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# Relationship between Trade Openness and Inflation: Empirical Evidences from Pakistan (1976–2010)

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## 1. INTRODUCTION

Inflation has always been an important issue for the policy-makers as it creates uncertain situation in the economy that may badly affect economic growth. Therefore, high and stable economic growth in addition with low inflation is the main objective of macroeconomic policies. Strict monetary policy with fiscal consolidation appears to have contributed to low price levels. The concern with inflation has not only to balance whole macroeconomic situation, but also from the fact that increase in inflation rates hurts the poor severely as their consumption basket becomes significantly decreased.

A general rise in prices in the economy is usually called inflation. Inflation was occurred due to some demand and supply side factors. Inflation can be resulted due to supply shocks of different food items and world wide oil prices. Rising oil prices always increase prices of almost all other commodities for consumers. These supply shocks are volatile and can occur huge changes in food and oil prices.

There are following demand side issues which increase price level in Pakistan. Firstly, increased local demand due to foreign remittances and demand management policies outpaced the local production, establishing positive output gap, which in turn put burden on prices to increase. Growth in private consumption remained above 10 percent during 2003 to 2006, showing symptoms of demand side burdens on prices. [Khan, Bukhari, and Ahmed (2007)]

Secondly, the widening gap among local demand and production was filled by growth in total imports; it was increases above 40 percent in FY05 and by 24 percent in FY06 as compare to that gap of imports, exports increased by only10 percent in FY05 and 13 percent in FY06.[1] Which result into increase in trade deficit and high expected inflation in future?

Thirdly, broad fiscal policy enhances local demand and add burden on current account deficit. This means, it increases gap among saving and investments, which has to be financed. Moreover, financing of fiscal deficit through money creation adds inflationary burden. On the other side, government borrowing from State Bank of

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[1]*Economic Survey 2005-06.*

Pakistan (SBP) also increased, which have serious effects on price level. Fourthly, broad monetary policy with high growth rate in money supply and loose credit policy was also contributing to large prices. [Khan, Bukhari, and Ahmed (2007)]

The extensive survey of International Monetary Fund, suggests that excessive credit growth in developing countries can have bad impacts on real variables. Increasing import prices is also a major reason in enhancing inflation and in this scenario the depreciating exchange rate can put upward pressure on prices.[2] Similarly, Khan and Qasim (1996) and Hasan, *et al.* (1995) suggested that indirect taxes are also the basic reason of inflation in Pakistan.

Trade Openness is defined as a "phenomena of sharp economic integration between countries capture through trade liberalisation, investment and capital flows, as well as technological changes"[3]. Trade Openness association with falling prices is the most popular propositions found in international trade and there has been unique turn in favor of higher economic integration of world. Openness suggests the economic benefit from international trade, international capital transactions, and the international exchange of knowledge and information. The lower the hurdles to international trade transactions the higher level of integration and benefits.

The new growth theory suggests that openness widens the market, induct an increase in development, reallocates employment to new activities that need more human capital and enhances knowledge flow between countries. Other than benefits, some expenses are also attached with it. A main problem arises from decreasing trade hurdles is the loss in tariff revenue that is 10-20 percent of government revenue in developing economies. If tariffs are decreased or vanished, these economies will have to implement other taxes in order to keep their budgets at desire level.

**Objectives of the Study:** The main objective of this research is to determine the nature of the relation among inflation and trade openness for Pakistan. The core focus of this study is to apply the cointegration approach of Johansen (1998) and Johansen and Juselius (1990) in order to examine whether the Romer's findings (1993), that the negative link among inflation and trade openness, holds for Pakistan or not.

**Hypothesis:** The null hypothesis (H0) of this study is to estimate the existence of Romer's Hypothesis in Pakistan and alternative hypothesis (H1) is otherwise.

## 2. REVIEW OF LITERATURE

Romer (1993) tested the hypothesis that there was negative relationship between trade openness and inflation. Romer's regressing inflation on openness for cross sectional data of 114 economies over the Post-Bretton Woods period.[4] He assessed the strong relationship between inflation and openness in politically unstable countries with independent central banks.

Lane (1997) emphasised on different channel through which openness and inflation related, especially the degree of imperfect competition, degree of central bank independence, political instability and price rigidity in the non-traded sector.15-years average annual data from 1973 to 1988 have undertaken for cross sectional analysis using

[2]IMF (2004).
[3]Torres (2001).
[4]From 1973 to the early 1990s.

OLS and finding shows the statistically significant negative link between openness and inflation.

Terra (1998) challenged Romer's empirical findings using regression on 20 sample countries which were dividing into 4 groups according to indebtness level. The time frames used in study were pre-debt crisis[5] and debt crisis period[6] for severely, moderately and less debted countries. Negative but significant link between inflation and openness was found among severely indebted countries in Latin America but that was not exists in moderately and less debted countries.

Bleaney (1999) estimated relationship between inflation and trade-openness for 100 countries through regression from 1973-88 and 1988-98. Results indicated the negative correlation between inflation and openness for cross-sectional data of 1970s and 1980s that has disappeared in 1990s. The same results were obtained if per capita income levels, population, area and exchange rate regimes were control.[7]

Cavallari (2001) inserted the relation of trade openness and inflation in monopolistic production model and unionised labour market of domestic sector. The result of theoretical model showed that trade openness can affect inflation in a positive or negative way and final result depends on level of concentration of wage bargaining in country. Results indicated that in countries where wage bargaining concentrated there did not exists any relation among openness and inflation. However, in countries where wage bargaining decentralised, there exists negative link between openness and inflation.

Alfaro (2001) estimated panel data of 146 countries from 1973-1998 by using fixed effect of country and time effect regression among openness and inflation. Results indicated that in the short run, there was no influence of openness on inflation and fixed exchange rate was an important factor to reduce inflation. In the long run, she concluded that negative and statistically significant relationship existed among openness and inflation.

Temple (2002) tried to establish relation of trade openness and the 'Phillips curve' for 44 countries from 1973-1990.[8] Regressions results indicated that Phillips' curve will be more inclined in open economies. Ashra (2002) used multiple regressions by taking panel data from 1980 and 1990 of 15 countries to discuss relation between inflation and openness. He concluded that inflation was effected by openness no matter either an economy possessing hyper-inflation or it is big.

Jin (2002) focused on the openness-growth and openness-inflation relations for "Korea" by applying variance decompositions (VDC's)[9] and impulse response functions (IRF's)[10] which were based on moving averages of quarterly data from 1960-1 to 1997-3.

[5]1973–1980.

[6]1982–1990.

[7]As a result of disinflation in industrial countries, the negative correlation between per capita GDP and inflation was strong in 1989-98, whereas it was weak in 1973-88.

[8]Phillips curve slope attached with openness is depend on small open economy system with nominal rigidity.

[9]Shows the quantity of information of each variable contributes to the other variables in a vector autoregression (VAR) models. It determines how much error variance of each variable can be explained by exogenous shocks to other variables.

[10]Impulse response functions show the effects of shocks on the adjustment path of the variables. It shows how an unexpected change in one variable at the beginning affects another variable with the passage of time. In time series analysis it is important in determining the effects of external shocks on the variables of the system.

Results of IRF's indicated that openness has inverse impacts on output growth but no long run effects, it further showed that financial market and trade openness has inverse effects on the output growth and prices. Results of VDC's showed that effects of openness were significant and increase in openness reduced tariffs and hence lower import prices.

Bowdler (2003) used cross sectional data of 20 countries to test the short term inclination of Phillips' curve relates positively with trade openness. He concluded that if cambial regime taken into consideration then degree of trade openness in a country exerted positive effect on inclination of Phillips' curve. Sachsida, Carneiro, and Loureiro (2003), used fixed and random effects model in order to verify the Romer's findings by using the data of 152 countries for the period of 1950 to 1992. They concluded that negative relation among openness and inflation was neither specific to countries nor to certain time period.

Agarwal and Narayanan (2003) used the dataset of 53 developing countries located at five different regions for the period of 1975 to 2002. GMM Findings showed that openness had significant negative effect on inflation after 1989. The analysis of pre 1989 data showed that only fixed exchange rate regime had significant negative effect.

Gruben and McLeod (2004) used panel regression for controlling country specific effects and confirmed about negative relation among inflation and trade openness. The time varying coefficients suggested that countries with more openness to trade enjoyed greatest deduction in their inflation during the 1990s. Empirical specification also provided coefficient of variation for inflation, that after 1985 the more open economies have less volatile inflation.

Kim and Beladi (2005) examined the relation among inflation and trade openness for 62 economies which consists of 28 OECD and 34 developing economies and selected on the basis of central bank dependency index form 1947 to 2002. Panel analysis indicated positive relation among prices and openness for advanced economies such as U.S., Belgium, and Ireland and inverse relation for developing countries as in line with Romer's (1993).

Nunziata and Bowdler (2006) hypothesised negative relation among openness and probability of huge increase in prices using data from 19 OECD economies from 1961–93. A range of probit regressions shown empirical support for greater openness reduces the probability of an inflation start even after controlling variables. The openness impact on lagged GDP growth and inflation in U.S. were positive but statistically insignificant.

Bowdler and Malik (2006) suggested that openness may change structure of consumption and production of goods whose prices were more stable internationally by using panel data of 96 countries from 1961-2000. Results of ordinary least squares suggested that opening of economy more sharply than the average has experienced huge deductions in inflation. Sachsida (2006) estimated relation among inflation and trade openness to verify Romer hypothesis for 152 countries with division in 7 different groups from 1950-1992. Fixed and random effect results given support to Romer's that inverse relation among inflation and openness were restricting neither to subset of economies nor to time period.

Chung-Shu Wu and Jin-Lung Lin (2006) investigated openness-inflation relationship using panel data of 13 countries that included Asian 4 Newly Industrialised

Economies (NIE's)[11] and the G7[12] from 1973 to 2001. Panel regression results clear that models with or without constant constraint give different relationships between openness and inflation. With restricted constant terms, the results were similar to Romer's (1993) however, if relax that restrictions, empirical results does not show a certain relationship. They concluded that openness has significant negative relationship with inflation for NIEs, but has mixed results for G7.

Aisen and Veiga (2006) analysed panel data of more than 100 countries from 1975 to 1999 and found that less economic openness along with higher degrees of political instability generated more volatile inflation rates. Results indicated that higher openness was related to lower inflation but this cannot be found in all countries at all times and they also supported the existence of import price effect.

Hanif and Batool (2006) tested Romer's hypothesis for Pakistan using time series data from 1973 to 2005. They found that real gross domestic product, monetary growth, interest rate, wheat support price and openness (the ratio of growth in trade to GDP) has inverse effect on inflation in Pakistan. Results from Regression Analysis clear that supply factors were important than monetary factors in the process of inflation.

Gopal (2007) discussed the effect of openness on tariff structure, export competitiveness, prices and economic growth for 11 countries of Latin American region[13] during 1985-2003. Ordinary least square results indicated the existence of significant positive relation and higher openness between Latin American countries would enhance to upgrade institutions. The opening up of markets could play vital role in decreasing economic rents atteched with economic and institutional arrangements.

Evans (2007) focused on level of imperfect competition that affects the relation among openness and inflation both within a country and between countries by using 2 country overlapping generations (OLG)[14] model from 1982-2005. Results indicated that level of imperfect competition among the producers plays a substitute for market power enjoyed by country's monetary authority in obtaining monopoly rents available in international structure.[15]

Badinger (2007) assessed the relation among inflation and openness measured in terms of financial openness using cross-sectional data of 91 countries from 1985-2004. 2SLS results indicated that larger trade and financial openness reduced central bank's independency which yield to less inflation that is attached with larger output-inflation tradeoff.

Daniels and Vanhoose (2007*)* considered open economy with degree of income-tax progressivity influenced on the interaction between openness, central bank independence and prices by using data of 17 countries from 1979 to 1999. Regression analysis of cross-country inflation provided favor inverse relationship between inflation

[11]Hong Kong, Korea, Mexico, Philippines, Singapore, and Taiwan.

[12]Canada, France, Germany, Italy, Japan, U.K. and the United States.

[13]Consist of various sub regional groups: Mexico, Central America (Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama), and the Caribbean 13 countries; South America contains the Andean Community (Colombia, Ecuador, Bolivia, Peru) and Mercosur (Argentina, Brazil, Uruguay, Paraguay and Venezuela) and Chile.

[14]In which agents live countable time span long enough to live one period at least with the next generations of agents.

[15]That is, greater level of imperfect competition among producers decreases the benefits from inflation generated by country's monetary authority.

and income tax progressive system. OLS Results indicated that higher openness and central bank independency reduced the income-tax progressivity effects on price levels.

Berument, Dogan, and Tansel (2008) assessed the role of openness on inflation for 4 MENA countries[16] through EGARCH model[17] from 1952 to 2006 by using export and import openness separately. Results suggested that increase in export openness[18] reduces inflation volatility for all MENA countries. However, increment in import openness[19] reduces price level for Jordan and Morocco but increases for Algeria and Turkey. The effect of inflation on openness was positive for Jordan, Morocco and Turkey and statistically significant just for Morocco.

Menghan (2008) estimated short and long run effect of openness on inflation through changes in productivity and interest rate by using industrial panel data of 20 industries in each of 6 OECD countries[20] from 1980 to 2006. Results indicated that openness reduced inflation rate, productivity and mark up in short run while; long run results were ambiguous.

Furuoka and Mun Ho (2009) examined relation between openness, unemployment and inflation by choosing 3 Asian economies[21] with different degrees of openness from 1980 to 2005. OLS results indicated that as country opened up to world by rising the quantity of imports then coefficient of Phillips curve slope become smaller. They concluded that more open countries tend to have flatter Phillips curve with higher sacrifice rate.

Lin (2010) investigated relation among trade openness and inflation of 106 countries using quantile regression from 1970-2007. Results reflected inverse impact of openness on inflation when price level was larger but no effect when it was less. He concluded that relation among openness and inflation appeared to be strengthening in larger prices period and was extremely robust to consider 1980s debt crisis and control the exchange-rate regime.

Mukhtar (2010) applied multivariate cointegration approach and vector error correction model to examine the Romer's hypothesis for Pakistan. He estimated time series data from 1960 to 2007 on budget deficit (BD), GDP, trade openness (TO), exchange rate (ER) and inflation (CPI). The empirical findings show that there was significant inverse long run relation among prices and openness which confirmed the existence of Romer's hypothesis in Pakistan.

Zakaria (2010) empirically examined relation among trade openness and prices in Pakistan using annual time series data from 1947 to 2007. Generalised Method of Moments (GMM) results shown that positive relation holds among openness and inflation in Pakistan and the control variables i.e. money supply, fiscal deficit, exchange rate depreciations, foreign inflation, terms of trade, foreign debt and democracy significantly affect inflation.

[16]Middle East and North African (Algeria, Jordan, Morocco and Turkey).

[17]GARCH models assumed that positive and inverse error terms effect on volatility. From empirical point exponential GARCH (EGARCH) volatility performs asymmetrically to the sign of shocks.

[18]Export-GDP ratio.

[19] Import-GDP ratio.

[20]USA, Japan, Canada, Portugal, Finland and Australia.

[21]Japan (9.8 percent), South Korea (32.9 percent) and Malaysia (77.2 percent).

Evans (2011) proposed that trade openness enhanced country's incentive to create inflation by estimating data through regression from 1973 to 1987 and 1988 to 2002. He concluded that openness was inflationary between developed countries in which monetary policy can roughly approximated by controlling for imperfect competition and inelasticity of labor supply within country.

## 3. THEORETICAL FRAMEWORK AND METHODOLOGY

Now, we designed the suitable model and explain how the variables are constructed and described the sources from where the data has been taken. After that explain the econometric methodology for estimation and interpretation of results.

### 3.1. Methodology

Inflation is a complex phenomena and it is not easy to establish an empirical model for a country. However, it is possible to find the key variables effecting the inflation in Pakistan. The most common empirical methodology for examining the trade openness and inflation relation had been to apply single equation model for inflation, treating trade openness as an independent variable with others.

Solomon and deWet (2004) use four variable single equation model where budget deficit (BD), gross domestic product (GDP) and exchange rate (ER) were treated as independent variables and inflation (CPI) as an dependent variable. Solomon and de Wet (2004) model is also used by Mukhtar (2010) in his study. To this, we add real agriculture value added (Agr), financial market openness (FMO), money and quasi money (M2), trade openness (TO) import openness (IO) and export openness (EO) as an independent variable with Gross Domestic product (GDP) and Exchange Rate (ER) are used in Real Terms. We also include Two Dummy Variables of 1982 and 1990 in Solomon and de Wet (2004) model for changes in Exchange Rate Regimes and Financial and Structural Reforms respectively.

In order to obtain the objectives of a study, model is expressed as follows;

$$CPI_t = \beta_0 + \beta_1 RealAgr_t + \beta_2 RealER_t + \beta_3 LnRealGDP_t + \beta_4 TO_t + \beta_5 FMO_t + \beta_6 LnM2_t + \mu_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (a)$$

Where,

*CPI* shows *Inflation rate*
*Real Agr* shows *Real Agriculture Value added*
*Real ER* shows *Real Exchange Rate*
*Ln RealGDP* shows Natural logarithm of *Real Gross Domestic Product*
*TO* shows *Trade Openness*
*FMO* shows *Financial Market Openness*
*LnM2* shows *Money and Quasi money*
*TO* shows *Trade Openness*

$$CPI_t = \beta_0 + \beta_1 RealAgr_t + \beta_2 RealER_t + \beta_3 LnRealGDP_t + \beta_4 IO_t + \beta_5 FMO_t + \beta_6 LnM2_t + \mu_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (b)$$

Where, *IO* shows *Import Openness.*

$$CPI_t = \beta_0 + \beta_1 RealAgr_t + \beta_2 RealER_t + \beta_3 LnRealGDP_t + \beta_4 EO_t + \beta_5 FMO_t + \beta_6 LnM2_t + \mu_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (c)$$

Where, *EO* shows *Export Openness.*

### 3.2. Data Sources

In this study we have taken annual time series data that covers the period of 1976 to 2010 from various sources including

- International Financial Statistics of International Monetary Fund (IMF's).
- World Development Indicators (WDI).
- Statistical Appendix 2010 of State Bank of Pakistan (SBP).

In independent variables, natural logarithms of real GDP and Money and Quasi Money are taken because the data is in Rs millions while, all others variables are taken as % of GDP except exchange rate and inflation rate which are index numbers with base year 2005.

### 3.3. Selection and Construction of Variables

Following are the variables used in this study

*Table of Variables Descriptions*

| Code | Variables | Definitions | Formula | Units | Source of Data and Definitions |
|---|---|---|---|---|---|
| Agr | Real Agriculture Value added | Includes forestry, hunting, fishing, cultivation of crops and livestock production. Value added is whole sector output after adding all outputs and subtracting inputs. It is estimated without making reductions for depreciation or depletion of fabricated assets and degradation of natural resources. | All outputs -Intermediate inputs (Not deducting depreciation of fabricated assets and degradation of natural resources) | % of GDP | WDI, World Bank national accounts data, and OECD National Accounts data files. |
| ER | Real Exchange Rate | The rate at which one currency will be exchanged for another. It is also considered as the value of one country's currency in terms of another currency | (Market rate)*Foreign Inflation ÷ Domestic Inflation | Index Number with base Year 2005 | International Monetary Fund, International Financial Statistics. |
| FMO | Financial Market Openness | Scenario where existing administrative and market restrictions on capital movement across borders have been vanished. When capital account liberalization implements, it should create 'Openness', then 'financial integration' will gradually be obtained.[Robert stehrer] | FDI (Net Inflows) | % of GDP | Statistics & DWH Department, SBP. |

*Continued—*

Table of Variable—(*Continued*)

| | | | | | |
|---|---|---|---|---|---|
| GDP | Real Gross Domestic Product | The market amount of goods and services produced by a country in a given year. | Nominal GDP ÷ Domestic Inflation | Rs Million | International Monetary Fund, International Financial Statistics and data files. |
| TO | Trade Openness | Value to which countries allow trade with other countries. Broad economies generally have higher opportunities, at the same time they also face competition from others economies Trade Openness is the sum of exports and imports of goods and services measured as a share of gross domestic product. | (Exports + Imports) ÷ GDP | % of GDP | WDI, World Bank national accounts data, and OECD National Accounts data files. |
| Δ CPI | Consumer Price Index | The annual percentage change in the value of fixed basket of goods and services that may be fixed or changed after specified periods. | $LnCPI_t - LnCPI_{t-1}$ | Index Number with base Year 2005. | International Monetary Fund, International Financial Statistics |
| M2 | Money and Quasi Money | Includes currency outside banks, demand deposits other than those of central government, the time, savings, and foreign currency deposits of resident sectors other than central government. | | Rs Million | International Monetary Fund, International Financial Statistics. |
| IO | Imports Openness | The value of all goods and services received from the rest of the world. | (Imports of goods & services ÷ GDP) *100 | % of GDP | WDI, World Bank national accounts data, and OECD National Accounts data files. |
| EO | Exports Openness | The value of all goods and services provided to the rest of the world. | (Exports of goods & services ÷ GDP) *100 | % of GDP | WDI, World Bank national accounts data, and OECD National Accounts data files. |

### 3.4. Estimation Techniques

Usually many macroeconomic variables are non-stationary for this purpose we can apply *unit root testing technique* in order to see that whether the variables are stationary or not. Then, the variables which are stationary at I (1) we have used Johansen (1998) and Johansen and Juselius (1990) *Maximum Likelihood Cointegration Technique and Vector Error Correction Model* in our study to check the long run relationships in between them.

#### 3.4.1. *Univariate Analysis*

*(a) Unit Root Test*

Many variables are non stationary for this we can use Unit Root Test in order to verify its order of integration. Then, only those variables are incorporated in the study which is stationary at 1st difference I (1).

*(b) Augmented Dickey- Fuller Test (ADF)*

The Augmented version of Dickey Fuller Test is used for larger and complicated models which adjust the DF test from serial correlation in the error term $\mu t$ by putting lagged values of dependent variable $\Delta Yt$.

### 3.4.2. *Multivariate Analysis*

In order to find the existence and number of long-run relationship(s) the econometric framework we used in the study for analysis is the Johansen (1998) and Johansen and Juselius (1990) *Maximum Likelihood Cointegration Approach*. Two or more series are cointegrated if they observe same kind of stochastic behavior. It is statistical property of time series variables and uses when all the variables are stationary at I (1).

The cointegration approach in a multivariate system is similar to the ADF test, but requires the use of vector autoregressive (VAR). A vector autoregressive (VAR) model with a lag length of 1 was used to test for the number of cointegrating relationships between the variables. When two series are cointegrated it suggests that even both processes are non stationary, there is some long run relationship linking both series so that it is stationary. The AIC or SBC is used to determine the number of lags in the cointegration test (order of VAR). [22]

There are two likelihood ratio test statistics in the Johansen (1998) and Johansen and Juselius (1990) Maximum likelihood Cointegration Approach; the trace and the Maximum Eigenvalue both can be used to determine the existence of number of cointegrating vectors and they don't always indicated the same number of cointegrating vectors. The distribution of both test statistics is non-standard. The Trace test is a joint test with null hypothesis of number of cointegrating vectors is less than or equal to *r*, against alternative hypothesis that there are more then *r* cointegrating vectors. The Maximum Eigenvalue test conducted separate tests on each eigenvalue with null hypothesis that there are *r* cointegrating vectors exist against the alternative hypothesis that there exists ($r + 1$).

The Johansen's maximum eigenvalue and trace tests indicate the cointegrating vector (eq's) in model and reject the null hypothesis of no cointegration at 5 percent significance level. Then consider the 1st cointegrating equation having normalised coefficients of all variables with standard error (S.E) in parentheses and calculate *T* value by dividing coefficient with S.E. T value greater then 2 indicate the significance of those variables at 5 percent confidence level.

### 3.4.3. *Vector Error Correction Model*

A main quality of cointegrated variables is that their time paths are effected by the extent of any deviation from the long-run equilibrium [Anders (2004)]. The error correction mechanism (ECM) term presents the percentage of correction to any deviation in the long-run equilibrium price in a single period and also represents how fast the deviations in the long-run equilibrium are corrected. Depending on the presence of how many cointegrating vectors, we can then test for the short run dynamics using a vector

[22]Gujarati, N. Damodar, *Basic Econometrics* (Fourth Edition).

error correction model. A vector error correction model (VECM) is a process with the quality of deviation from present state means its long-run link will put into its short-run dynamics i.e., how changes in trade openness in short run contributed to its long run relation with inflation.

## 4. ESTIMATION RESULTS

The first step in cointegration analysis is to test the stationarity of variables. Table 2 in Appendix presents the Results of Augmented Dickey Fuller Test. It shows that all the variables incorporated in this study are found to be stationary at first difference I(1).

To obtain optimal lag length for cointegration analysis, basically two criteria are used namely the AIC and the SBC. The SBC has suggested lag length of 1 as optimal, while the AIC indicates 3 as an optimal lag length. However, we have selected optimal lag length 1 as suggested by the SBC because when we use the lag length 3 for cointegration analysis we find no cointegrating vectors under both Trace and Max-Eigen statistics. While with lag length 1, we may obtain same and different numbers of cointegrating vectors under both these statistics.

First, we explain the results of inflation rate with openness by using the proxy of Trade ratio (Expors + Imports) from equation (a). The cointegration relationships between inflation rate, Real Agr, Real ER, Real GDP, FMO, M2 and TO has been investigated assuming linear trend in data with an intercept in cointegrating equation using the estimation technique. Table 3 in Appendix reports Johansen (1998) and Johansen and Juselius (1990) Maximum Likelihood Cointegration Results. The Trace statistics (λ trace) and Maximum-Eigenvalue (λ max) statistics indicate that there is Four cointegrating vectors in seven time series under both statistics.

We can reject the null hypothesis of no cointegrating vector in favour of four cointegrating vectors under Trace and Maximum-Eigenvalue statistics at 5 percent level of significance. Under the assumption of no deterministic trend in data and intercept and no trend in cointegration equation, we can obtain the equation which is normalised for inflation to obtain meanings from the coefficients are given below;

$$CPI_t = -0.532275 + 0.046969 RealAgr_t + 0.011581 RealER_t - 0.164388 LnRealGDP_t$$

T Val (0.2212) (2.84315) (4.19565) (0.60310)

$$+0.026124 TO_t + 0.119921 FMO_t - 0.023952 LnM2_t$$

(6.514713) (6.32156) (0.34168)

Normalised coefficients with *T* value shows that except two variables all the independent variables reflect significant and standarised relationships at 5 percent level of significance. The coefficient of Trade Openness carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in trade openness brings about 0.02612 percent increase in inflation rate. This finding is supported by the empirical results of Kim and Beladi (2005), Pehnelt (2007), Gopal (2007), Evans (2007), Razin and Loungani (2007), Berument, Dogan, and Tansel (2008) and Zakaria (2010). There is significant positive long run relationship among inflation and trade openness in Pakistan and coefficient cleared that 1 percent increment in trade openness increases the inflation by 0.02612 percent. Which confirms the rejection of our null hypothesis.

The coefficient of real GDP carries a negative sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in real GDP brings about 0.164388 percent decrease in inflation rate. This finding is in line with Agarwal and Narayanan (2003) which shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. Mukhtar (2010) also supported the significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP. While, Menghan (2008) found a positive long run relationship between GDP and prices.

The coefficient of real ER carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 0.011581 percent increase in inflation rate. This finding is not supported by the results of Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomenon. But, Mukhtar (2010) found a significant positive relationship between inflation rate and ER such that a 0.388 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real Agr carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in real Agr brings about 0.046969 percent increase in inflation rate. This finding is in line with Hanif and Batool (2006) that growth in support prices of wheat is found to be positive and significant. And, Ashra (2002) also supported that rate of growth of agricultural output have statistically significant impact on the local inflationary process.

The coefficient of money and quasi money carries a negative sign but statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 0.023952 percent decrease in inflation rate. But, Agarwal and Narayanan (2003) and Ashra (2002) found a significant positive robust effect of the money growth on inflation and supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy [Romer (1993)].

The coefficient of FMO carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.119921 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. And, Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

Vector error correction mechanism (VECM) term represents the speed of adjustment back to the long run relationship among the variables. Table 4 in Appendix presents the results of the error correction model for Pakistan under study for Inflation with Trade Openness. The estimated coefficients show the immediate impact of different independent variables i.e., (real agriculture value added, real exchange rate, financial market openness, real GDP, trade openness, money and quasi money) on Inflation Rate. The ECM term for Pakistan is –0.028037 which is negative but insignificant in the

analysis at 5 percent level of significance and suggests that inflation is corrected by 2.8037 per annum. In the short run, it can be observed that fluctuation exists in general. While, all adjustments take place with in the same or following time periods, implying that the system settles down quickly.

The coefficient of the ECT of inflation variable carries the negative sign and statistically insignificant at 5 percent level with the speed of convergence to equilibrium of 2.8037 percent. This means that, whenever there is any disturbance in the system in the long run, in every short-run period, a 2.8037 percent correction to disequilibrium will take place. More specifically, ECT coefficient shows that a deviation from the long run equilibrium value in one period is corrected in the next period by the size of the coefficient. This indicates the stability of the model.

While, FMO and M2 are statistically insignificant and TO is statistically significant but they carry a positive sign. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

Then, we explain the results of inflation rate with openness by using the proxy of Import ratio from equation (b). The cointegration relationships between inflation rate, Real Agr, Real ER, Real GDP, FMO, M2 and IO has been investigated assuming linear trend in data with an intercept in cointegrating equation using the estimation technique. Table 5 in Appendix reports Johansen (1998) and Johansen and Juselius (1990) Maximum Likelihood Cointegration Results. The Trace statistics (λ trace) and Maximum-Eigenvalue (λ max) statistics indicate that there is Five and Three cointegrating vectors respectively in seven time series.

We can reject the null hypothesis of no cointegrating vector in favour of five and three cointegrating vectors under Trace and Maximum-Eigenvalue statistics at 5 percent level of significance. Under the assumption of no deterministic trend in data and intercept and no trend in cointegration equation, we can obtain the equation which is normalised for inflation to obtain meanings from the coefficients are given below;

$$CPI_t = 5.861244 + 0.083002 RealAgr_t + 0.051451 RealER_t - 1.356627 LnRealGDP_t$$

T Val (1.30466) (2.62664) (7.24647) (2.59487)

$$+0.078529 IO_t + 0.226791 FMO_t + 0.162824 LnM2_t$$

(6.858427) (4.760495) (1.14500)

Normalised coefficients with T value shows that except M2 all the independent variables reflect significant and standardised relationships at 5 percent level of significance. The coefficient of Import Openness carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in import openness brings about 0.078529 percent increase in inflation rate and confirmed that if imports share rises in total trade then it positively effect inflation.

These results are not in line with the empirical results of Berument, Dogan, and Tansel (2008) as coefficients of Import openness is negative which suggests that higher import openness decreases inflation volatility for Jordan and Morocco and this effect is statistically significant just for Jordan. However, it is positive for the other two countries but statistically significant just for Turkey. While, Wu and Lin (2006) supports positive relationships between import openness and inflation without constant constraint.

But, Agarwal and Narayanan (2003) shows the mixed results that before 1989 only fixed exchange rate regime had significant negative effect on inflation and after 1989 openness had significant negative effect on inflation. There is positive long run relationship among inflation and import openness in Pakistan and coefficient cleared that 1 percent increment in import openness increases the inflation by 0.078529 percent. Which reflects that imported inflation increases in Pakistan because of increase in demands of imports and confirmed the rejection of our null hypothesis.

The coefficient of real GDP carries a negative sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real GDP brings about 1.356627 percent decrease in inflation rate. This finding is supported by Agarwal and Narayanan (2003) which shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. And, Mukhtar (2010) also support a significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP. While, Menghan (2008) found positive long run relationship between GDP and prices.

The coefficient of real ER carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 0.051451 percent increase in inflation rate. This is not supported by Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomenon. But, Mukhtar (2010) supports our results that there exists significant positive relationship between inflation rate and ER such that a 0.388 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real Agr carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in real Agr brings about 0.083002 percent increase in inflation rate. This finding is in line with Hanif and Batool (2006) that growth in support prices of wheat is found to be positive and significant. And, Ashra (2002) also supported that rate of growth of agricultural output have statistically significant impact on the local inflationary process.

The coefficient of money and quasi money carries a positive sign but statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 0.162824 percent increase in inflation rate. Our results are supported by Agarwal and Narayanan (2003) and Ashra (2002) that a significant positive robust effect of the money growth on inflation which also supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy [Romer (1993)]. This shows that money remains an important factor of the inflationary process in Pakistan.

The coefficient of FMO carries a significant positive sign at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.226791 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. And, Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

Vector error correction mechanism (VECM) term represents the speed of adjustment back to the long run relationship among the variables. Table 6 in Appendix presents the results of the error correction model for Pakistan under study for Inflation with Import Openness. The estimated coefficients show the immediate impact of different independent variables i.e.; (real agriculture value added, real exchange rate, financial market openness, real GDP, import openness, money and quasi money) on Inflation Rate. The coefficient of the ECT of inflation variable carries the positive sign and statistically insignificant at 5 percent level and suggests that long-run equilibrium conditions of inflation does not influence the short-run dynamics in Pakistan with import openness which indicates the instability of the model.

While, the coefficients of the ECTs of import openness, FMO, Agr and M2 carries a positive sign but except import openness all others are statistically insignificant at 5 percent level of significance. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

Lastly, we explain the results of inflation rate with openness by using the proxy of Export ratio from equation (c). The cointegration relationships between inflation rate, Real Agr, Real ER, Real GDP, FMO, M2 and EO has been investigated assuming linear trend in data with an intercept in cointegrating equation using the estimation technique. Table 7 in Appendix reports Johansen (1998) and Johansen and Juselius (1990) Maximum Likelihood Cointegration Results. The Trace statistics (λ trace) and Maximum-Eigenvalue (λ max) statistics indicate that there is same Five cointegrating vectors in seven time series.

We can reject the null hypothesis of no cointegrating vector in favour of five cointegrating vectors under both Trace and Maximum-Eigenvalue statistics at 5 percent level of significance. Under the assumption of no deterministic trend in data and intercept and no trend in cointegration equation, we can obtain the equation which is normalised for inflation to obtain meanings from the coefficients are given below;

$$CPI_t = -1.186288 + 0.008447\,RealAgr_t - 0.007104\,RealER_t + 0.158709\,LnRealGDP_t$$

T Val (0.74645) (0.87443) (3.01016) (0.807602)

$$+0.039428\,EO_t + 0.025796\,FMO_t - 0.053897\,LnM2_t$$

(9.00182) (1.92107) (1.03608)

Normalised coefficients with *T* value shows that only Real ER and EO reflects insignificant relationships at 5 percent level of significance. The coefficient of Export Openness carries a positive sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in export openness brings about 0.039428 percent increase in inflation rate. This finding is not supported by empirical results of Berument, Dogan, and Tansel (2008) as export openness reduces inflation for all Middle East and North African (MENA) countries. While, Agarwal and Narayanan (2003) shows the mixed results that before 1989 only fixed exchange rate regime had significant negative effect on inflation and after 1989 openness had significant negative effect on inflation.

But, Ashra (2002) shows that openness has significant positive effects on inflation no matter either an economy is experiencing hyper-inflation or it is large. There is

positive long run relationship among inflation and export openness in Pakistan and coefficient cleared that a 1 percent increment in export openness increases the inflation by 0.039428 percent.

The coefficient of real GDP carries a positive sign and statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in real GDP brings about 0.158709 percent increase in inflation rate. These results are supported by Menghan (2008) which shows positive long run relationship between GDP and prices. While, Agarwal and Narayanan (2003) shows that GDP has a significant negative effect without dummies for country, time and exchange rate regimes. Mukhtar (2010) also found a significant negative relationship between inflation rate and GDP such that a 0.42 percent decrease in the inflation is associated with a 1 percent increase in GDP.

The coefficient of real ER carries a negative sign and statistically significant at 5 percent level of significance, which shows that a 1 percent increase in real ER brings about 0.007104 percent decrease in inflation rate. This finding is supported by Agarwal and Narayanan (2003) that the fixed exchange rate regime has significant negative effect on inflation if the dataset is analysed in two different time spans indicating that it is a short-run phenomena. But, Mukhtar (2010) found a significant positive relationship between inflation rate and ER such that a 0.388 percent increase in the inflation is associated with a 1 percent increase in ER. Rogoff (1985) proposed that increased inflation has an extra cost and the optimal rate chosen by monetary authorities was lesser as the deteriorating effect on exchange rate increases.

The coefficient of real Agr carries a positive sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in real Agr brings about 0.008447 percent increase in inflation rate. This finding is in line with Hanif and Batool (2006) that growth in support prices of wheat is found to be positive and significant. And, Ashra (2002) also supported that rate of growth of agricultural output have statistically significant impact on the local inflationary process.

The coefficient of money and quasi money carries a negative sign but statistically insignificant at 5 percent level of significance, which shows that a 1 percent increase in money and quasi money brings about 0.053897 percent increase in inflation rate. While, both Agarwal and Narayanan (2003) and Ashra (2002) found a significant positive robust effect of the money growth on inflation and supports the theoretical arguments of the monetarists. Broad monetary policy increases GDP and depreciates the exchange rate, and the latter adjustment puts up import prices and inflation in proportion to the openness of the economy [Romer (1993)].

The coefficient of FMO carries a positive sign but statistically insignificant at 5 percent level of significance and shows that a 1 percent increase in FMO brings about 0.025796 percent increase in inflation rate. Our results are not supported by Jin (2002) which shows significant negative short-run effects of financial market openness on the growth rates of the price level. And, Badinger (2007) also found that increase in financial openness by one percentage point leads to a decrease in inflation by 0.36 percent.

Vector error correction mechanism (VECM) term represents the speed of adjustment back to the long run relationship among the variables. Table 8 in Appendix presents the results of the error correction model for Pakistan under study for Inflation with Export Openness. The estimated coefficients show the immediate impact of different

independent variables i.e., (real agriculture value added, real exchange rate, financial market openness, real GDP, export openness, money and quasi money) on Inflation Rate. The ECM term for Pakistan is –0.153528 which is negative and insignificant at 5 percent level of significance in the analysis and suggests that inflation is corrected by 15.3528 per annum. In the short run, it can be observed that fluctuation exists in general. While, all adjustments take place with in the same or following time periods, implying that the system settles down quickly.

The coefficient of the ECT of inflation variable carries the negative sign and statistically insignificant at 5 percent level with the speed of convergence to equilibrium of 15.3528 percent. This means that, whenever there is any disturbance in the system in the long run, in every short-run period, a 15.3528 percent correction to disequilibrium will take place. More specifically, ECT coefficient shows that a deviation from the long run equilibrium value in one period is corrected in the next period by the size of the coefficient. This indicates the stability of the model.

While, the coefficients of the ECTs of export openness carries a positive sign and real ER carries a negative sign but they both are statistically significant at 5 percent level of significance. While, all others variables carries a negative sign and statistically insignificant. This means that, in case of any disturbance, divergence from the equilibrium path will take place and the whole system cannot be brought to equilibrium position in each case.

## 5. CONCLUSION

The paper empirically explores the relationship between trade openness and inflation in Pakistan using annual time series data for the period of 1976 to 2010. Since Pakistan's economy has a considerable degree of trade openness, the local price level cannot remain immune from abroad shocks. The expected empirical findings shows that there is a significant positive long-run relationship between inflation and trade openness, import openness and export openness which rejects the existence of Romer's hypothesis in Pakistan.

The positive insignificant effect of money and quasi money on inflation with import openness proxy is somehow follows the monetarists who argue money to be the most important variable influencing the inflationary process. An increase in the development level of the country and a shift from fixed to flexible exchange rate regime are also found to put up the country's inflation rate.

The study also shows the significant positive effect of financial market openness (FMO) on inflation with trade and import openness proxy as capital account liberalisation implements which should create openness, then 'financial integration' will gradually be obtained. As, Pakistan has rich agriculture base with large share of agri-products in exports and real agriculture value added also shows the significant positive effect on inflation with trade and import openness proxy.

The study shows the significant positive effect of Real ER on inflation with trade and import openness proxy. This implies that it is not advisable for policymakers to implement a flexible exchange rate system because that could lead to a major depreciation that would create inflationary problems. The challenges for the future is to find ways of combine flexible exchange rate with low inflation in Pakistan.

The positive relationship between openness and inflation is bound to have vast reaching implications for policy makers in Pakistan having some for the development purposes. Specifically, it will have implications for the optimum trade policy (inward looking versus outward looking policies) and the optimal capital accumulation strategy. Large inflation discourages local capital accumulation, while high capital accumulation is needed for development. So, it will turn out that outward looking trade policy may not be reliable as it is inflationary.

Finally, the short-run analysis by using a VECM suggests that long-run equilibrium condition does not influence the short-run dynamics by using the Import Openness proxy. However, the result for Trade and Export Openness proxy confirms that the Inflation Rate has an automatic adjustment mechanism and that the economy responds to deviations from equilibrium in a balancing manner. Since, inflation is one of the hurdle on the way of development for 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.

***Appendix***

Table 1

*Descriptive Statistics*

| Variables | Mean | Standard Deviation |
|---|---|---|
| Real Agriculture Value-added | 26.193 | 3.534 |
| Real Exchange Rate | 46.919 | 13.829 |
| Ln Real Gross Domestic Product | 10.35244 | 0.59623 |
| Financial Market Openness | 0.951 | 0.907 |
| Ln Money and Quasi money | 13.2679 | 1.422302 |
| Trade Openness | 34.372 | 3.163 |
| Inflation Rate [ΔCPI] | 0.08082 | 0.03492 |
| Export Openness | 13.923 | 2.462 |
| Import Openness | 20.449 | 2.800 |

Table 2

*Results of Unit Root Test*

| | Level | | 1st Difference | | |
|---|---|---|---|---|---|
| Variables | Intercept | Trend and Intercept | Intercept | Trend and Intercept | Order of Cointegration |
| Real Agriculture Value added | –1.084 (–2.95) 5% Lag (1) | –2.460 (–3.55) 5% Lag (1) | –5.518* (–2.95) 5% Lag (0) | –5.419* (–3.55) 5% Lag (0) | I (1) |
| Real Exchange Rate | –1.720 (–2.95) 5% Lag (1) | –0.764 (–3.55) 5% Lag (1) | –5.247* (–2.95) 5% Lag (0) | –5.530* (–3.55) 5% Lag (0) | I (1) |
| Financial Market Openness | –1.939 (–2.95) 5% Lag (2) | –3.380 (–3.55) 5% Lag (2) | –3.876* (–2.95) 5% Lag (0) | –3.826* (–3.55) 5% Lag (0) | I (1) |
| Real Gross Domestic Product | –0.947 (–2.95) 5% Lag (1) | –2.237 (–3.55) 5% Lag (1) | –5.790* (–2.95) 5% Lag (0) | –5.777* (–3.55) 5% Lag (0) | I (1) |
| Trade Openness | –2.757 (–2.95) 5% Lag (1) | –2.775 (–3.55) 5% Lag (1) | –5.824* (–2.95) 5% Lag (0) | –5.720* (–3.55) 5% Lag (0) | I (1) |
| Export Openness | –2.249 (–2.95) 5% Lag (1) | –2.298 (–3.55) 5% Lag (1) | –5.017* (2.95) 5% Lag (0) | –5.041* (–3.55) 5% Lag (0) | I (1) |
| Import Openness | –1.727 (–2.95) 5% Lag (1) | –1.622 (–3.55) 5% Lag (1) | –6.167* (–2.95) 5% Lag (0) | –6.110* (–3.55) 5% Lag (0) | I (1) |
| ΔCPI/Inflation | –2.416 (–2.95) 5% Lag (2) | –2.620 (–3.55) 5% Lag (2) | –8.529* (–2.95) 5% Lag (0) | –8.446* (–3.55) 5% Lag (0) | I (1) |
| Money and Quasi Money | –1.217 (–2.95) 5% Lag (1) | –2.940 (–3.55) 5% Lag (1) | –3.607* (–2.95) 5% Lag (0) | –3.766* (–3.55) 5% Lag (0) | I (1) |

Table 3

*Results of Johensen Cointegartion Test with TO*

Trend assumption: No deterministic trend (restricted constant)
Series: CPI AGR ER FMO GDP TO M2
Exogenous series: D1 D2
Lags interval (in first differences): 1 to 1

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistics | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.880748 | 215.8707 | 134.6780 | 0.0000 |
| At most 1 * | 0.746474 | 145.6958 | 103.8473 | 0.0000 |
| At most 2 * | 0.689734 | 100.4103 | 76.97277 | 0.0003 |
| At most 3 * | 0.593131 | 61.78952 | 54.07904 | 0.0088 |
| At most 4 | 0.429886 | 32.11385 | 35.19275 | 0.1035 |
| At most 5 | 0.258014 | 13.57053 | 20.26184 | 0.3200 |
| At most 6 | 0.106674 | 3.722527 | 9.164546 | 0.4550 |

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.880748 | 70.17490 | 47.07897 | 0.0000 |
| At most 1 * | 0.746474 | 45.28554 | 40.95680 | 0.0153 |
| At most 2 * | 0.689734 | 38.62077 | 34.80587 | 0.0167 |
| At most 3 * | 0.593131 | 29.67567 | 28.58808 | 0.0362 |
| At most 4 | 0.429886 | 18.54332 | 22.29962 | 0.1543 |
| At most 5 | 0.258014 | 9.848002 | 15.89210 | 0.3484 |
| At most 6 | 0.106674 | 3.722527 | 9.164546 | 0.4550 |

Max-Eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Table 4

*Vector Error Correction Estimates with TO*

| Error Correction: | D(CPI) | D(AGR) | D(ER) | D(FMO) | D(GDP) | D(TO) | D(M2) |
|---|---|---|---|---|---|---|---|
| CointEq1 | –0.028037 | –0.935177 | –27.50890 | 2.738435 | –0.057268 | 29.00586 | 0.057424 |
| SE | (0.08290) | (2.63073) | (7.52778) | (1.40009) | (0.11616) | (5.25239) | (0.16119) |
| t-statistics | [–0.33821] | [–0.35548] | [–3.65432] | [ 1.95591] | [–0.49302] | [ 5.52241] | [ 0.35624] |
| R-squared | 0.423517 | 0.348996 | 0.556352 | 0.351405 | 0.325431 | 0.700060 | 0.271009 |
| Adj. R-squared | 0.161479 | 0.053085 | 0.354694 | 0.056589 | 0.018808 | 0.563723 | –0.060351 |
| Sum Sq. Resids | 0.017156 | 17.27705 | 141.4653 | 4.893570 | 0.033684 | 68.87007 | 0.064866 |
| S.E. Equation | 0.027925 | 0.886183 | 2.535792 | 0.471630 | 0.039129 | 1.769310 | 0.054300 |
| F-statistic | 1.616244 | 1.179395 | 2.758887 | 1.191945 | 1.061340 | 5.134790 | 0.817869 |

Table 5

*Results of Johensen Cointegartion Test with IO*

Trend assumption: No deterministic trend (restricted constant)
Series: CPI AGR ER FMO GDP IO M2
Exogenous series: D1 D2
Lags interval (in first differences): 1 to 1

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistics | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.867646 | 224.8148 | 134.6780 | 0.0000 |
| At most 1 * | 0.764597 | 158.0797 | 103.8473 | 0.0000 |
| At most 2 * | 0.709751 | 110.3466 | 76.97277 | 0.0000 |
| At most 3 * | 0.565693 | 69.52506 | 54.07904 | 0.0012 |
| At most 4* | 0.499353 | 42.00292 | 35.19275 | 0.0079 |
| At most 5 | 0.366420 | 19.17173 | 20.26184 | 0.0701 |
| At most 6 | 0.117143 | 4.111529 | 9.164546 | 0.3958 |

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.867646 | 66.73508 | 47.07897 | 0.0001 |
| At most 1 * | 0.764597 | 47.73309 | 40.95680 | 0.0075 |
| At most 2 * | 0.709751 | 40.82153 | 34.80587 | 0.0085 |
| At most 3 | 0.565693 | 27.52215 | 28.58808 | 0.0679 |
| At most 4* | 0.499353 | 22.83119 | 22.29962 | 0.0421 |
| At most 5 | 0.366420 | 15.06020 | 15.89210 | 0.0672 |
| At most 6 | 0.117143 | 4.111529 | 9.164546 | 0.3958 |

Max-Eigenvalue test indicates 3 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Table 6

*Vector Error Correction Estimates with IO*

| Error Correction: | D(CPI) | D(AGR) | D(ER) | D(FMO) | D(GDP) | D(IO) | D(M2) |
|---|---|---|---|---|---|---|---|
| CointEq1 | 0.027670 | 0.223952 | –4.571406 | 0.815417 | –0.025212 | 7.818929 | 0.058026 |
| SE | (0.02780) | (0.89074) | (3.07097) | (0.48254) | (0.03925) | (1.51724) | (0.05339) |
| t-statistics | [ 0.99534] | [ 0.25142] | [–1.48859] | [ 1.68983] | [–0.64236] | [ 5.15338] | [ 1.08688] |
| R-squared | 0.435245 | 0.349867 | 0.356825 | 0.328866 | 0.329130 | 0.655134 | 0.303403 |
| Adj. R-squared | 0.178538 | 0.054352 | 0.064473 | 0.023805 | 0.024189 | 0.498376 | –0.013232 |
| Sum sq. resids | 0.016807 | 17.25394 | 205.0881 | 5.063619 | 0.033499 | 50.06104 | 0.061983 |
| S.E. equation | 0.027639 | 0.885590 | 3.053225 | 0.479755 | 0.039022 | 1.508477 | 0.053079 |
| F-statistic | 1.695496 | 1.183921 | 1.220533 | 1.078035 | 1.079322 | 4.179282 | 0.958211 |

Table 7

*Results of Johensen Cointegartion Test with EO*

Trend assumption: No deterministic trend (restricted constant)
Series: CPI AGR ER FMO GDP EO M2
Exogenous series: D1 D2
Lags interval (in first differences): 1 to 1

**Unrestricted Cointegration Rank Test (Trace)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistics | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.885132 | 240.9189 | 134.6780 | 0.0000 |
| At most 1 * | 0.806458 | 169.5078 | 103.8473 | 0.0000 |
| At most 2 * | 0.721359 | 115.3132 | 76.97277 | 0.0000 |
| At most 3 * | 0.637892 | 73.14469 | 54.07904 | 0.0004 |
| At most 4* | 0.508247 | 39.62288 | 35.19275 | 0.0156 |
| At most 5 | 0.282838 | 16.20021 | 20.26184 | 0.1652 |
| At most 6 | 0.146544 | 5.229223 | 9.164546 | 0.2592 |

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.885132 | 71.41110 | 47.07897 | 0.0000 |
| At most 1 * | 0.806458 | 54.19465 | 40.95680 | 0.0010 |
| At most 2 * | 0.721359 | 42.16848 | 34.80587 | 0.0056 |
| At most 3 * | 0.637892 | 33.52182 | 28.58808 | 0.0107 |
| At most 4* | 0.508247 | 23.42267 | 22.29962 | 0.0347 |
| At most 5 | 0.282838 | 10.97099 | 15.89210 | 0.2540 |
| At most 6 | 0.146544 | 5.229223 | 9.164546 | 0.2592 |

Max-Eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level.
* denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Table 8

*Vector Error Correction Estimates with EO*

| Error Correction: | D(CPI) | D(AGR) | D(ER) | D(FMO) | D(GDP) | D(EO) | D(M2) |
|---|---|---|---|---|---|---|---|
| CointEq1 | –0.153528 | –4.233552 | –39.13288 | –1.464104 | –0.085179 | 14.03171 | –0.129073 |
| SE | (0.10783) | (3.54291) | (9.65583) | (2.02344) | (0.15620) | (4.06751) | (0.21581) |
| t-statistics | [–1.42377] | [–1.19494] | [–4.05277] | [–0.72357] | [–0.54534] | [ 3.44971] | [–0.59809] |
| R-squared | 0.464447 | 0.351718 | 0.599227 | 0.256195 | 0.330313 | 0.521688 | 0.282571 |
| Adj. R-squared | 0.221013 | 0.057045 | 0.417058 | –0.081898 | 0.025910 | 0.304273 | –0.043533 |
| Sum sq. resids | 0.015938 | 17.20481 | 127.7938 | 5.611915 | 0.033440 | 22.67709 | 0.063837 |
| S.E. equation | 0.026915 | 0.884328 | 2.410147 | 0.505061 | 0.038987 | 1.015272 | 0.053867 |
| F-statistic | 1.907900 | 1.193586 | 3.289396 | 0.757764 | 1.085118 | 2.399505 | 0.866504 |

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