Inflation Expectations in Nepal

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There is a significant positive relationship between inflation and inflation expectations in Nepal, where the latter variable has been generated under Adaptive Expectation Hypothesis (AEH). Using 33 annual observations of actual inflation from 1973 to 2006, one percent increase in inflation expectations has 0.83 percent impact on contemporaneous inflation. The forecastability of inflation expectations on current inflation is higher than that of the expected inflation proxied by one-period lagged inflation. The forecastability of the model has been examined on the basis of minimum Root Mean Squared Error (RMSE). Therefore, it is desirable for the policymakers to consider inflation expectations while formulating monetary policy to anchor inflationary expectations of the economic agents.

I. INTRODUCTION

Inflation expectations play an important role in determining macroeconomic variables of an economy. Understanding the path of inflation expectations is imperative to the policymakers and economic agents in formulating policies and economic decision-makings. Controlling inflation through demand management has become a major objective of monetary policy in the recent global context. An emergence of various possible transmission mechanisms of monetary policy has opened an avenue to scrutinize the effect of inflation expectations on contemporaneous inflation in the framework of anchoring inflation expectations to achieve the desired objectives of monetary policy.

There is a positive relationship between inflation expectations and actual inflation (Dornbusch, Fischer and Startz, 2000). Expectation is a statement about an unknown future event (Frisch, 1983). Given the constant supply of goods and services in the market, an excess of expected inflation over actual inflation increases the consumers' demand for goods and services leading to a rise in contemporaneous inflation characterizing demand-pull inflation. Similarly, given the fixed demand for goods and services, if the supply of goods and services by the producers decreases as a result of an excess of expected inflation over the actual inflation and hence a rise in contemporaneous inflation, the inflation is attributed to short supply. If economic agents expect that inflation will take place in the future, inflation is sure to grow because the buyers would

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like to buy more and sellers want to supply less. Such phenomenon is referred to as the self-fulfilling prophecy (Friedman, 1968).

The production of goods and services depends on the anticipated or expected inflation. If the actual inflation is higher than the anticipated inflation, producers increase their production particularly in the short-run. They do so because high inflation is an incentive to the producers. A decrease in expectations of future inflation lead to a decrease in the current inflation via an incorporation of reduced inflationary expectations into current wage and price agreements between employers and employees (Sargent and Wallace, 1981, Flood and Garber, 1980). Large swings in inflation expectations are the factors leading to high volatility of output.

II. LITERATURE REVIEW

In the late 1960s and early 1970s, expectations of economic outcomes to the private economic agents dominated the field of macroeconomic analysis. The long-run policy prescription as postulated by Phillips Curve broke down since the early 1970s when the OPEC increased the price of crude oil. Consequently, the world economy suffered from stagflation and issues of inflation expectations gathered momentum. Friedman (1968) and Phelps (1967, 1968) based their natural-rate theories of unemployment on the Expectations Augmented Phillips Curve, where the relationship between actual inflation and unemployment depended on expected inflation. They introduced the inflation expectations in the erstwhile Phillips curve using the hypothesis that the workers as well as the firms are interested in the real wage rate rather than the nominal one (an absence of money illusion).[1] The Keynesian theory, which the Monetarists equate with a simple Phillips Curve[2] without adjustment for expectations, cannot explain the problem of accelerated inflation arising from high inflation expectations.

Irving Fisher (1980) argued the importance of expected rate of inflation while discussing real rate of return and expected rate of inflation as two determinants of nominal rate of interest, that is, $i = c + \Delta\%P$, where, ‘c’ is real rate of return and $\Delta\%P$ is change in inflation rate. Ex post, the price change will not be equal to its expectation unless financial markets in the country utilize all the available information; a possible risk premium, due to uncertainty about the future price change, is incorporated in nominal interest rate contemporaneously (Giddy, 2000).

Policy credibility, an issue which is gaining popularity at present, is one of the major determinants of inflation expectations. A lack of credibility of a policy would inhibit a sufficient fall in inflationary expectations (Fellner, 1976, 1979). In order to reduce inflation expectations, Jose, Slack and Sriram (2002) emphasized credibility, accountability and transparency in policy formulation. Summers (1993) found the inverse

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[1] The price equation for Augmented Phillips curve is $\dot{P} = \dot{P}^e - \beta(u - u_n) + v$, where the inflation rate has a positive and one-to-one relationship on the expected inflation rate & adverse supply shock and a negative relationship on the deviation of the unemployment rate from its natural rate.

[2] $\dot{P} = -\beta(u - u_n) + v$, where inflation ($\dot{P}$) depends on the rate of unemployment (u) which diverge from natural rate of unemployment (u_n), β stands for degree of responsiveness between the variables and v stands for other shocks affecting inflation.

relationship between central bank independency and reduction in inflation expectations. Nordhaus (1975) showed that political business cycle inhibited the reduction of inflation expectations. Alesina (1987) and Kydland and Prescott (1977) analyzed the prevalence of dynamic consistency problem arising from lack of credibility of economic policies to anchor the expectations formation of private economic agents. Monetary and fiscal coordination is the panacea for policy credibility (Blinder 1982, Loewy, 1983 and Sargent 1986). However, credibility is very difficult to obtain because of the inflationary inertia (Croushore, 1992).

Moreover, high credibility of monetary policy is to decrease inflation expectations which otherwise will increase today's inflation and interest rates, and hence a reduction of real money demand (Baxter, 1985). Therefore, there is a negative correlation between credibility and inflation and interest rates, and a positive correlation between credibility and real cash balances and reserves. High inflation in the past combined with indexation and weak credibility of monetary policy can make price more sensitive to shocks and create unstable inflation expectations (Crockett, 2000).

The countries adopting inflation targeting regime as a monetary policy framework rely on such regime as one possible means of stabilizing inflation expectations. Monetary policy credibility under the inflation targeting regime stabilizes inflation expectations. Large swings in inflation expectations could be a factor causing high volatility in output. A discretionary policy framework without announcing any numerical policy targets might create difficulties in forming inflation expectations. If monetary policy lacks credibility, the central bank is likely to influence expectations through actions than through announcements, and hence a retardation of economic growth (Higo, 2000).

As explained above, inflation expectation is an important variable that controls current inflation. Two theories are developed to explain the formation of expectations: the first is the Adaptive Expectations Hypothesis (AEH); and the second is the Rational Expectations Hypothesis (REH). If an economic agent has historical information on how the economic system functions, expectations are formed on the basis of adaptive expectations model where future values of a variable are related to the history of its past values. Therefore, the AEH is a backward looking hypothesis. The current expected rate of inflation according to the AEH is the weighted average of past rates of inflation where weights decline geometrically as one goes back to the past periods. The reduced form equation to derive inflation expectations is $\pi_t^* = \lambda\pi_{t-1} + (1-\lambda)\pi_{t-1}^*$ where, the expected rate of inflation at time *'t'* is a weighted average of the actual inflation and the expected inflation at time '*t-1*', where the adjustment parameters λ and $(1-\lambda)$ serve as weights.

According to Frisch (1983), the weight 'λ' is fixed on the basis of memory of the economic agents. There are two types of economic agents: short memory economic agents and long memory economic agents. The short memory economic agents are those who base recent past information in forming expectations. In this case 'λ' is fixed closer to unity. It implies that economic agents have only the last period information but not the periods before that and hence the expected rate of inflation at time 't' becomes the last period's actual inflation. The long memory economic agents use all possible information throughout the periods besides the recent past information. In such a case, 'λ' is fixed closer to zero. In practice, however, it is difficult to find short memory economic agents who base their expectations utilizing only last period's information in forming expectations. Therefore, in order to incorporate all the available information throughout the past, an application of distributed lag model is used to find the appropriate 'λ' value serving as weight. The weight pattern for the different values of 'λ' yields the learning behavior of economic agents in the formation of expectations.[3]

Rational Expectations Hypothesis (REH) presumes that expectations formation of a variable is determined on the basis of economic theory that determines the variable (Sargent and Wallace 1973). According to Muth (1961) changes in the structure of the economic system affect future expectations of variables. The advantage of rational expectations in expectations formation over other methods is that it eliminates the systematic forecast errors. However, it does not mean that it eliminates all the errors. In REH, conditional expectation forecasting matters[4]. In conditional forecasting, economic agents make probability assessments based on all available information at the time of forecast. Mathematically, it is represented as $\pi_t = E[\pi_t / I_{t-1}] + \varepsilon_t$ where forecast of π_t is equal to the conditional expected value of π_t utilizing all available information at the time of forecast, i.e. 'I_{t-1}'. The error term 'ε_t' in conditional expectation model, which is equal to $\pi_t - E[\pi_t / I_{t-1}]$, should have zero expected value and uncorrelated with any information available to economic agents. In other words, the mean and variance of ε_t in the equation $\varepsilon_t = \pi_t - E[\pi_t / I_{t-1}]$ are zero and constant respectively.

The empirical analysis of the models incorporating expectation variables dominated the literature in the 1950s. A number of studies attempted to search for the behavior and derivation of expected variables and its application in the model. The adaptive expectations model was used to derive inflation expectations by Cagan (1956) in an analysis of hyperinflation for Hungary. Using monthly data from 1921 to 1924, Cagan found that the demand for real cash balances is inversely related to the expected rate of inflation. Similarly, Nerlove (1958), using monthly data ranging from 1921 to 1924 for Germany, also found an inverse relationship between demand for real cash balances and inflation expectations. He used the partial adjustment model in the analysis. In Nepal, Khatiwada (1994) empirically analyzed the relationship between inflation and inflation expectation as an additional variable in a multivariate inflation equation over the sample period 1965-90 for Nepal. Taking one period lagged rate of inflation as a proxy for

[3] Weight when λ equals

Past Period	Weight Smoothing	Short Memory λ=0.9	Long Memory (λ=0.1)
t-1	λ	0.9	0.1
t-2	$\lambda(1-\lambda)$	0.09	0.09
t-3	$\lambda(1-\lambda)^2$	0.009	0.081
t-4	$\lambda(1-\lambda)^3$	0.0009	0.0729
t-n	$\lambda(1-\lambda)^{n-1}$	Etc.	etc.

[4]In such a forecasting method, expected current and future value of dependent variable is based not only on the past value of the independent variable but also on the forecasted value of independent variable itself by the auxiliary model. The information from auxiliary model is included in the main forecasting model and then the forecast is performed.

inflation expectation, he found an insignificant relationship between inflation and inflation expectation because of the prevalence of unstable and unpredictable rate of inflation. In such a situation, people may accord importance to other factors for expectation formation than depend solely on the rates of past inflation.

III. APPROACH, OBJECTIVE AND METHODOLOGY

The basic approach of this paper is to find the validity of inflation expectation variable derived under AEH rather than the prevailing practice of utilizing one period lagged inflation as a proxy of inflation expectations in Nepal. The latter concept relies on the instantaneous adjustment between actual and expected inflation where the speed of adjustment between actual and desired (expected) inflation is assumed to be equal to unity. It ignores geometrically declining weights of past observations in order to derive inflation expectations which demands further research for the validity. Keeping this in view, the objectives of this paper is to derive the inflation expectations series of inflation for Nepal and to assess the relationship between inflation and inflation expectations.

This paper uses annual data of national urban Consumer Price Index (CPI) from 1973 to 2006 for the analysis. The first difference of the logarithm of CPI gives inflation rates. In the course of deriving the expected inflation, the AEH is taken into consideration. Expected inflation is not an observable variable and, thus, there is a need to determine its values through an appropriate procedure. According to AEH, observations of expected inflation are related to observations of the past. The model of adaptive expectations to generate inflation expectations is represented as: $\pi_t^* - \pi_{t-1}^* = \lambda(\pi_{t-1} - \pi_{t-1}^*)$ and its simplified form for the estimation purpose is as: $\pi_t^* = \lambda\pi_{t-1} + (1-\lambda)\pi_{t-1}^*$.[5] This equation states that the expected inflation (π_t^*) at time *'t'* is the function of current inflation 'π_{t-1}' and one period lagged forecast of inflation 'π_{t-1}^*' where adjustment parameters 'λ' and '$(1-\lambda)$' serve as relative weights given to each term. The first forecast value of the expected inflation series is proxied by the actual inflation.

The minimization of the sum of Residual Standard Error $(RSE) = \sqrt{\sum_{t=1}^{n} e_t^2 /(n-1)}$, is the criteria for the optimal selection of 'λ' where e_t is residual error obtained by subtracting inflation expectations from actual inflation. A trial and error search process is followed by fixing the value of 'λ' ranging from zero to unity in order to find the optimum desired value. In other words 'λ' that yields the most accurate forecast is the one that achieves the lowest RSE.

After generating the inflation expectation series, a linear relationship is examined between inflation and inflation expectation using bi-variate regression model. Since the

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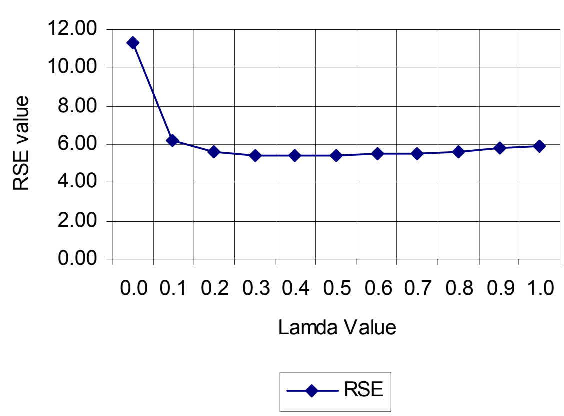
[5] $\pi_t^* = \lambda\pi_{t-1} - (1-\lambda)\pi_{t-1}^*$; 0< λ <1 can be derived by taking lags and continuous substitution yields $\pi_t^* = \pi_{t-1} + (\lambda-1)\pi_{t-2} + \lambda(\lambda-1)^2\pi_{t-3} + ... + \lambda(\lambda-1)^{n-1}\pi_{t-n} + (\lambda-1)^n \pi^*_{t-n}$. It simply states that the forecast in period 't' is equal to a weighted average of all past actual values and one initial forecast.

variables used in this paper are in percentage change, that is, first difference of log of CPI, coefficients are interpreted as elasticity coefficients. The forecastability of a model is examined by Root Mean Squared Error (RMSE) of in-sample period forecast as well as ex-post forecast. The formula for the calculation of RMSE is as: $\sqrt{\sum_{t=1}^{n} e_t^2 / n}$. The model is selected that minimizes the RMSE.

IV. RESULTS OF THE ANALYSIS

In estimating inflation expectation series for Nepal for analyzing inflation and inflation expectation, the study utilizes the AEH. As derived in Annex 1 along with the exercise presented in Annex 2, the value of weight 'λ' that minimize RSE is 0.40 using model as $\pi_t^* = \lambda\pi_{t-1} + (1-\lambda)\pi_{t-1}^*$. The weight, that is, '$\lambda$' can be considered as memory of economic agents. If 'λ' is close to zero, then the weights decline slowly and the economic agents have a long memory. The reverse is true when 'λ' is close to unity. The weight 0.40 gives an inference that economic agents have neither too long nor too short memory in terms of inflation expectations in Nepal. The relationship between selected values of 'λ' and RSE is shown in Figure 1. Since the value of 'λ' equal to 0.40, the economic agent (or society at large) adjust inflation expectations with some time lags.

FIGURE 1: Lamda Minimizing RSE



If the actual inflation and expected inflation are plotted in a time scale diagram, a smooth series of expected inflation is generated, which is considered as long-run trend of inflation, as shown in Figure 2. The expectation gap is presented in Figure 3 depicting a convergence pattern of errors.

FIGURE 2: Actual and Expected Rate of Inflation

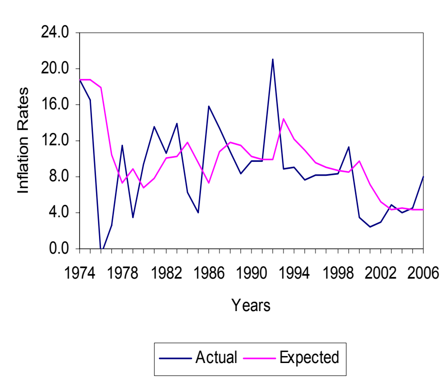
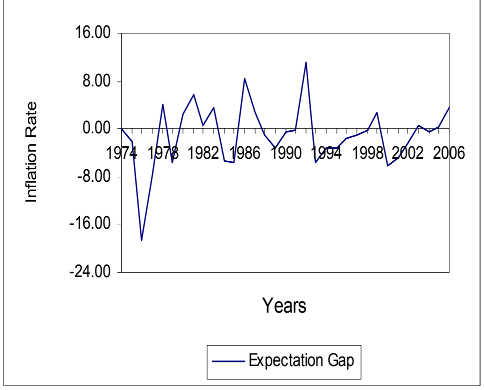


FIGURE 3: Expectation Gap



After the selection of inflation expectations series on the basis of minimum RSE, the series is used for estimation. This study hypothesizes that there is a positive relationship between actual inflation and expected inflation, that is, changes in inflation expectations leads to a changes in actual inflation. Mathematically, $\pi_t = \alpha + \beta\pi_t^*$; β>0, where β is elasticity of inflation with respect to inflation expectations 'π_t^*'. The effect of inflation expectations and one-period lagged inflation on current inflation is presented in Table 1.

TABLE 1: The Effect π_t^* and π_{t-1} on π_t (1973 to 2006)

Equation no.	π_t^*	π_{t-1}	DW	In-sample RMSE	Ex-post RMSE
1.	0.837 (9.81)*	-	1.82	5.22	2.50
2.		0.784 (8.05)*	2.36	8.93	3.40

Note: Figures in the parenthesis are 't' values.
* significant at 1 percent level.
** significant at 5 percent level
*** significant at 10 percent level.

The coefficient of expected rate of inflation possesses a priori sign, that is, there is positive relationship between inflation and inflation expectations. The coefficient 0.83 is interpreted as follows: one percent increase in expected inflation will have an effect of 0.83 percent increase in current inflation. The coefficient is statistically significant at 1 percent level. The R^2 value is not presented here because it is negative and insignificant as the application of the variables used in the model are in percentage change form. DW statistic is statistically significant at 5 percent level. Similarly, as shown in equation 2, one percent increase in one-period lag inflation will have an effect of 0.83 percent increase in contemporaneous inflation. If a comparison is made between the effect of expected rate of inflation derived under AEH and expectation under one-period lagged inflation, the former explains the variation of current inflation in a better way.

The in-sample RMSE and ex-post forecast are examined to assess the predictability of the models in Table 1. Using the last three observations to assess the ex-post forecast of the model, the inflation expectation derived under AEH has better forecastability than that of inflation expectation derived under one-period lagged inflation. The ex-post RMSE in case of he former is less than that of the latter implying that the expected inflation derived under AEH has higher forecasting ability than the expected inflation derived under one-period lagged inflation.

V. CONCLUSION

This paper found that there is a significant positive relationship between inflation and inflation expectations in Nepal. Using 33 annual observations of expected inflation from 1973 to 2006, it is found that one percent increase in inflation expectations will have 0.83 percent increase in contemporaneous inflation. Since the inflation expectations derived under the AEH is the better explanatory variable of current inflation as compared to inflation expectations under one-period lagged inflation, the weight used to derive inflation expectations under AEH minimizing RSE is found to be 0.40. This weight gives an inference that the economic agents have neither too long nor too short memory in inflation expectations. The forecastability of inflation expectations on contemporaneous inflation, as inflation expectation calculated on the basis of AEH, is higher than that of the inflation expectations proxied by one-period lagged inflation, where forecastability of the model has been examined on the basis of minimum RMSE. Therefore, it is desirable for the policymakers to consider the impact of inflation expectations while formulating monetary policy to anchor inflationary expectations of the economic agents.

ANNEX 1 : Derivation of Inflation Expectations Series on the Basis of Different λ Values (Weight)

Years	CPI	Log of CPI	Δ log of CPI	Long Memory Economic Agents							Short Memory Economic Agents			
				λ = 0	λ = .1	λ = .2	λ = .3	λ = .4	λ = .5	λ = .6	λ = .7	λ = .8	λ = .9	λ = 1
1973	11.20	2.4159	-											
1974	13.30	2.5878	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500
1975	15.50	2.7408	16.5414	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500
1976	15.40	2.7344	-0.6452	18.7500	18.5291	18.5291	18.0874	17.8665	17.6457	17.4248	17.2039	16.9831	16.7622	16.5414
1977	15.80	2.7600	2.5974	18.7500	16.6117	16.6117	12.4676	10.4619	8.5003	6.5828	4.7096	2.8805	1.0956	-0.6452
1978	17.60	2.8679	11.3924	18.7500	15.2103	15.2103	9.5066	7.3161	5.5488	4.1916	3.2311	2.6540	2.4472	2.5974
1979	18.20	2.9014	3.4091	18.7500	14.8285	14.8285	10.0723	8.9466	8.4706	8.5121	8.9440	9.6447	10.4979	11.3924
1980	19.90	2.9907	9.3407	18.7500	13.6865	13.6865	8.0733	6.7316	5.9399	5.4503	5.0696	4.6562	4.1180	3.4091
1981	22.60	3.1179	13.5678	18.7500	13.2520	13.2520	8.4535	7.7752	7.6403	7.7845	8.0593	8.4038	8.8184	9.3407
1982	25.00	3.2189	10.6195	18.7500	13.2835	13.2835	9.9878	10.0923	10.6040	11.2545	11.9153	12.5350	13.0929	13.5678
1983	28.50	3.3499	14.0000	18.7500	13.0171	13.0171	10.1773	10.3031	10.6118	10.8735	11.0082	11.0026	10.8668	10.6195
1984	30.30	3.4111	6.3158	18.7500	13.1154	13.1154	11.3241	11.7819	12.3059	12.7494	13.1025	13.4005	13.6867	14.0000
1985	31.50	3.4500	3.9604	18.7500	12.4355	12.4355	9.8216	9.5954	9.3108	8.8892	8.3518	7.7327	7.0529	6.3158
1986	36.50	3.5973	15.8730	18.7500	11.5880	11.5880	8.0633	7.3414	6.6356	5.9319	5.2778	4.7149	4.2696	3.9604
1987	41.40	3.7233	13.4247	18.7500	12.0165	12.0165	10.4062	10.7541	11.2543	11.8966	12.6945	13.6414	14.7127	15.8730
1988	45.90	3.8265	10.8696	18.7500	12.1573	12.1573	11.3117	11.8223	12.3395	12.8134	13.2056	13.4680	13.5535	13.4247
1989	49.70	3.9060	8.2789	18.7500	12.0285	12.0285	11.1791	11.4412	11.6045	11.6471	11.5704	11.3893	11.1380	10.8696
1990	54.50	3.9982	9.6579	18.7500	11.6535	11.6535	10.3090	10.1763	9.9417	9.6262	9.2663	8.9009	8.5648	8.2789
1991	59.80	4.0910	9.7248	18.7500	11.4540	11.4540	10.1137	9.9689	9.7998	9.6452	9.5405	9.5065	9.5486	9.6579
1992	72.40	4.2822	21.0702	18.7500	11.2811	11.2811	9.9970	9.8713	9.7623	9.6930	9.6695	9.6811	9.7072	9.7248
1993	78.80	4.3669	8.8398	18.7500	12.2600	12.2600	13.3190	14.3509	15.4163	16.5193	17.6500	18.7924	19.9339	21.0702
1994	85.90	4.4532	9.0102	18.7500	11.9180	11.9180	11.9752	12.1464	12.1280	11.9116	11.4828	10.8303	9.9492	8.8398
1995	92.50	4.5272	7.6834	18.7500	11.6272	11.6272	11.0857	10.8919	10.5691	10.1707	9.7520	9.3742	9.1041	9.0102
1996	100.00	4.6052	8.1081	18.7500	11.2328	11.2328	10.0650	9.6085	9.1262	8.6783	8.3039	8.0215	7.8254	7.6834
1997	108.10	4.6831	8.1000	18.7500	10.9203	10.9203	9.4779	9.0083	8.6172	8.3362	8.1669	8.0908	8.0798	8.1081
1998	117.10	4.7630	8.3256	18.7500	10.6383	10.6383	9.0646	8.6450	8.3586	8.1945	8.1201	8.0982	8.0980	8.1000
1999	130.40	4.8706	11.3578	18.7500	10.4070	10.4070	8.8429	8.5173	8.3421	8.2732	8.2640	8.2801	8.3029	8.3256
2000	134.90	4.9045	3.4509	18.7500	10.5021	10.5021	9.5974	9.6535	9.8500	10.1240	10.4297	10.7423	11.0523	11.3578
2001	138.10	4.9280	2.3721	18.7500	9.7970	9.7970	7.7534	7.1725	6.6504	6.1201	5.5445	4.9092	4.2111	3.4509
2002	142.10	4.9565	2.8965	18.7500	9.0545	9.0545	6.1390	5.2523	4.5113	3.8713	3.3239	2.8795	2.5560	2.3721
2003	148.90	5.0033	4.7854	18.7500	8.4387	8.4387	5.1663	4.3100	3.7039	3.2864	3.0247	2.8931	2.8624	2.8965
2004	154.80	5.0421	3.9624	18.7500	8.0734	8.0734	5.0520	4.5001	4.2446	4.1858	4.2572	4.4069	4.5931	4.7854
2005	161.80	5.0864	4.5220	18.7500	7.6623	7.6623	4.7251	4.2850	4.1035	4.0517	4.0508	4.0513	4.0255	3.9624
2006	174.70	5.1631	7.9728	18.7500	7.3482	7.3482	4.6642	4.3798	4.3127	4.3339	4.3806	4.4278	4.4723	4.5220

ANNEX 2 : Derivation of Residual Squared Error (RSE) on the Basis of Different λ Values (Weight)

Years	Δ CPI	λ = 0	λ = .1	λ = .2	λ = .3	λ = .4	λ = .5	λ = .6	λ = .7	λ = .8	λ = .9	λ = 1
1974	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500	18.7500
1975	16.5414	4.8781	4.8781	4.8781	4.8781	4.8781	4.8781	4.8781	4.8781	4.8781	4.8781	4.8781
1976	-0.6452	376.1723	367.6537	359.2326	350.9091	342.6831	334.5548	326.5239	318.5907	310.7550	303.0169	295.3763
1977	2.5974	260.9064	196.4007	142.0907	97.4215	61.8497	34.8437	15.8836	4.4613	0.0801	2.2555	10.5142
1978	11.3924	54.1342	14.5761	0.5493	3.5564	16.6164	34.1474	51.8520	66.6077	76.3594	80.0163	77.3521
1979	3.4091	235.3435	130.4026	73.5517	44.3986	30.6641	25.6191	26.0404	30.6352	38.8832	50.2510	63.7333
1980	9.3407	88.5357	18.8868	0.8638	1.6061	6.8072	11.5655	15.1350	18.2423	21.9440	27.2765	35.1835
1981	13.5678	26.8548	0.0998	12.1358	26.1560	33.5544	35.1362	33.4469	30.3437	26.6676	22.5573	17.8690
1982	10.6195	66.1055	7.0973	0.0261	0.3990	0.2779	0.0002	0.4033	1.6791	3.6694	6.1178	8.6929
1983	14.0000	22.5625	0.9660	10.5714	14.6129	13.6667	11.4802	9.7751	8.9508	8.9845	9.8169	11.4280
1984	6.3158	154.6096	46.2351	25.8381	25.0834	29.8783	35.8812	41.3913	46.0590	50.1934	54.3300	59.0471
1985	3.9604	218.7324	71.8267	41.2406	34.3540	31.7538	28.6272	24.2934	19.2844	14.2305	9.5634	5.5479
1986	15.8730	8.2770	18.3617	45.9021	60.9923	72.7880	85.3296	98.8252	112.2583	124.5044	134.6382	141.9105
1987	13.4247	28.3593	1.9830	8.8312	9.1112	7.1321	4.7104	2.3350	0.5332	0.0470	1.6590	5.9945
1988	10.8696	62.1013	1.6582	0.0316	0.1955	0.9077	2.1607	3.7786	5.4570	6.7519	7.2033	6.5285
1989	8.2789	109.6446	14.0598	7.4685	8.4112	10.0004	11.0600	11.3451	10.8340	9.6745	8.1744	6.7117
1990	9.6579	82.6654	3.9824	0.6516	0.4239	0.2687	0.0805	0.0010	0.1534	0.5731	1.1950	1.9019
1991	9.7248	81.4548	2.9902	0.3352	0.1513	0.0596	0.0056	0.0063	0.0340	0.0476	0.0310	0.0045
1992	21.0702	5.3835	95.8279	118.4246	122.6161	125.4167	127.8695	129.4425	129.9773	129.7118	129.1195	128.7195
1993	8.8398	98.2125	11.6978	12.4229	20.0633	30.3720	43.2502	58.9754	77.6201	99.0549	123.0801	149.5840
1994	9.0102	94.8646	8.4554	7.0189	8.7916	9.8362	9.7211	8.4184	6.1142	3.3130	0.8818	0.0290
1995	7.6834	122.4707	15.5538	11.8766	11.5760	10.2949	8.3275	6.1870	4.2791	2.8589	2.0184	1.7604
1996	8.1081	113.2499	9.7637	5.4394	3.8294	2.2511	1.0366	0.3251	0.0383	0.0075	0.0799	0.1804
1997	8.1000	113.4225	7.9543	3.5115	1.8987	0.8251	0.2675	0.0558	0.0045	0.0001	0.0004	0.0001
1998	8.3256	108.6676	5.3484	1.6218	0.5460	0.1020	0.0011	0.0172	0.0423	0.0517	0.0518	0.0509
1999	11.3578	54.6444	0.9040	4.0537	6.3249	8.0688	9.0945	9.5151	9.5720	9.4721	9.3327	9.1942
2000	3.4509	234.0618	49.7192	39.6419	37.7787	38.4717	40.9477	44.5294	48.7028	53.1639	57.7813	62.5190
2001	2.3721	268.2347	55.1286	37.4023	28.9584	23.0431	18.3040	14.0476	10.0642	6.4367	3.3817	1.1638
2002	2.8965	251.3350	37.9216	19.0817	10.5143	5.5501	2.6077	0.9504	0.1827	0.0003	0.1159	0.2749
2003	4.7854	195.0111	13.3469	2.5783	0.1451	0.2260	1.1696	2.2469	3.1000	3.5808	3.6978	3.5680
2004	3.9624	218.6734	16.9001	4.4417	1.1872	0.2892	0.0797	0.0499	0.0869	0.1976	0.3978	0.6773
2005	4.5220	202.4370	9.8615	1.2689	0.0413	0.0561	0.1751	0.2211	0.2220	0.2215	0.2465	0.3131
2006	7.9728	116.1479	0.3901	6.5009	10.9471	12.9096	13.3961	13.2418	12.9038	12.5669	12.2534	11.9083
$\sum_{t=1}^{n} e_t^2 =$		4078.1540	1240.8313	1009.4834	947.8785	931.4990	936.3279	954.1377	981.9121	1018.8812	1065.4197	1122.6168
$RSE = \sqrt{\sum_{t=1}^{n} e_t^2 /(n-1)} =$		11.2890	6.2270	5.6166	5.4425	5.3953	5.4093	5.4605	5.5394	5.6427	5.7701	5.9230

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