115490
Prob(F-statistic)	0.201079	Wald F-statistic	0.329376
Prob(Wald F-statistic)	0.719496		

Table 15.0: Gold Returns and Expected Inflation

Dependent Variable: Gold Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.028813	0.038943	0.739869	0.4600
WPI Inflation Forecast	1.006497	0.522989	1.924508	0.0553

R-squared	0.047835	Mean dependent var	0.093852
Adjusted R-squared	0.044322	S.D. dependent var	0.133672
S.E. of regression	0.130677	Akaike info criterion	-1.224884
Sum squared resid	4.627695	Schwarz criterion	-1.198441
Log likelihood	169.1966	Hannan-Quinn criter.	-1.214269
F-statistic	13.61460	Durbin-Watson stat	0.138212
Prob(F-statistic)	0.000271	Wald F-statistic	3.703732
Prob(Wald F-statistic)	0.055338		

Table 15.1: Gold Returns, Expected Inflation and Unexpected Inflation

Dependent Variable: Gold Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.026659	0.039054	0.682606	0.4954
WPI Inflation Forecast	1.048238	0.526914	1.989392	0.0477
Forecast Error	1.674138	1.182229	1.416086	0.1579

R-squared	0.054351	Mean dependent var	0.093852
Adjusted R-squared	0.047346	S.D. dependent var	0.133672
S.E. of regression	0.130470	Akaike info criterion	-1.224424
Sum squared resid	4.596028	Schwarz criterion	-1.184760
Log likelihood	170.1339	Hannan-Quinn criter.	-1.208502
F-statistic	7.759069	Durbin-Watson stat	0.134565
Prob(F-statistic)	0.000529	Wald F-statistic	2.625115
Prob(Wald F-statistic)	0.074280		

Table 16.0: Gold as a Hedge Against Expected Inflation

Wald Test:
Equation: Gold Returns

Test Statistic	Value	df	Probability
t-statistic	0.012423	271	0.9901
F-statistic	0.000154	(1, 271)	0.9901
Chi-square	0.000154	1	0.9901

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	0.006497	0.522989

Restrictions are linear in coefficients.

Table 16.1: Gold as a Hedge Against Expected Inflation

Wald Test:
Equation: Gold Returns

Test Statistic	Value	df	Probability
t-statistic	0.091548	270	0.9271
F-statistic	0.008381	(1, 270)	0.9271
Chi-square	0.008381	1	0.9271

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	0.048238	0.526914

Restrictions are linear in coefficients.

Table 17.0: Silver Returns and Expected Inflation

Dependent Variable: Silver Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002176	0.039670	-0.054858	0.9563
WPI Inflation Forecast	1.383387	0.662171	2.089168	0.0376

R-squared	0.039769	Mean dependent var	0.087217
Adjusted R-squared	0.036226	S.D. dependent var	0.201500
S.E. of regression	0.197816	Akaike info criterion	-0.395656
Sum squared resid	10.60459	Schwarz criterion	-0.369213
Log likelihood	56.00707	Hannan-Quinn criter.	-0.385041
F-statistic	11.22376	Durbin-Watson stat	0.152865
Prob(F-statistic)	0.000922	Wald F-statistic	4.364624
Prob(Wald F-statistic)	0.037625		

Table 17.1: Silver Returns, Expected Inflation and Unexpected Inflation

Dependent Variable: Silver Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.005299	0.040158	-0.131954	0.8951
WPI Inflation Forecast	1.443892	0.681195	2.119648	0.0349
Forecast Error	2.426751	1.790858	1.355077	0.1765

R-squared	0.045794	Mean dependent var	0.087217
Adjusted R-squared	0.038726	S.D. dependent var	0.201500
S.E. of regression	0.197560	Akaike info criterion	-0.394624
Sum squared resid	10.53805	Schwarz criterion	-0.354960
Log likelihood	56.86624	Hannan-Quinn criter.	-0.378702
F-statistic	6.478880	Durbin-Watson stat	0.149793
Prob(F-statistic)	0.001785	Wald F-statistic	2.736129
Prob(Wald F-statistic)	0.066619		

Table 18.0: Silver Returns as a Hedge Against Expected Inflation

Wald Test:
Equation: Silver Returns

Test Statistic	Value	df	Probability
t-statistic	0.578985	271	0.5631
F-statistic	0.335223	(1, 271)	0.5631
Chi-square	0.335223	1	0.5626

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	0.383387	0.662171

Restrictions are linear in coefficients.

Table 18.1: Silver Returns as a Hedge Against Expected Inflation

Wald Test:
Equation: Silver Returns

Test Statistic	Value	df	Probability
t-statistic	0.651638	270	0.5152
F-statistic	0.424632	(1, 270)	0.5152
Chi-square	0.424632	1	0.5146

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	0.443892	0.681195

Restrictions are linear in coefficients.

Table 19.0: Stock Returns and Expected Inflation

Dependent Variable: Stock Returns
Method: Least Squares
Sample (adjusted): 1961M10 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 7.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.114539	0.033799	3.388798	0.0007
WPI Inflation Forecast	-0.328237	0.437396	-0.750434	0.4533

R-squared	0.003829	Mean dependent var	0.091537
Adjusted R-squared	0.002236	S.D. dependent var	0.266591
S.E. of regression	0.266293	Akaike info criterion	0.194747
Sum squared resid	44.32004	Schwarz criterion	0.208913
Log likelihood	-59.05322	Hannan-Quinn criter.	0.200251
F-statistic	2.402575	Durbin-Watson stat	0.115319
Prob(F-statistic)	0.121642	Wald F-statistic	0.563151
Prob(Wald F-statistic)	0.453276		

Table 19.1 Stock Returns, Expected Inflation and Unexpected Inflation

Dependent Variable: Stock Returns
Method: Least Squares
Sample (adjusted): 1961M10 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 7.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.114596	0.033821	3.388309	0.0007
WPI Inflation Forecast	-0.332746	0.438286	-0.759197	0.4480
Forecast Error	1.246745	1.453772	0.857593	0.3914

R-squared	0.005468	Mean dependent var	0.091537
Adjusted R-squared	0.002281	S.D. dependent var	0.266591
S.E. of regression	0.266287	Akaike info criterion	0.196290
Sum squared resid	44.24713	Schwarz criterion	0.217539
Log likelihood	-58.53705	Hannan-Quinn criter.	0.204546
F-statistic	1.715467	Durbin-Watson stat	0.118586
Prob(F-statistic)	0.180727	Wald F-statistic	1.135820
Prob(Wald F-statistic)	0.321822		

Figure 10: Correlogram of Squared Residuals for SARMA (2, 3) Model of CPI Inflation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.166	0.166	17.606	0.000
		2	0.083	0.057	22.016	0.000
		3	0.047	0.025	23.430	0.000
		4	0.069	0.054	26.442	0.000
		5	0.043	0.021	27.651	0.000
		6	0.086	0.070	32.411	0.000
		7	0.103	0.076	39.292	0.000
		8	0.060	0.021	41.640	0.000
		9	0.052	0.025	43.411	0.000
		10	0.122	0.098	52.991	0.000
		11	0.022	-0.028	53.318	0.000
		12	0.081	0.060	57.547	0.000
		13	0.061	0.023	59.927	0.000
		14	0.087	0.048	64.814	0.000
		15	0.023	-0.016	65.145	0.000
		16	-0.005	-0.040	65.159	0.000
		17	0.057	0.041	67.307	0.000
		18	-0.037	-0.074	68.194	0.000
		19	0.014	0.004	68.322	0.000
		20	0.035	0.011	69.127	0.000
		21	0.043	0.021	70.327	0.000
		22	-0.006	-0.032	70.349	0.000
		23	-0.016	-0.025	70.511	0.000
		24	0.021	0.012	70.800	0.000
		25	-0.043	-0.049	72.049	0.000
		26	-0.001	0.007	72.050	0.000
		27	-0.009	-0.025	72.107	0.000
		28	-0.064	-0.055	74.858	0.000
		29	-0.000	0.019	74.858	0.000
		30	-0.006	0.002	74.884	0.000
		31	-0.019	-0.022	75.126	0.000
		32	-0.037	-0.012	76.043	0.000
		33	-0.049	-0.037	77.622	0.000
		34	0.019	0.037	77.877	0.000
		35	0.038	0.065	78.862	0.000
		36	0.012	-0.001	78.960	0.000

Table 20: ARCH LM Test for Sesonal ARMA (2, 3) Model of CPI Inflation

Heteroskedasticity Test: ARCH			
F-statistic	3.170251	Prob. F(12,609)	0.0002
Obs*R-squared	36.57060	Prob. Chi-Square(12)	0.0003

Figure 11: Correlogram of Squared Residuals for SARMA (2, 2) Model of WPI Inflation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.115	0.115	8.2875	0.004
		2	0.156	0.145	23.625	0.000
		3	0.169	0.142	41.705	0.000
		4	0.140	0.095	54.028	0.000
		5	0.090	0.032	59.218	0.000
		6	0.116	0.058	67.768	0.000
		7	0.098	0.041	73.828	0.000
		8	0.090	0.035	78.996	0.000
		9	0.141	0.089	91.605	0.000
		10	0.110	0.051	99.357	0.000
		11	0.100	0.034	105.76	0.000
		12	0.143	0.075	118.83	0.000
		13	0.093	0.018	124.37	0.000
		14	0.122	0.052	133.95	0.000
		15	0.059	-0.021	136.21	0.000
		16	0.069	-0.006	139.27	0.000
		17	0.009	-0.060	139.32	0.000
		18	0.073	0.017	142.75	0.000
		19	0.060	0.017	145.08	0.000
		20	0.089	0.048	150.23	0.000
		21	0.113	0.065	158.62	0.000
		22	0.082	0.020	162.97	0.000
		23	0.088	0.020	168.01	0.000
		24	0.110	0.043	175.99	0.000
		25	0.065	-0.002	178.74	0.000
		26	0.113	0.056	187.09	0.000
		27	0.037	-0.029	188.01	0.000
		28	0.009	-0.060	188.06	0.000
		29	0.042	-0.005	189.25	0.000
		30	0.104	0.062	196.45	0.000
		31	0.012	-0.026	196.56	0.000
		32	0.037	-0.024	197.45	0.000
		33	0.107	0.051	204.99	0.000
		34	0.033	-0.024	205.73	0.000
		35	0.110	0.063	213.76	0.000
		36	0.064	0.008	216.53	0.000

Table 21: ARCH LM Test for Sesonal ARMA (2, 2) Model of WPI Inflation

Heteroskedasticity Test: ARCH			
F-statistic	4.601416	Prob. F(12,602)	0.0000
Obs*R-squared	51.67008	Prob. Chi-Square(12)	0.0000

Table 22: GARCH (1, 1) Model for CPI Inflation

Dependent Variable: CPI Inflation
Method: ML - ARCH (Marquardt) - Normal distribution
Sample (adjusted): 1961M03 2013M12
MA Backcast: 1959M12 1961M02
Presample variance: backcast (parameter = 0.7)
GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.075960	0.002111	35.97605	0.0000
AR(1)	1.894947	0.049957	37.93121	0.0000
AR(2)	-0.897493	0.049408	-18.16498	0.0000
MA(1)	-0.599009	0.074476	-8.042953	0.0000
MA(2)	-0.206611	0.052243	-3.954775	0.0001
MA(3)	0.060281	0.044631	1.350640	0.1768
SMA(12)	-0.953084	0.008896	-107.1395	0.0000
Variance Equation				
C	4.92E-06	1.38E-06	3.567893	0.0004
RESID(-1)^2	0.107319	0.022758	4.715655	0.0000
GARCH(-1)	0.810105	0.038308	21.14720	0.0000

R-squared	0.978208	Mean dependent var	0.074384
Adjusted R-squared	0.978000	S.D. dependent var	0.051674
S.E. of regression	0.007665	Akaike info criterion	-6.970650
Sum squared resid	0.036833	Schwarz criterion	-6.900428
Log likelihood	2219.696	Hannan-Quinn criter.	-6.943382
Durbin-Watson stat	1.984517		

Figure 12: Correlogram of Standardized Squared Residuals for GARCH (1, 1) Model of CPI Inflation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.011	0.011	0.0838	0.772
		2	-0.015	-0.015	0.2213	0.895
		3	0.015	0.015	0.3680	0.947
		4	-0.027	-0.028	0.8465	0.932
		5	-0.019	-0.018	1.0797	0.956
		6	-0.015	-0.016	1.2320	0.975
		7	0.039	0.039	2.1976	0.948
		8	0.004	0.002	2.2070	0.974
		9	-0.020	-0.019	2.4597	0.982
		10	0.019	0.018	2.7020	0.988
		11	-0.042	-0.041	3.8328	0.975
		12	0.001	0.005	3.8336	0.986
		13	0.025	0.024	4.2556	0.988
		14	0.034	0.034	4.9948	0.986
		15	-0.005	-0.007	5.0084	0.992
		16	-0.036	-0.035	5.8477	0.990
		17	0.050	0.049	7.4928	0.976
		18	-0.039	-0.036	8.4900	0.970
		19	0.010	0.016	8.5557	0.980
		20	0.028	0.020	9.0742	0.982
		21	0.023	0.025	9.4347	0.985
		22	-0.002	-0.005	9.4387	0.991
		23	-0.026	-0.022	9.8796	0.992
		24	0.025	0.023	10.288	0.993
		25	-0.047	-0.043	11.754	0.988
		26	0.004	0.010	11.764	0.992
		27	-0.002	-0.015	11.768	0.995
		28	-0.049	-0.044	13.364	0.991
		29	0.040	0.038	14.414	0.989
		30	-0.030	-0.031	15.013	0.990
		31	-0.022	-0.023	15.352	0.992
		32	-0.024	-0.023	15.724	0.993
		33	-0.042	-0.039	16.919	0.991
		34	0.010	-0.002	16.985	0.993
		35	0.038	0.048	17.972	0.992
		36	0.037	0.030	18.896	0.992

Table 23: ARCH LM Test for GARCH (1, 1) Model of CPI Inflation

Heteroskedasticity Test: ARCH			
F-statistic	0.306480	Prob. F(12,609)	0.9883
Obs*R-squared	3.733725	Prob. Chi-Square(12)	0.9878

Figure 13: Correlogram of Standardized Residuals for GARCH (1, 1) Model of CPI Inflation

Q-statistic probabilities adjusted for 6 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.005	-0.005	0.0171	
		2	0.005	0.005	0.0355	
		3	0.022	0.023	0.3590	
		4	-0.042	-0.042	1.4882	
		5	0.018	0.017	1.6950	
		6	0.052	0.052	3.4273	
		7	-0.031	-0.029	4.0603	0.044
		8	0.022	0.019	4.3749	0.112
		9	0.023	0.022	4.7022	0.195
		10	0.074	0.080	8.2418	0.083
		11	0.017	0.012	8.4243	0.134
		12	-0.013	-0.014	8.5257	0.202
		13	-0.019	-0.019	8.7706	0.270
		14	-0.045	-0.044	10.097	0.258
		15	-0.056	-0.059	12.144	0.205
		16	-0.012	-0.020	12.233	0.270
		17	0.028	0.032	12.759	0.309
		18	-0.026	-0.028	13.199	0.355
		19	-0.018	-0.025	13.416	0.416
		20	0.032	0.030	14.080	0.444
		21	-0.022	-0.015	14.407	0.495
		22	-0.043	-0.045	15.624	0.480
		23	-0.022	-0.022	15.948	0.528
		24	-0.059	-0.040	18.240	0.440
		25	0.016	0.025	18.418	0.495
		26	0.004	0.000	18.428	0.559
		27	0.046	0.048	19.818	0.533
		28	-0.013	-0.014	19.923	0.588
		29	0.033	0.035	20.644	0.603
		30	-0.016	-0.020	20.817	0.649
		31	-0.007	-0.004	20.849	0.701
		32	-0.046	-0.040	22.255	0.675
		33	0.035	0.037	23.088	0.680
		34	-0.001	0.006	23.088	0.729
		35	0.006	0.001	23.112	0.771
		36	0.035	0.026	23.931	0.775

Table 24: GARCH (1, 1) Model for WPI Inflation

Dependent Variable: WPI Inflation
Method: ML - ARCH
Sample (adjusted): 1961M10 2013M12
MA Backcast: 1960M08 1961M09
Presample variance: backcast (parameter = 0.7)
GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.068098	0.005691	11.96637	0.0000
AR(1)	1.812485	0.131740	13.75807	0.0000
AR(2)	-0.814976	0.130425	-6.248606	0.0000
SAR(7)	0.066809	0.043833	1.524183	0.1275
MA(1)	-0.548293	0.141799	-3.866705	0.0001
MA(2)	-0.144631	0.064395	-2.245985	0.0247
SMA(12)	-0.878578	0.020269	-43.34633	0.0000
Variance Equation				
C	1.30E-06	7.18E-07	1.816135	0.0693
RESID(-1)^2	0.081649	0.022423	3.641395	0.0003
GARCH(-1)	0.901956	0.026655	33.83826	0.0000

R-squared	0.970815	Mean dependent var	0.070285
Adjusted R-squared	0.970533	S.D. dependent var	0.051179
S.E. of regression	0.008785	Akaike info criterion	-6.774047
Sum squared resid	0.047854	Schwarz criterion	-6.703218
Log likelihood	2133.664	Hannan-Quinn criter.	-6.746529
Durbin-Watson stat	1.997124		

Figure 14: Correlogram of Standardized Squared Residuals for GARCH (1, 1) Model of WPI Inflation

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.027	0.027	0.4660	0.495
		2	-0.040	-0.041	1.4980	0.473
		3	0.008	0.010	1.5399	0.673
		4	-0.022	-0.024	1.8373	0.766
		5	-0.006	-0.003	1.8565	0.869
		6	0.011	0.009	1.9294	0.926
		7	-0.057	-0.058	3.9957	0.780
		8	-0.016	-0.012	4.1512	0.843
		9	0.076	0.073	7.8853	0.546
		10	-0.012	-0.016	7.9780	0.631
		11	0.007	0.012	8.0091	0.712
		12	0.028	0.024	8.5219	0.743
		13	0.067	0.071	11.384	0.579
		14	0.029	0.024	11.921	0.613
		15	-0.021	-0.020	12.196	0.664
		16	-0.054	-0.043	14.067	0.594
		17	-0.036	-0.032	14.923	0.601
		18	-0.030	-0.036	15.498	0.628
		19	-0.063	-0.062	18.059	0.519
		20	-0.008	-0.003	18.096	0.581
		21	0.019	0.016	18.343	0.627
		22	0.025	0.014	18.745	0.661
		23	0.007	-0.003	18.778	0.714
		24	0.058	0.058	20.990	0.639
		25	0.004	0.002	20.999	0.693
		26	0.052	0.050	22.765	0.646
		27	-0.004	-0.007	22.773	0.697
		28	-0.065	-0.045	25.569	0.597
		29	-0.053	-0.042	27.418	0.549
		30	0.021	0.027	27.716	0.586
		31	-0.032	-0.027	28.386	0.601
		32	-0.022	-0.015	28.708	0.634
		33	0.044	0.036	29.979	0.618
		34	-0.005	-0.012	29.995	0.664
		35	0.082	0.064	34.498	0.492
		36	0.003	-0.016	34.502	0.540

Table 25: ARCH LM Test for GARCH (1, 1) Model of WPI Inflation

Heteroskedasticity Test: ARCH			
F-statistic	0.666343	Prob. F(12,602)	0.7844
Obs*R-squared	8.061708	Prob. Chi-Square(12)	0.7803

Figure 15: Correlogram of Standardized Residuals for GARCH (1, 1) Model of WPI Inflation

Q-statistic probabilities adjusted for 6 ARMA terms

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.021	-0.021	0.2847	
		2	-0.006	-0.007	0.3087	
		3	0.026	0.026	0.7348	
		4	-0.004	-0.003	0.7430	
		5	-0.009	-0.009	0.7990	
		6	0.025	0.024	1.1914	
		7	0.025	0.026	1.5940	0.207
		8	-0.055	-0.054	3.5424	0.170
		9	0.019	0.016	3.7789	0.286
		10	0.059	0.058	5.9966	0.199
		11	0.016	0.022	6.1654	0.290
		12	-0.055	-0.055	8.0770	0.233
		13	-0.029	-0.037	8.6296	0.280
		14	-0.026	-0.025	9.0493	0.338
		15	0.028	0.033	9.5643	0.387
		16	0.015	0.012	9.7184	0.466
		17	0.022	0.021	10.031	0.528
		18	0.023	0.029	10.359	0.585
		19	-0.004	0.001	10.368	0.664
		20	-0.049	-0.058	11.956	0.610
		21	-0.032	-0.041	12.627	0.631
		22	0.026	0.029	13.079	0.667
		23	-0.020	-0.007	13.348	0.713
		24	-0.010	-0.010	13.411	0.767
		25	0.018	0.009	13.624	0.805
		26	-0.033	-0.034	14.346	0.813
		27	-0.026	-0.026	14.787	0.833
		28	-0.020	-0.030	15.052	0.860
		29	0.006	0.008	15.073	0.892
		30	0.002	0.021	15.076	0.919
		31	-0.033	-0.027	15.812	0.920
		32	0.011	-0.000	15.890	0.939
		33	0.006	0.001	15.917	0.955
		34	0.070	0.071	19.165	0.893
		35	0.016	0.018	19.338	0.912
		36	0.029	0.034	19.917	0.919

Table 26: Gold Returns, Expected Inflation and Inflation Uncertainty

Dependent Variable: Gold Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.108139	0.091849	1.177361	0.2401
CPI Inflation Forecast	0.763573	0.418778	1.823334	0.0694
S.D. of CPI Inflation	-10.15110	13.83261	-0.733853	0.4637

R-squared	0.033432	Mean dependent var	0.093852
Adjusted R-squared	0.026272	S.D. dependent var	0.133672
S.E. of regression	0.131905	Akaike info criterion	-1.202544
Sum squared resid	4.697697	Schwarz criterion	-1.162880
Log likelihood	167.1473	Hannan-Quinn criter.	-1.186622
F-statistic	4.669458	Durbin-Watson stat	0.137236
Prob(F-statistic)	0.010148	Wald F-statistic	1.669444
Prob(Wald F-statistic)	0.190290		

Table 27: Gold as a Hedge Against Expected Inflation

Wald Test:
Equation: Gold Returns

Test Statistic	Value	df	Probability
t-statistic	-0.564563	270	0.5728
F-statistic	0.318732	(1, 270)	0.5728
Chi-square	0.318732	1	0.5724

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	-0.236427	0.418778

Restrictions are linear in coefficients.

Table 28: Silver Returns, Expected Inflation and Inflation Uncertainty

Dependent Variable: Silver Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.167441	0.142987	-1.171022	0.2426
CPI Inflation Forecast	0.081754	0.503909	0.162239	0.8712
S.D. of CPI Inflation	35.05687	20.66943	1.696073	0.0910

R-squared	0.062702	Mean dependent var	0.087217
Adjusted R-squared	0.055759	S.D. dependent var	0.201500
S.E. of regression	0.195801	Akaike info criterion	-0.412503
Sum squared resid	10.35132	Schwarz criterion	-0.372838
Log likelihood	59.30660	Hannan-Quinn criter.	-0.396580
F-statistic	9.031000	Durbin-Watson stat	0.163532
Prob(F-statistic)	0.000160	Wald F-statistic	1.531989
Prob(Wald F-statistic)	0.217978		

Table 29: Stock Returns, Expected Inflation and Inflation Uncertainty

Dependent Variable: Stock Returns
Method: Least Squares
Sample (adjusted): 1961M03 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 7.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.233844	0.103923	2.250176	0.0248
CPI Infaltion Forecast	-0.318258	0.449402	-0.708180	0.4791
S.D. of CPI Inflation	-15.96729	11.89823	-1.341989	0.1801

R-squared	0.015078	Mean dependent var	0.090979
Adjusted R-squared	0.011956	S.D. dependent var	0.265184
S.E. of regression	0.263594	Akaike info criterion	0.175908
Sum squared resid	43.84307	Schwarz criterion	0.196975
Log likelihood	-52.76298	Hannan-Quinn criter.	0.184089
F-statistic	4.830007	Durbin-Watson stat	0.120470
Prob(F-statistic)	0.008284	Wald F-statistic	1.055993
Prob(Wald F-statistic)	0.348461		

Table 30: Gold Returns, Expected Inflation and Inflation Uncertainty

Dependent Variable: Gold Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.246222	0.114050	2.158897	0.0317
WPI Inflation Forecast	1.211218	0.622036	1.947185	0.0525
S.D. of WPI Inflation	-34.80138	19.06966	-1.824961	0.0691

R-squared	0.093689	Mean dependent var	0.093852
Adjusted R-squared	0.086976	S.D. dependent var	0.133672
S.E. of regression	0.127727	Akaike info criterion	-1.266913
Sum squared resid	4.404838	Schwarz criterion	-1.227249
Log likelihood	175.9337	Hannan-Quinn criter.	-1.250991
F-statistic	13.95549	Durbin-Watson stat	0.149446
Prob(F-statistic)	0.000002	Wald F-statistic	2.398252
Prob(Wald F-statistic)	0.092810		

Table 31: Gold as a Hedge Against Expected Inflation

Wald Test:
Equation: Gold Returns

Test Statistic	Value	df	Probability
t-statistic	0.339560	270	0.7345
F-statistic	0.115301	(1, 270)	0.7345
Chi-square	0.115301	1	0.7342

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	0.211218	0.622036

Restrictions are linear in coefficients.

Table 32: Silver Returns, Expected Inflation and Inflation Uncertainty

Dependent Variable: Silver Returns
Method: Least Squares
Sample (adjusted): 1991M04 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 6.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.282927	0.160280	1.765204	0.0787
WPI Inflation Forecast	1.657920	0.666379	2.487955	0.0135
S.D. of WPI Inflation	-45.69617	23.89849	-1.912095	0.0569

R-squared	0.074679	Mean dependent var	0.087217
Adjusted R-squared	0.067825	S.D. dependent var	0.201500
S.E. of regression	0.194546	Akaike info criterion	-0.425363
Sum squared resid	10.21905	Schwarz criterion	-0.385699
Log likelihood	61.06210	Hannan-Quinn criter.	-0.409441
F-statistic	10.89532	Durbin-Watson stat	0.160294
Prob(F-statistic)	0.000028	Wald F-statistic	4.077352
Prob(Wald F-statistic)	0.018007		

Table 32: Silver as a Hedge Against Expected Inflation

Wald Test:
Equation: Silver Returns

Test Statistic	Value	df	Probability
t-statistic	0.987307	270	0.3244
F-statistic	0.974775	(1, 270)	0.3244
Chi-square	0.974775	1	0.3235

Null Hypothesis: C(2) = 1
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
-1 + C(2)	0.657920	0.666379

Restrictions are linear in coefficients.

Table 33: Stock Returns, Expected Inflation and Inflation Uncertainty

Dependent Variable: Stock Returns
Method: Least Squares
Sample (adjusted): 1961M10 2013M12
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 7.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.291015	0.074380	3.912549	0.0001
WPI Inflation Forecast	-0.059806	0.422549	-0.141537	0.8875
S.D. of WPI Inflation	-23.32856	7.717610	-3.022770	0.0026

R-squared	0.050897	Mean dependent var	0.091537
Adjusted R-squared	0.047855	S.D. dependent var	0.266591
S.E. of regression	0.260134	Akaike info criterion	0.149535
Sum squared resid	42.22598	Schwarz criterion	0.170784
Log likelihood	-43.87938	Hannan-Quinn criter.	0.157791
F-statistic	16.73151	Durbin-Watson stat	0.123919
Prob(F-statistic)	0.000000	Wald F-statistic	4.837250
Prob(Wald F-statistic)	0.008229		

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Abstract:

Inflation in India has been moderately high and volatile. In this paper we provide an estimate of the conditional mean and variance of CPI and WPI inflation rates with the help of a GARCH (1, 1) model. Under an environment of inflation uncertainty, rational risk-averse investors demand an inflation risk premium, defined as the difference between the expected real return on a nominal bond and the expected riskless real interest rate (often represented by the expected real return on an inflation-indexed bond). The sign of the inflation risk premium is a function of the inflation-hedging capability of alternative securities, such as gold, silver and stocks. Our estimated empirical models consistently find gold and silver to be effective hedges against expected WPI inflation rate, the predominant measure of Indian inflation. As for Indian equities, we find a strong negative correlation between the nominal returns and the conditional standard deviation of WPI inflation, providing empirical support of a positive inflation risk premium for Indian interest rates.

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