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# **ANALYSIS OF STRUCTURAL SHIFTS AND INFLATION IN PAKISTAN**

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**Abstract:**

*The structural shifts and their impact on inflation in Pakistan were estimated in the research paper. The macroeconomic variables money supplies, income velocity of circulation, real income of the economy for the period of 1973 to 2007 and two structural shifts 1983 and 1998 in Pakistan were included as the main variables of the present study. The time series properties of data were checked through ADF test. The included variables were stationary at level. The relationship among these variables was estimated by OLS technique because all the variables were stationary at level. Impacts of structural breaks on inflation in Pakistan were observed by applying Chow Test. It was concluded that the structural shifts in 1983 and 1998 have impact upon the inflation in Pakistan.*

**Key words:** *Inflation, Structural Shifts and Chow Test*

## **1. Introduction**

Inflation creates uncertainty in the economy, adversely affects the economic growth of the country and hurts the poor particularly. Achievement of stable economic growth is the core of macroeconomic policies in the developing countries like Pakistan. The factors responsible for inflation in Pakistan were excess money supply, production shortage, political unrest, and structural shifts along with other factors. For example during the decade of 1970s, the governmental policies were anti-agriculture and

decisions like devaluation of rupee by 47 percent in 1973, delinking of Pak rupee from US dollar in early 1982 were the main structural shifts generated the inflationary process in the country. It was hypothesized by Romer (1993) that inflation was lower in small and open nations and same type of relationship was investigated by Hanif and Batool (2006). The author observed that supply side factors were more important than monetary factors in the process of inflation and found that openness has negative and significant influence on the domestic price growth in Pakistan.

Pakistan also signed a Structural Adjustment Programme (SAP) with the IMF in 1988. The exports and imports of the country were liberalized under (SAP) to remove the balance of payments deficit problems from the country. Consequently, the overall trade to GDP ratio reached to 35.2 percent of GDP in 2005 from 26.7 percent in 1975. Openness might affect the inflation in country through its positive effect on output (Jin, 2000). The import cost of traded commodities might go down under World Trade Organization (WTO) to maintain the tariff structures across the countries. Such factors created inflationary process in Pakistan.

The objective of the research paper was to analyze the structural shifts in Pakistan and to capture the impact of these shifts on the inflationary process in the country. For this purpose, the two structural shifts 1983 and 1998 were incorporated in the research study.

### **1.1 The year 1983 Structural Break**

Following factors were responsible to select 1983 as a year of structural shifts: There was an increase in remittances from the Middle East to Pakistan as a result of delinking of Pakistan rupee with dollar in 1982. The rupee value of remittances was significantly increased because Pakistan rupee was depreciated by 52 percent. The largest single source of foreign exchange earnings was remittances in 1983. Nearly 40 percent of total foreign exchange earnings were obtained through remittances. The remittances were nearly \$ 3.2 billion which was equal to 8 percent of Gross National Product (GNP). The remittances also brought a change in the living standard of the people (GOP 1983-84). Agriculture sector showed resilience due to favorable weather and adequate supplies of water during this period. The production of four major crops reached record point during that period. There was a surplus of wheat which was exported. Foreign exchange was received by exporting cotton and rice. Agricultural credit was distributed to the tune of Rs 6.3 billion in 1983 (GOP 1983-84).

Macroeconomic structure also faced some problems along with agriculture development.

There was a huge difference in the supply and demand of energy. Supply of energy was increasing at 11 percent rate while the rate of increase of demand of energy was 24 percent. Therefore, both industrial and domestic consumers faced serious problem of energy crisis. Load shedding of electricity affected the households as well as industries (GOP 1983-84). The domestic saving rate fell to 5.4 percent

during 1982-83 although it was estimated in 5<sup>th</sup> five year plan (1978 - 1983) to increase from 7.8 percent of Gross Domestic Product to 12.5 percent. The neighbor India has much higher saving rates than the saving rates of Pakistan in 1982-83 (World Bank 1984). Investments in large scale and manufacturing were not in practice by the private sector. The investors showed intentions to invest in real assets because of various economic and non economic factors (GOP 1983-84).

There was not much emphasis on the development of social sectors. The share of expenditure on education was 2.1 percent of GNP in 1976-77 while it declined to 1.5 percent in 1983-88. Therefore, the literacy rate of Pakistan was 21 percent which was dismal by any standard. The population welfare was provided Rs 1.8 billion in 5<sup>th</sup> five year plan but only 38 percent was utilized. The performance of health sector was also very inactive (World Bank 1984).

### **1.2 The year 1998 Structural Break**

The year 1998-99 was the difficult year in the history of Pakistan as according to the annual report of the State Bank of Pakistan released in December 1999. This year was considered as structural break to analyze the impacts of nuclear tests. The growth rate of this year was slightly lower than the previous eight years. Many economic sanctions were imposed by G-7 countries against Pakistan. The Japanese Government stopped all funding of projects and aids to Pakistan. United States (US) foreign aids programmes were ended as a result of sanctions imposed by the US president. The termination of sales of defense articles and of all military financing were also the outcomes of these tests. The extension of any loan for financial or technical assistance was opposed by any international institutions (Zaidi, 2005).

## **2. Data and Methodology**

There may be a structural change in the relationship between the regressand and the regressors when time series data was involved in a regression analysis. In a structural change, the values of parameters of the model were not the same during the whole time period. The external forces, policy changes, action taken by the government or variety of other reasons were involved to bring these breaks. An OLS regression of dependent variable on independent variable was normally obtained. That procedure showed that both variables were not changed over the total sampling period. But if some shifts or breaks were involved then the method was not the same to get meaningful results (Gujarati 2003).

The annual data was employed in the present study during the period of 1973 to 2007. The variables of the study were prices, output, money supply and velocity of money and two structural breaks 1983 and 1998. The growth rate of these variables was determined and used in the model specification. The data sources were the Federal Bureau of Statistics, Islamabad and State Bank of Pakistan, Karachi. The quantity theory of money was used to calculate the velocity of money. The order of

integration of these variables was determined with the help of Augmented Dickey Fuller (ADF) unit root test (Dickey and Fuller,1981). The results of ADF at level were reported in the Table 1.

**Table1: Unit Root tests using Augmented Dickey-Fuller Method**

| Variables | Without trend | With trend |
|-----------|---------------|------------|
| Gv        | -5.23         | -5.15      |
| Gm        | -3.16         | -3.23      |
| Gq        | -2.96         | -2.79      |
| Gp        | -4.80         | -4.42      |
| LnGm      | -3.12         | -3.12      |
| LnGq      | -3.02         | -2.89      |
| LnGp      | -3.06         | -2.89      |

- Critical value for the augmented Dickey-Fuller statistic with intercept and without trend was  $-2.96$  ( $p = 0.05$  per cent)
- Critical value for the augmented Dickey-Fuller statistic with intercept and trend was  $-3.56$  ( $p = 0.05$  per cent)

Where:

LnGp = Natural log of price growth,  
LnGm = Natural log of money supply growth,  
LnGq = Natural log of real income growth,  
Gv = Velocity growth

Table 1 indicated that these variables have same order of integration i.e.  $I(0)$  if trend term was not included in the analysis. Therefore, it was concluded that these variables were stationary. These variables were changed into log form at model specification stage. The ordinary least square (OLS) technique was utilized for estimation.

Impacts of structural breaks on inflation in Pakistan were observed by applying Chow Test (1960). The sample was divided into three separate periods. The equations were estimated for each period. The residual sum of squares from the separate equations was compared with the residual sum of square of whole period and then F-test was employed to judge the null hypothesis (Gujarati 2003).

**Hypothesis - 1**

The null hypothesis was constructed that structural shifts 1983 has no impact on inflation.

**Hypothesis – 2**

The null hypothesis was that there is no impact of structural shift 1998 on the inflation.

**3. Results and Discussion**

Three different data sets were suggested to test the null hypothesis that a structural shift of 1983 has no impact on inflation and regression equations were estimated for all.

- a. The complete sample period (1973 - 2007)
- b. Transition period (1973-1982)
- c. Period of structural shifts (1983- 2007)

**Overall sample (1973-2007)**

Whole data was estimated by OLS method. The results were given in Table 2.

**TABLE 2: Regression Results with selected explanatory variables**

| Variable | Coefficient | Std. Error | t-Statistic |
|----------|-------------|------------|-------------|
| C        | -1.402***   | 0.546      | -2.565      |
| LnGm     | 0.268       | 0.218      | 1.227       |
| LnGq     | -0.090      | 0.121      | -0.747      |
| Gv       | 0.041***    | 0.010      | 3.899       |
| LnGm(-1) | 0.621***    | 0.138      | 4.494       |
| LnGp(-1) | 0.586***    | 0.094      | 6.223       |

R<sup>2</sup> 0.78  
 Adjusted R<sup>2</sup> 0.74  
 Durbin-Watson 1.85

\*\*\* Indicated that the coefficient was significantly different from zero at 0.01 probability level.

**Transition period (1973-1982)**

The regression results showed that the estimated coefficients of growth rate of velocity, growth rate of one year lagged money supply and prices were significant at 0.01 percent probability level and showed positive relation with inflation, whereas growth rate of GDP was also significant but showed a negative sign.

**TABLE 3: Regression Results with selected explanatory variables**

| Variable                | Coefficient | Std. Error | t-Statistic |
|-------------------------|-------------|------------|-------------|
| C                       | 2.726**     | 1.422      | 1.918       |
| LnGm                    | 0.741***    | 0.272      | 2.729       |
| LnGq                    | -0.68***    | 0.186      | -3.648      |
| Gv                      | 0.083***    | 0.012      | 6.857       |
| LnGm(-1)                | -0.199      | 0.205      | -0.975      |
| LnGp(-1)                | -0.267***   | 0.216      | -1.236      |
| R <sup>2</sup>          | 0.97        |            |             |
| Adjusted R <sup>2</sup> | 0.93        |            |             |
| Durbin-Watson           | 2.13        |            |             |

\*\* Indicated that the coefficient was significantly different from zero at 0.05 probability level.

\*\*\* Indicated that the coefficient was significantly different from zero at 0.01 probability level.

**Period of structural shifts (1983- 2007)**

The regression results showed that the estimated coefficient of growth rate of velocity, growth rate of one year lagged money supply and prices were significant at 0.01 percent probability level.

**TABLE 4: Regression Results with selected explanatory variables**

| Variable                | Coefficient | Std. Error | t-Statistic |
|-------------------------|-------------|------------|-------------|
| C                       | -1.347**    | 0.692      | -1.946      |
| LnGm                    | 0.195       | 0.255      | 0.764       |
| LnGq                    | -0.088      | 0.144      | -0.614      |
| Gv                      | 0.029***    | 0.013      | 2.216       |
| LnGm(-1)                | 0.689***    | 0.176      | 3.905       |
| LnGp(-1)                | 0.556***    | 0.129      | 4.308       |
| R <sup>2</sup>          | 0.69        |            |             |
| Adjusted R <sup>2</sup> | 0.61        |            |             |
| Durbin-Watson           | 1.73        |            |             |

\*\* Indicated that the coefficient was significantly different from zero at 0.05 probability level.

\*\*\* Indicated that the coefficient was significantly different from zero at 0.01 probability level.

**3.1 Comparison of residual sum of squares**

The residual sum of squares of three different data sets was found as under:

$SSR_t = 2.0494$  (1973-2007)

$SSR_1 = 0.050035$  (1973-1982)

SSR<sub>2</sub> = 1.4961 (1983-2007)

F-statistics was obtained by using following formula.

$$F_{cal} = \frac{(SSR_t - (SSR_1 + SSR_2)) / k}{(SSR_1 + SSR_2) / (n_1 + n_2 + 2k)}$$

k = no of variables

F<sub>cal</sub> = 2.495

F<sub>tab</sub> = 2.304

As F<sub>cal</sub> > F<sub>tab</sub>, so the null hypothesis was not accepted. It showed that the variables were not stable in the whole period. The structural break of the year 1983 affected the inflation process in Pakistan's economy.

Three different data sets were also formed to test the null hypothesis that a structural shift 1998 has no impact on inflation and regression equations were estimated for all.

- a. The complete sample period (1973 - 2007)
- b. Transition period (1973 -1997)
- c. Period of structural shifts (1998 - 2007)

### Transition period (1973-1997)

Regression results showed that the estimated coefficients of growth rate of velocity, growth rate of one year lagged money supply and prices were significant at 0.01 percent probability level and showed positive relation with inflation whereas growth rate of GDP was also significant but showed a negative sign.

**TABLE 5: Regression Results with selected explanatory variables**

| Variable | Coefficient | Std. Error | t-Statistic |
|----------|-------------|------------|-------------|
| C        | -0.979*     | 0.596      | -1.642      |
| LnGm     | 0.652***    | 0.253      | 2.58        |
| LnGq     | -0.229***   | 0.113      | -2.038      |
| Gv       | 0.071***    | 0.012      | 5.860       |
| LnGm(-1) | 0.306***    | 0.141      | 2.168       |
| LnGp(-1) | 0.429***    | 0.107      | 4.017       |

R<sup>2</sup> 0.87

Adjusted R<sup>2</sup> 0.84

Durbin-Watson 2.186

\* Indicated that the coefficient was significantly different from zero at 0.10 probability level.

\*\*\* Indicated that the coefficient was significantly different from zero at 0.01 probability level.

### Period of structural shifts (1998- 2007)

The regression results showed that from the estimated coefficients only the growth rate of one year lagged inflation rate was significant at 0.01 percent probability level.

**TABLE 6: Regression Results with selected explanatory variables**

| Variable                | Coefficient | Std. Error | t-Statistic |
|-------------------------|-------------|------------|-------------|
| C                       | -1.584      | 1.797      | -0.881      |
| LnGm                    | 0.291       | 0.517      | 0.561       |
| LnGq                    | -0.182      | 0.517      | -0.352      |
| Gv                      | 0.016       | 0.025      | 0.633       |
| LnGm(-1)                | 0.727       | 0.541      | 1.342       |
| LnGp(-1)                | 0.536***    | 0.246      | 2.177       |
| R <sup>2</sup>          |             | 0.72       |             |
| Adjusted R <sup>2</sup> |             | 0.37       |             |
| Durbin-Watson           |             | 2.46       |             |

\*\* Indicated that the coefficient was significantly different from zero at 0.05 probability level.

\*\*\* Indicated that the coefficient was significantly different from zero at 0.01 probability level.

### 3.2 Comparison of residual sum of squares

The residual sum of squares of three different data sets was found as under:

$$SSR_t = 2.0494 \quad (1973 - 2007)$$

$$SSR_1 = 0.73505 \quad (1973 - 1997)$$

$$SSR_2 = 0.39192 \quad (1998 - 2007)$$

F-statistics was obtained by using following formula.

$$F_{cal} = \frac{(SSR_t - (SSR_1 + SSR_2)) / k}{(SSR_1 + SSR_2) / (n_1 + n_2 + 2k)}$$

k = no of variables

$$F_{cal} = 6.275$$

$$F_{tab} = 2.304$$

As  $F_{cal} > F_{tab}$ , so the null hypothesis was not accepted. It showed that the variables were not stable in the whole period. That's why the structural break of the year 1983 affected inflation and Pakistan's economy.

#### 4. Conclusion and Recommendations

The impact of structural shifts on inflation in Pakistan was empirically tested in the research study using the data for the Money Supply, real GDP, and Prices with 1983 and 1998 as the years of structural shifts in Pakistan economy. The annual data during the period 1973 to 2007 was used in the study. For this purpose, income velocity of money was calculated from nominal GDP and growth rates of all the variables were estimated. The ADF test was used to investigate the stationarity of the data. Chow test was used to analyze the impacts of these shifts in Pakistan's structure on inflation. The test confirmed that both breaks affected the Pakistan's economy. The study was an extension to earlier research work done in the past as previous studies did not incorporate the impacts of structural shifts and also did not cover the recent period.

The tight monetary policy might be suggested as an important policy implication to control inflation in Pakistan as it was observed during 1970s. Expansionary monetary policy was implemented in that decade therefore, inflation was very high while monetary growth decreased in 1980's and inflation also reduced. Gordon (1985) suggested that the formulation of monetary policy of the country must consider the goal of development in the real and financial sector of the economy and these goals must be treated as constraints upon the monetary policy formulation.

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