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A Dynamic Cointegration Analysis of Money Supply, Inflation and Economic Growth in Pakistan

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ABSTRACT

The understanding of the dynamic and complex interdependence between the money supply, inflation and economic growth needs extraordinary consideration for devising the effective policy formulation to attain the desired macroeconomic goals of the country. Therefore this study is attempted to deeply investigate the interconnecting behavioral patterns of money supply, inflation and economic growth in case of Pakistan. In order to examine the short run and long run nexus between the variables, the present study acquired the time series data over the years from 1990 to 2022. An execution of Johansen Cointegration technique along with Vector Auto regression Analysis (VAR) revealed the existence of long run cointegration between the variables. The results of the study disclosed that rising trends of inflationary trends are dominantly destructive for the economic growth of the country. The findings from the study also explain a proportionate impact of money supply towards the rate of inflation in Pakistan. This study also suggests that an upsurge of economic growth rate is a vital element to discourage the climbing prices in the country.

Introduction

Economic growth, supply of Money and inflation are considered to be the very significant indicators for any country to judge the macroeconomic performance of the country .Therefore it is essential for policy maker to diagnose and inspect the dynamic association among these variables, in order to comprehend financial steadiness and economic prosperity. There is a lot of debate about how economic growth and inflation relate (Barro, 1995; Harris et al., 2005; Parveen et al., 2020). Each nation of the world desires to attain the accelerated pace of economic growth along with sustainable inflation rate. Therefore it is the ultimate objective of the countries to maintained the stability of these vital macroeconomic indicators by steering the

efficiently implementations of the macroeconomic policies (Fisher, 1993; Ishfaq et al., 2024; Asghar et al., 2024).

The rising rates of Inflation undesirably effect the general growth of economy, overall level of investment and the living standard of major segments of the population. There is sturdy harmony amongst the economists that economic growth process of the countries is adversely provoked by price hikes in the economy (Stephen, 2001). Rising trends of Inflation discourages the growth patterns and upsurge instability as well as uncertainty (Mario, 2000). Consequently monetary instruments aim to target the inflation as their key objective of its monetary policy strategies. Price stability along with continuity of economic growth patterns are the dominant objectives for any nation of the world, while gearing the economic policy instruments by the government officials (Friedman, 1963; Sibt-e-Ali et al., 2021).

The literary theoretical discussions of various schools of thoughts illustrate divergent views on the nexus between these variables. Classical economist largely weighs on supply side theoretical approach. Keynesian and neo- Keynesians frames substantial attention towards AD and AS model to associate inflation and growth. The monetarist's arguments centers on the monetary growth role in inflation rate fluctuations.

An adequate number of studies discuss the mechanism of Quantity Theory of Money (QTM) to exhibit the proportionate association between growth pattern supply of money and inflation rate. The equation of the QTM MV=PT is based on the assumption of stable velocity of money in the short run, meaning that in the short run real output of the country remains stable. Research literature frequently examined by the economists to recognize the impact of money supply. Brunner & Meltzer (1993) pointed out towards the proportionate correlation between supply of money and rate of inflation in long run scenario as compared to short run time period. On the other hand in 1993 Fisher evidenced a beneficial moderate inflation on the progress of economic output. Barro (1995) supported the stability in money supply formulation to accelerate the economic performance in the long run time period. Simillarly, the studies like Granger (1980) reveals the bidirectional causal association between inflation and economic growth.

Objectives

The relevant objectives of the current study are:

1. The first objective is to scrutinize the short term links among with the economic growth, inflation and money supply in Pakistan.

2. To explore the long term association between economic growth, inflation & money supply stock in Pakistan

Literature Review

Burhan et al., (2019) attempted to examine the long run time period nexus among money supply, GDP & rate of inflation for Syrian economy by recognizing the time interval from 1980 to 2002. Dynamic data analysis tools of Johansen cointegration test disclosed that GDP and rate of inflation remains negative association. Money supply and GDP depicted positive implications over economic growth rate and inflation.

In 2018 Hussain & Zafar searched for the corresponding behavior linking economic growth, price level and money supply by way of operating with the time series data for the economy of Pakistan. After applying the cointegration econometric procedure, the study distinguished that a worthwhile connection is present among inflation, fiscal spending, money supply and economic growth. Granger causality also assured the unidirectional causality between inflation and economic growth as well as inflation and fiscal spending. The outcomes also affirm the existence of a both way causative scenario between money supply and inflation.

The study by Aslam & Awan (2018) aims to determine the bearings of monetary policy on economic accomplishments of Pakistan. To analyze the effectiveness of monetary endeavors over the economic outcomes of the country, the study used multiple regression time series estimation techniques on the data to unveil that monetary stance puts valuable impact on economic performance. It was also concluded that money supply also effects on inflation rate.

In 2017 Haque & Hussain explored the interdependence between economic growth and supply of money while considering the time series data of Bangladesh from 1972-2014.After using granger causality test and VECM techniques, it was pointed out that money supply has proportionate contribution with regards to explaining the rate of economic growth.

Another very important time series case study steered by Korkmaz (2017) .The utilization of annual data from 2008 to 2014 to observe the attachment uniting the money supply & economic growth for countries of Mediterranean region. After applying the panel causality, it was indicated that causation emerges from inflation to money supply contrary to no causal incidence between supplies of money to growth rate of economy.

The economy of U.A.E was the focus of a study by Hasanov et al., (2017) to discover the bond between among GDP, supply of money, prices, tax and the rate of interest. The study was based on the annual data from 1970-2016. Johansen cointegration test was managed to observe the incidence of a firm interrelationship among the GDP, money supply, price level along with interest rate. Result revealed that in the long term GDP and inflationary trends are linked proportionally to money supply.

Salunkhe & Patnaik (2017) in India analyzed the influence of money supply on inflation and economic growth .They applied causality approach to determined that money supply puts overwhelming impression to explain the economic output and prices in India.

Tabar *et al*., (2016) look at the short and long term bond of economic growth, money & price level for the Iranian economy. Their research work based an ARDL model and while taking data from 1981-2011. It was established that relevant variables included in the study places overpowering impressions on economic expansion.

For the Ethiopian economy a study from Denbel *et al.,* (2016) was an attempt to explore the interconnecting behavior among output, inflation and monetary flows for the period of 1970 to 2011. For the short run time period, the study suggested that monetary flows & inflation is a source to enhance country's output along with one-causation from economic growth to inflation in the long run.

The annual data regarding the time period from 1998 to 2012 went under a complete econometric scanning by the Vladova & Yanchev (2015) to inspect the money, price connection in Bulgaria. The study conducted to employ the cross-correlation, Granger Causality and Johansen co integration. After the outcomes were generated, it was logically explained that money and inflation are proportionally attracts to each other during the long run.

It was the study by Chude *et al.*, (2015) which was conducted in Nigeria on a time series data to study the interconnected influencing patterns of economic growth and money supply. The results obtained from the study suggested a supportive association among the variables of the study during the concerned time period.

Regarding the economy of Pakistan, Ayub & Maqbool (2015) determined the effect of economic growth on money supply for the period 2005-2014.After applying the correlation and regression techniques to explore the relation amongst the variables. It was depicted that the rate of interest, price & money affect dominantly to recognize the status of GDP.

Chaitip *et al.,* (2015) explored link comprising monetary stance & economic growth for a panel data set of 19 developing economies. The famous panel data modeling technique ARDL was attempted to scrutinize the short and long term linkage among money supply & growth. The generated outcomes visualized the encouraging and significant relationships among money and economic development.

Ghosh *et al.,* (2015) examined the bond amongst money supply, inflation & economic growth for the economy of Bangladesh .On a time series data regarding the period of 1974-2012,they practiced Johansen to determined that rate of inflation has a strong unidirectional causal impact on growth in short run.

For the Turkish economy, a study was carried out by Balibey (2015) to examine the association between economic output, inflation and rate of exchange during the period 2005 to 2015. The study employed the VECM model and Johhansen cointegration methodology to root out the alignment between variables. Money supply disclosed a leading stimulus over the rate of economic growth. However, Granger Causality methodical aspect witnessed a one way causal

inspiration from money supply to GDP and GDP to inflation, exchange rate to inflation also two ways causality of money supply with inflation.

Research Methodology

The present study utilizes the time series data regarding economy of Pakistan for the concern variable such Economic Growth rate which is measured by the annual growth rate of GDP; Money Supply measured by M2 which is also regarded as the broadly explain element of money supply in economy: the rate of Inflation considered by the CPI. For the purpose of econometric analysis the required time series data for the period 1990 to 2022 is collected from the World Development Indicators (WDI) and the data published by Pakistan Bureau of Statistics (PBS).

Econometric Model

$$\boldsymbol{GDP_t = \beta_{01} + \sum_{i=1}^{k} \beta_i (GDP)_{t-i} + \sum_{i=1}^{k} \beta_i (M2)_{t-i} + \sum_{i=1}^{k} \beta_i (CPI)_{t-i} + dummy \quad + u1_t}$$

$$\boldsymbol{M2_t = \beta_{11} + \sum_{i=1}^{k} \beta_i (GDP)_{t-i} + \sum_{i=1}^{k} \beta_i (M2)_{t-1} + \sum_{i=1}^{k} \beta_i (CPI)_{t-i} + dummy + u2_t}$$

$$\boldsymbol{CPI_t = \beta_{21} + \sum_{i=1}^{k} \beta_i (GDP)_{t-i} + \sum_{i=1}^{k} \beta_i (CPI)_{t-i} + \sum_{i=1}^{k} \beta_i (M2)_{t-i} + dummy + u3_t}$$

Where

GDP growth = Gross domestic product growth (annual %)

CPI = Consumer price index

M2 = Broad money ⁒of GDP

Dummy = Dummy variable which appears in the model to represent the time period before and after the monetary and fiscal coordination board is constituted in the country in year 1994

μt is error terms, *i* is the time period, the number of lags is k and *bi* are coefficients to be estimated.

The study uses few important econometric tools to explore the short run and long run nexus between the concerned variables .These significant tools of analysis includes;

- Break point unit root test to check for the stationary properties of the data.
- Johansen co-integration techniques developed by Johansen (1991) to check the long run cointegrattion among the variables.

❖ This technique uses trace test statistic and Eigen value to explore the number of cointegrating equations while using the trace statistic test constructed as:

$$\tau \text{ trace} = -T \sum_{i=r+1}^{k} \log(1 - \lambda_i)$$

Test of maximum Eigen value

The maximum Eigen value explains the Null hypothesis of no cointegrating relation in contrast to alternative of r + 1 cointegrating relatives through the test statistics.

T max…… T log (1-λr+1)

Where as

λr+1 is the (r+1).

❖ Vector auto regressive (VAR) approach to calculate the long run and short run coefficient of the econometric model in the presence of long run equilibrium cointegration among variables such as economic growth, inflation and supply of money

Results and Discussion

Table 1: Results of Break Point Unit Root Test: 1990–2022

	TEST	GDP	CPI	M2
Break Model	F statistic	-6.861271	-4.920350	-6.118997
Innovative outlier	Prob.	< 0.01	0.0117	< 0.01

H_0: There is absence of Unit root.
H_1: There is existence of unit root.

Table 2: Optimal Lags Selection

LAG	LL	LR	AIC	SC	HQ
0	-.434.2351	NA	16.54787	14.56785	14.356787
1	-215.1867	40.34769*	13.23765	15.56141*	13.812373*
2	-185.1341	15.65325	14.132456*	14.25674	13.81293

Johansen Cointegration Test

Table 3: Trace test statistic

No of CE(S)	Eigen value	Trace statistic	Critical value 0.05	Prob.**	Null Hypothesis	Alternative Hypothesis
None*	0. 128578	46. 3982	431. 52591	0.1303	r =0*	*r* □□
At most 1	0. 188371	21.2489	24. 211287	0.1842	r ≤ 1	*r* □□□

At most 2	0. 615208	6. 22191	11.31897	0.3885	r ≤ 2	*r* □□□

The trace statistic value displays the presence of one co integrating equation at 5% (0.05) significance level .Hence the Null Hypothesis of no cointegration is straightaway rejected while accepting the alternative hypothesis of at most one cointegrations equation.

Table 4: Maximum Eigen Value Test Statistic

No of CE(s)	Eigen Value	Max-Eigen Static	Critical Value 0.05	Prob.**	Null Hypothesis	Alternative Hypothesis
None*	0. 1285	26.6089	22. 38221	0. 9004	r=0*	*r* □□
At most 1	0. 1883	11. 1797	16. 03874	0.3427	r ≤ 1	*r* □□□
At most 2	0. 6179	6.0192	14. 95178	0. 2345	r ≤ 2	*r* □□□

Similarly, according to maximum Eigen value alternative hypothesis is accepted and null hypothesis of no cointegration is rejected.

Short Run Coefficients of the VAR Model

Table 5: Endogenous Variable: GDP

Exogenous Variables	Coefficient	t-Statistic
GDP	- 0.063504	- 0.566283
GDP(1)	0.190701	0.892358
CPI	- 0.206836	-2.005054*
CPI(1)	0.142683	1.206880
M2	- 1.250288	- 1.174650
M2 (1)	- 0.092004	-0.834603
C	5.388118	1.762075
Dummy Variable	- 0.092004	-0.834603
R-Squared=0.405744		

During the short run time span CPI has significant adverse implications over the GDP in short term. Whereas the supply of money and the dummy variable included in the model showed their insignificant impact on GDP.

Table 6: Endogenous variable CPI

Exogenous Variables	Coefficient	t-Statistic
GDP	- 0.313644	- 0.870775
GDP(1)	0.439806	2.187680
CPI	0.514529	2.588629*
CPI(1)	0.076491	0.348578

M2	- 0.282350	- 1.220502
M2 (1)	0.476804	2.210409*
C	- 4.760136	-0.795545
Dummy Variable	- 1.504581	- 0.722390
R-Squared=0.540260		

The current empirical results display the significant contribution of GDP growth rate to discourage the inflationary pressures. Moreover the inclusion of CPI and money supply as other exogenous variables in the model exhibits their positive contributions towards the rate of inflation in the economy. The dummy variable remains irrelevant again in the model.

Table 7: Endogenous Variable: M_2

Exogenous Variables	**Coefficient**	**t-Statistic**
GDP	0. 224413	1.218149
GDP(1)	9.465207	1.950045
CPI	0. 211426	2. 794761*
CPI(1)	- 0. 639093	- 2. 781945*
M2	1. 661021	5.404876
M2 (1)	- 0. 052350	- 2. 480000*
C	9.467520	1. 004955
Dummy variable	3. 593334	2.313287*
R-squared = 0.848798		

The rate of Gross domestic product depicts insignificant bearings over money supply but CPI shows its vital and positive impressions over money supply in the short run. Where lagged values of money supply to plays its vital contribution to influence the current instance of monetary directions in the country. Here the constituted monetary and fiscal coordination board is also a significant player to alter the monetary behaviors of Pakistan economy.

Long Run Estimation of VAR Model

Table 8: Endogenous Variable: GDP

Exogenous Variables	**Coefficient**	**t-Statistic**
GDP	0. 701190	0. 38926
GDP(1)	-0. 638231	-1.26539
CPI	-0.266038	-2.00505 *
CPI	-0.064350	-0. 62568
M2	0.146832	1.20688
M2 (1)	-0. 200094	-0.83460
C	5.388811	1. 08762
Dummy Variable	-1.258028	-1.15746
R-Squared=0.444057		

While considering the GDP as an endogenous variable in the system of long run, it becomes clear that the rising rate of inflation proves to be significantly destructive exogenous variables as it vitally declines the growth rate of the country. Whereas other variables included in the system of VAR diagnoses their irrelevant contribution to alter the economic growth of Pakistan.

Table 9: Endogenous Variable: CPI

Exogenous Variables	Coefficient	t-Statistic
GDP	-0.313464	-0. 78707
GDP(1)	0.496380	1. 76818
CPI	0.512945	2. 88653 *
CPI(1)	0.091764	0. 58348
M2	-0. 350282	-1. 05022
M2(1)	0.404768	2.21104*
C	-4. 136760	- 0. 55794
Dummy Variable	-1. 581504	-0.73922
R-Squared=0. 260540		

There is significant analytical negative impact of GDP and money supply on CPI in the long term. Whereas lagged values of the variable supply of money has progressive and noteworthy impact on CPI which demonstrates the money supply's dominant involvement to raise the inflation rate in the economy.

Table 10: Endogenous Variable: M2

Exogenous Variables	Coefficient	t-Statistic
GDP	0.413224	1.21815
GDP(1)	0.231098	0.77232
CPI	0.422116	2.61795*
CPI(1)	-0.390693	- 2.19478*
M2	1.026611	5.47049*
M2 (1)	-0.350052	- 2.00048*
C	9.465207	1.95005
Dummy Variable	3.933534	2.32814*
R-Squared=0.848798		

The endogenous variable money supply is expressively deviates in long run by CPI behavioral patterns in the current as well as lagged periods. The dummy variable included in the model appears to be a significant influencer of money supply in case of long run dynamics of the economy.

Table 11: Diagnostic Tests Results

Test	F-Statistic	Prob.

Breusch pagan Godfrey Heteroskedasticity analysis	0.212752	0. 9747
The Breusch – Godfrey serial correlation LM test	1. 331597	0. 8322
Ramsey-Reset test for Model Specification	0. 391506	0. 8160
Jarque-Bera test of Normality	0. 391506	0. 1608

Conclusion and Policy Recommendations

All over the world ,the macroeconomic indicators of economic growth, supply of money and inflation are recognized as the tremendously imperative parameters to evaluate the overall health condition of an economy .Therefore it crucial for policy makers to identify and evaluate the interplaying behavior among these variables in order to realize economic growth steadiness. The outcome of this empirical study suggests that there is cointegration relation between GDP, inflation and money supply in Pakistan over the short and long term.

The findings from the current study recommends that economic growth rate of the country should be encouraged in the policy formulations and implementations in order to decline the rising rate of inflation .Whereas successful price control mechanism of the country can also be beneficial to boost the economic growth rate. Hence money supply function can be tactfully utilized by the monetary authorities in order to encourage the economic progress of the country because on the other hand it can also lead to price surge in the country.

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