

## OPENNESS AND INFLATION: EVIDENCE FROM TIME SERIES DATA

### *DIŞA AÇIKLIK VE ENFLASYON: ZAMAN SERİLERİ VERİLERİ İLE BİR KANIT*

**Muhammad ZAKARIA\***

*Pakistan Institute of Development Economics, Department of Economics  
mzakaria09@yahoo.com*

**ABSTRACT:** The paper empirically examines relationship between trade openness and inflation in Pakistan using annual time-series data for the period 1947 to 2007. The empirical analysis shows that a positive relation holds between trade openness and inflation in Pakistan. The results are robust to controlling for other inflation determining variables and performing sensitivity analysis. Flexible exchange rate regime and an increase in the level of development inflate domestic inflation. Other control variables i.e. money supply, fiscal deficit, exchange rate depreciations, foreign inflation, terms of trade, foreign debt and democracy significantly affect inflation in the expected directions.

**Keywords:** Openness; Inflation; Exchange Rate Regime

**JEL Classification:** E31; F14; F41

**ÖZET:** Bu çalışma, 1947–2007 dönemini kapsayan yıllık veriler kullanılarak Pakistan’da dış ticaret alanında dışa açıklık ile enflasyon arasındaki ilişki ampirik olarak incelenmiştir. Ampirik analiz sonuçları, Pakistan’da dışa açıklık ile enflasyon arasında pozitif bir ilişki olduğunu göstermektedir. Sonuçlar, enflasyonu belirleyen diğer değişkenlerden ve duyarlılık analizlerinden etkilenmemektedir. Esnek kambiyo rejimi ve gelişme düzeyindeki artış yurtiçi enflasyonu artırmaktadır. Diğer kontrol değişkenleri olan para arzı, mali açık, döviz kurunun değer yitirmesi, dış enflasyon, ticaret haddi, dış borç ve demokrasi enflasyonu beklenen yönde anlamlı bir şekilde etkilemektedir.

**Anahtar Kelimeler:** Dışa Açıklık; Enflasyon; Kambiyo Rejimi

**JEL Sınıflaması:** E31; F14; F41

### **1. Introduction**

The association between trade openness and inflation is one of the more celebrated propositions found in every international trade text. Temple (2002) calls it one of the modern puzzles of international macroeconomics. Proponents of trade openness (spillover hypothesis) argue that trade openness is associated with declining prices, so that protectionism is inflationary (Musa, 1974). There are different theories that explain this inverse impact of trade openness on inflation. According to conventional view, inflation is lower in more open countries because real depreciation, say due to unanticipated monetary expansion, produces harms like increased cost of production that are greater in more open countries, so the

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\* Author is Assistant Professor at the Department of Economics, Pakistan Institute of Development Economics (PIDE), Islamabad, Pakistan. The views expressed in this paper are those of author and cannot be attributed to the PIDE.

authorities will expand less and hence inflation rate will be less (Romer, 1993). Lane (1997) proposes that it is existence of imperfect competition and the presence of rigid nominal prices in the non-tradable sector that leads inverse relationship between openness and inflation. According to new growth theory, openness reduces inflation through its positive influence on output, mainly through increased efficiency, better allocation of resources, improved capacity utilization, and increased foreign investment (Jin, 2000). Cukierman *et al.* (1992) documents that in small open countries most of the revenues are generated through (given levels of) tariffs and less through other sources like seignorage, which results in lower rates of inflation. Further, in open countries prices of traded goods converge across countries because of free trade, therefore, theory suggests a lower degree of price distortions in outward-looking countries. Moreover, in highly open countries conversion of domestic currency into foreign currency is very easy. Therefore, the inflation rate – a kind of tax on domestic currency – will be low in more open countries.

In turn, opponents (cost push hypothesis) argue that trade openness does not necessarily reduce inflation; rather it increases inflation. Evans (2007) argues that the positive effect of openness on inflation is driven by the fact that the monetary authority enjoys a degree of monopoly power in international markets as foreign consumers have some degree of inelasticity in their demand for goods produced in the home country. The decision of the monetary authority is then to balance the benefits of increased money growth that come from the open economy setting with the well-known consumption tax costs of inflation. Further, it is also possible for an open economy to import inflation from the rest of the world via the prices of manufactured imports or raw material imports. Moreover, as the economy opens up, the fiscal and monetary authorities tend to lose their ability to control inflation through fiscal and monetary policies.

Empirically, a number of studies have investigated the effects of trade openness on inflation, and have reached inconclusive results. Some studies have identified negative effects of trade openness on inflation (Triffin and Grubel, 1962; Whitman, 1969; Iyoha, 1973; Romer, 1993; Lane, 1997; Sachsida *et al.*, 2003; Ashra, 2002; Gruben and McLeod, 2004; IMF, 2006), others confirmed an insignificant or even positive relationship (Batra, 2001; Alfaro, 2005; Kim and Beladi, 2005; Evans, 2007). Alternatively, Bleaney (1999) stipulates that robust negative correlation between openness and inflation emerged only during 1970s and 1980s and has disappeared in the 1990s. There are number of reasons for conflicting conclusions including different researchers have used different indicators for trade openness and different methods to analyze the effect, difference in the extent of openness studies, most studies have analyzed scenarios rather than evaluating the effects and so on.

The inconclusive association between trade openness and inflation that has empirically been established in the literature reveals some important considerations. First, one can infer that the correlation between openness and inflation retains both country and time specific effects. Second, previous studies on this issue are normally cross-section analyses, in which the mean of the variables being studied for several countries is adopted to verify the relation between openness and inflation. Our work departs from previous research in that we move beyond cross-sectional correlations and utilize time-series data in which we expect to obtain more information on the association between trade openness and inflation. In this paper, an attempt is made to examine the influence of trade openness on inflation in Pakistan using annual

time-series data for the period 1947 to 2007. The empirical literature on inflation and openness is limited in Pakistan<sup>1</sup> and this study tries to fill this gap to some extent.

The paper opens up in section 2 with a brief review of trade openness process and inflation in Pakistan. The model is formulated in section 3. Section 4 provides overview of the data and discusses empirical results and their interpretation. Section 5 provides the sensitivity analysis. Final section concludes the paper.

## 2. Openness and Inflation in Pakistan

Pakistan initially followed commercial policies that favored import substitution, which created a highly protected environment for industrialization. Tariffs, quantitative restrictions and other nontariff barriers were the principal policy instruments used to shield the domestic import-substituting industry. However, Pakistan gradually moved towards outward-looking strategy as it reduced drastically its import tariffs, export taxes and quantitative restrictions on trade and followed prudent exchange rate policies. As a result, the process of trade liberalization has started in the country. The extent of bias against exports has declined and the share of Pakistan's trade in GDP has increased. High dependence on tariffs as a source of government revenue is the major aspect that hinders trade openness process in Pakistan. In fact, the gains from trade openness would result mostly from a lowering of trade restrictions from Pakistan's major trading partners rather than Pakistan's own commitment to trade openness. Although concerns remain about lingering tariffs, nontariff barriers, and other protectionist practices, it is hard to deny that Pakistan economy has become more liberalized.

Inflation in Pakistan over the last 60 years had an erratic trend, ranging as high as 23 per cent in 1974 and as low as -3.52 per cent in 1959. Monetary factors played a dominant role in inflation creation in the country followed by food and other non-food items. Inflation was relatively low during 1980s compared to 1990s. Tight monetary policy (combined with fiscal consolidation) appears to have contributed to this low-inflation environment. Devaluation of domestic currency and political instability are held responsible for high inflation during 1990s. Trade openness and flexible exchange rate system also contributed to cosmic inflation in the country. After remaining relatively low during early 2000s, the inflation rate in Pakistan started acceleration in 2005, which is mainly because of low export growth relative to import, high oil prices, reduction in foreign capital inflows and inadequate supply of food and non food items. Both food and non-food inflation contributed to the persistence of double-digit inflation during the period 2005-08.

Table 1 reveals that during 1950s when total trade was low (23 per cent of GDP) inflation was also low (3.4 %); however, during 1990s when trade has increased to 33 per cent of GDP inflation also reaches to 9.25 per cent. A similar pattern holds between inflation and other trade openness measures i.e. exports and imports (both expressed as percentage of GDP). This gives us the idea that inflation and trade openness remained positively correlated in Pakistan over the entire sample period.

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<sup>1</sup> The only exception is Hanif and Batool (2006), which finds negative effect of trade openness on inflation in Pakistan. Unfortunately, the study is weak in terms of theoretical rigor, data and estimation, and lacks interpretation. The policy implications thus drawn may not hold.

The positive relationship between inflation and openness is empirical examined in the subsequent section.

**Table 1. Inflation and Trade Openness Indicators (1947 – 2007)**

Period	Inflation	Exports	Imports	Total Trade
1950s	3.40	11.90	11.55	23.44
1960s	3.58	6.87	12.51	19.38
1970s	10.87	9.08	14.99	24.06
1980s	6.98	10.72	19.29	30.00
1990s	9.25	14.59	18.80	33.38
2000s	4.31	14.30	15.60	29.90
<i>Total</i>	<i>6.44</i>	<i>11.14</i>	<i>15.42</i>	<i>26.56</i>

**Note:** Inflation is percentage change in CPI, while exports, imports and total trade (openness) are expressed as percentage of GDP. All values are period averages.

### 3. The Model

This section explores the link between trade openness and inflation using regression analysis. The approach followed here is to add trade openness to the right-hand-side variables in a standard inflation equation as an explanatory variable. Here the hypothesis is that openness variable is likely to significantly positively affect inflation rate. In order to be consistent with previous studies, we utilize a conventional model. In what follows we estimated the model given by:-

$$\text{Inflation}_i = \beta_1 + \beta_2 \text{Openness}_i + \beta_3 \text{Controls}_i + v_i$$

where  $\beta_i$ 's are the parameters to be estimated, and  $v_i$  is the stochastic disturbance term such that  $v_i \sim N(0, \sigma^2)$ . The set of control variables is included to take account of variables determining the steady-state inflation. Hence, controls comprise money supply, fiscal deficit, exchange rate depreciations, foreign inflation, terms of trade, foreign debt and democracy. The first five variables are theoretically expected to inflate domestic inflation while the theoretical signs of foreign debt and democracy cannot be determined priori.

### 4. Data and Empirical Results

#### 4.1. Overview of the Data

Annual time-series data is collected for Pakistan for the period 1947 to 2007. The dependent variable is inflation rate, which is measured by growth rate of CPI. For openness measure, we use the share of total trade (exports plus import) in GDP. Money supply (proxied by M2), fiscal deficit and foreign debt are taken as a share of GDP; exchange rate is defined as domestic currency per unit of foreign currency; terms of trade is the ratio of export price to import price; democracy is proxied by Polity2 score, which is taken from Polity IV dataset described by Marshall and Jaggers (2009), Polity2 is an index ranging from -10 (full autocracy) to +10 (complete democracy); while per capita income is measured by real per capita GDP. The data is taken from *International Financial Statistics* and *Pakistan Economic Survey*.

Table 2 contains summary statistics for the variables used in this study, which may help in the interpretation of the coefficient estimates by providing the scale of the relevant variables. Table 3 presents the correlation matrix for the variables. Column (1) of Table 3 correlates inflation with all independent variables. The value of

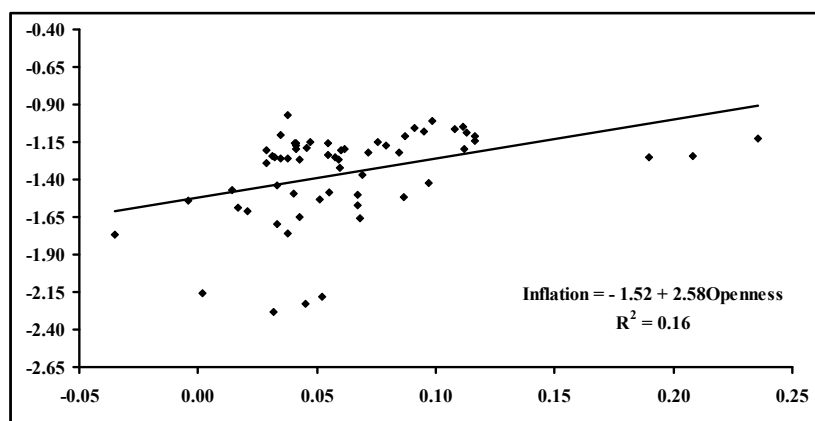
correlation coefficient 0.41 indicates that inflation is positively correlated with trade openness. Figure 1 plots the correlation between inflation and openness. The figure displays an apparent positive relationship between inflation and trade openness for Pakistan. The correlation exercises, being essentially bivariate and simplistic, calls for exploration in a more rigorous framework. This is what the next section of the paper attempts to do.

**Table 2. Summary Statistics for the Variables (1947 – 2007)**

	Mean	Median	Std. Dev.	Minimum	Maximum	Count
Inflation	6.37	5.47	4.64	-3.52	23.56	60
Openness	26.78	28.69	6.60	10.24	37.95	61
Money Supply	39.88	39.24	6.67	28.44	57.22	61
Fiscal Deficit	5.48	6.00	2.39	0.00	10.00	61
Exchange Rate	19.06	9.90	19.42	3.32	60.86	61
Foreign Inflation	3.55	2.84	2.81	-1.42	12.66	60
Terms of Trade	1.52	1.36	0.52	0.79	2.74	61
Foreign Debt	36.32	41.71	25.19	0.02	82.06	61
Democracy	0.54	1.00	5.97	-7.00	8.00	61
Per Capita Income	9.74	9.65	0.38	8.74	10.30	61

**Table 3. Correlation Table for the Variables Included in the Regressions (1947-2007)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Openness	0.41	1								
Per Capita Income	-0.03	0.11	1							
Money Supply	0.19	0.19	-0.21	1						
Fiscal Deficit	0.43	-0.03	-0.24	0.45	1					
Exchange Rate	0.19	0.53	-0.12	0.77	0.30	1				
Foreign Inflation	0.58	0.16	-0.15	0.19	0.45	0.03	1			
Terms of Trade	-0.27	-0.31	0.17	-0.79	-0.48	-0.88	-0.28	1		
Foreign Debt	0.38	0.09	-0.24	0.72	0.77	0.65	0.43	-0.83	1	
Democracy	0.41	0.10	0.02	-0.13	0.07	-0.11	-0.09	0.16	-0.11	1
Exchange Rate Regime	0.05	0.53	-0.07	0.63	0.25	0.88	-0.14	-0.74	0.50	-0.05



**Figure 1. Correlation between Inflation and Openness (1947 – 2007)**

#### 4.2. Empirical Analysis<sup>2</sup>

We have applied Generalized Method of Moments (GMM) estimation technique of Arellano and Bond (1991), and Arellano (1993) to estimate inflation equation. The GMM estimators control for the endogeneity of the lagged dependent variable and for the potential endogeneity of other explanatory variables. Lagged values of the variables are used as instruments.

The corresponding regression is reported in Table 4. The t-statistics on openness (10.429) indicates that there is a statistically significant positive relationship between openness and inflation.<sup>3</sup> The coefficient for the openness stood at 0.047, which means that a one-standard-deviation increase in openness (6.60) leads to about 0.31 percent increase in the inflation rate. In other words, outward orientation is inflationary for Pakistan. This is possibly due to the importance of imports in total trade, which has an enhancing effect on the inflationary process of the economy as the experience of increasing world oil prices and manufacture goods indicate. The fraction of the variation in inflation rate due to openness, as explained by column (2), is nontrivial. The remaining columns of the table investigate the robustness of these results to some simple changes in specification. These changes alter the results only trivially. Thus, the estimated impact of openness on inflation is robust to alternative equation specification with reasonable values of overall R-square. This finding is consistent with the notion that trade openness fosters inflationary growth in developing countries. The results show that openness is a constraint on policymakers' incentives to deflate.

The usual macro variables such as money supply and fiscal deficit have expected and statistically significant impact on the domestic inflationary process. This shows that monetary as well as fiscal policies remain important determinants of inflationary process in Pakistan. Further, we observe that both (nominal) exchange rate and foreign inflation rate have significant positive influence on domestic inflation rate. It supports conventional purchasing power parity theory. The coefficient of terms of trade is also observed to be consistently significant positive, as we would expect. Our results are against Terra's (1998) findings as shown in the table the results on openness and inflation are robust to controlling for government debt, which has a statistically significant positive influence on inflation. Similarly, democratic institutions in Pakistan remained inflationary as the positive coefficient on democracy indicates (0.004). This effect is significant statistically and trivial economically.

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<sup>2</sup> Results of unit root tests show that all variables do not have same order of integration. Therefore, bounds testing approach (ARDL) is employed to ascertain the existence of long run cointegrating relationship among the variables. The results of ARDL test show that there exists a long run cointegrating relationship among the variables of inflation equation. The results of both unit root and ARDL tests are not reported here to conserve space. However, they are available from the author on request.

<sup>3</sup> To check the non-linear effect of openness on inflation, a squared term of openness was included in inflation equation. However, its effect on inflation turned out to be insignificant and hence excluded from the estimation.

**Table 4. Relationship between Inflation and Openness [1947 to 2007]**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept	0.068 (3.941)*	0.077 (4.875)*	0.264 (11.129)*	0.186 (6.428)*	0.154 (12.985)*	0.076 (3.650)*	0.308 (10.443)*	0.559 (15.225)*	0.040 (2.679)*	0.046 (5.012)*	0.131 (6.432)*	0.160 (8.938)*
Openness	0.047 (10.429)*	0.029 (2.459)*	0.062 (5.374)*	0.062 (4.871)*	0.049 (5.623)*	0.036 (2.351)*	0.054 (7.624)*	0.157 (13.692)*	0.019 (1.728)**	0.035 (10.584)*	0.031 (2.411)*	0.084 (5.950)*
Money Supply	0.039 (3.532)*		0.056 (3.039)*			-0.011 (-0.423)						
Fiscal Deficit	0.016 (3.945)*		0.057 (8.930)*				0.058 (8.463)*					
Exchange Rate	0.004 (1.192)			0.027 (5.185)*				0.091 (9.126)*				
Foreign Inflation	0.886 (12.000)*			0.713 (9.573)*					1.193 (5.319)*			
Terms of Trade	0.053 (3.678)*				0.017 (0.797)					0.120 (19.975)*		
Foreign Debt	0.007 (4.963)*				0.013 (4.252)*						0.009 (5.103)*	
Democracy	0.004 (22.470)*											0.004 (5.137)*
AR(1)		0.580 (8.579)*	0.352 (5.354)*	0.693 (21.450)*	0.437 (8.455)*	0.610 (8.694)*	0.612 (14.504)*	0.823 (48.356)*	0.395 (4.715)*	0.864 (11.577)*	0.593 (7.901)*	0.345 (4.773)*
R <sup>2</sup>	0.607	0.402	0.483	0.543	0.480	0.422	0.449	0.464	0.505	0.278	0.471	0.388
Adjusted R <sup>2</sup>	0.542	0.380	0.445	0.509	0.441	0.390	0.419	0.434	0.478	0.233	0.442	0.354
DW	1.821	1.773	1.766	2.278	1.707	1.744	2.142	2.062	1.875	1.927	1.959	1.804

**Note:** Values in parentheses denote underlying student-*t* values. The *t* statistics significant at 5 % and 10 % levels of significance are indicated by \* and \*\* respectively.

## 5. Sensitivity Analysis

### 5.1. The Role of Per Capita Income

The budgetary argument linking inflation and openness rests on the importance of revenue sources, which predict that the link between inflation and openness should decline as per capita income rises because fiscal position will benefit. This prediction can be tested by adding an interaction term between openness and per capita income to the regressions. If the link between openness and inflation lessens as tariffs and seignorage decline in importance, the coefficient on the interaction term will be negative. As Table 5 reveals the interaction term enters with a significant positive coefficient (0.023), which indicates there is no evidence that the relationship between openness and inflation becomes weaker as income rises. Thus, our results are contrary to the prediction of the budgetary view of link between inflation and trade openness. However, the results are not robust to alternative equation specification.

### 5.2. The Role of Exchange Rate Regime

Pakistan initially pegged its currency against US dollar. However, after the collapse of Bretton Woods System in 1973 and adoption of flexible exchange rate system by major trading partners, Pakistan was persuaded to move to a flexible exchange rate regime. Resultantly, Pakistan moved to a managed floating exchange rate system in 1982. An important feature of flexible exchange rate system is that it is associated with higher levels of trade openness in Pakistan; therefore, excluding the flexible exchange-rate regime variable can bias the results.

In Table 5 an interaction term between openness and exchange rate regime is included as a regressor. Exchange rate regime is measured by a dichotomous variable that takes the value of 1 if exchange rate regime is flexible and zero

otherwise. The magnitude of the openness–inflation coefficient increases with the inclusion of interaction term. The interaction term always has a positive coefficient, implying that the effect of openness on inflation increases under flexible exchange rate regime. Our results support Frankel's (1999) concern that in flexible exchange rate system monetary authority loses its control over monetary policy, which has inflationary effects in the economy. It also supports Bleaney (1999) who argues that since 1973 the most consistent finding is that floating exchange rate regimes are associated with inflation rates at least 10 per cent a year higher than pegged exchange rate regimes, after allowing for other factors.

**Table 5. Relationship Between Inflation and Openness:  
Inclusion of Interaction Terms [1947 to 2007]**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Per Capita Income</i>				<i>Exchange Rate Regime</i>			
Intercept	0.084 (4.708)*	0.186 (11.719)*	0.179 (5.147)*	0.161 (10.984)*	0.134 (4.910)*	0.327 (16.101)*	0.148 (5.470)*	0.275 (30.886)*
Openness	0.046 (9.926)*	0.009 (1.133)	0.042 (2.988)*	0.061 (5.425)*	0.051 (12.245)*	0.064 (10.843)*	0.040 (3.599)*	0.117 (19.830)*
Money Supply	0.032 (2.872)*	0.090 (8.736)*			-0.006 (-0.507)	0.031 (2.003)*		
Fiscal Deficit	0.012 (2.835)*	0.059 (13.244)*			0.012 (1.733)**	0.067 (20.377)*		
Exchange Rate	0.001 (0.444)		0.029 (5.196)*		0.011 (2.147)*		0.018 (3.363)*	
Foreign Inflation	0.835 (12.204)*		0.692 (6.962)*		0.596 (7.613)*		0.803 (14.833)*	
Terms of Trade	0.038 (2.680)*			0.073 (3.496)*	-0.011 (-0.631)			0.016 (1.968)**
Foreign Debt	0.007 (4.720)*			0.020 (5.752)*	0.001 (0.750)			0.012 (10.885)*
Democracy	0.004 (22.665)*			0.000 (0.671)	0.003 (15.301)*			0.003 (13.504)*
Openness*Per Capita Income	-0.004 (-0.647)	0.023 (8.787)*	0.007 (1.564)	-0.007 (-0.994)				
Openness*Exchange Rate Regime					0.038 (4.166)*	0.011 (2.206)*	0.017 (3.286)*	0.061 (25.462)*
AR(1)		0.634 (13.664)*	0.717 (24.584)*	0.461 (8.226)*		0.445 (22.443)*	0.662 (21.230)*	-0.200 (-4.032)*
R <sup>2</sup>	0.626	0.372	0.514	0.500	0.656	0.480	0.522	0.521
Adjusted R <sup>2</sup>	0.556	0.311	0.468	0.441	0.592	0.430	0.477	0.465
DW	1.811	1.881	2.227	1.883	1.705	1.965	2.152	1.732

Note: Values in parentheses denote underlying student-*t* values. The *t* statistics significant at 5 % and 10 % levels of significance are indicated by \* and \*\* respectively.

## 6. Conclusion

The paper empirically explores the relationship between trade openness and inflation in Pakistan using annual time series data for the period 1947 to 2007. Since Pakistan's economy has a considerable degree of openness to foreign trade, the domestic price level cannot remain immune to external shocks. This hypothesis is supported by this study. The results show that trade openness has a significant positive effect on inflation in Pakistan. This result is robust to alternative equation specifications and to the inclusion of per capita income and exchange rate regime. Thus, the results in this paper substantiate the recent empirical literature that reveals positive relationship between inflation and openness. These results indicate that the traditional closed economy explanation for inflationary process is no more important.

The positive significant influence of money supply on inflation is somewhat in congruence with the monetarists who argue money to be the most important variable affecting the inflationary process. Fiscal deficits, exchange rate depreciations, foreign inflation, terms of trade, foreign debt and democracy are also found to be



important explanatory variables affecting inflationary process. An increase in the level of development of the country and a shift from pegged to floating exchange rate regime are also predicted to add to the country's inflation rate.

The positive relationship between openness and inflation is bound to have far-reaching implications for policy makers in Pakistan including some for the optimum strategy for development. Specifically, it will have implications for the optimal trade policy (inward-looking vs. outward-looking policies) and the optimal capital accumulation strategy. If rapid inflation discourages domestic capital accumulation and if increased capital accumulation is needed for development, it will turn out that outward-looking trade policy may not be optimal as it is inflationary. This paper also argues that, in the short run, a flexible exchange rate has not served as a commitment mechanism and thereby cosmic inflation. The challenge of the future is clearly for Pakistan to find ways to combine flexible exchange rate with low inflation. Further, we all know that long-run inflation levels are determined by central banks. Inflation behavior is and should be a perennial topic at central bank. Since inflation is one of the obstacles on the way of development in the country, it should also be controlled by non monetary and non fiscal measures e.g. increase in volume of production, rationing policy, sound managerial and financial system, etc. Further, analysis is needed to explore the channels through which openness is likely to affect inflation in Pakistan.

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