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Whether Monetary Policy Shocks Have Symmetric or Asymmetric Effect on Price Level: A Time Series Analysis of Pakistan

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Abstract: *The current study worked on the symmetric or asymmetric nature of monetary policy variable on general price level in Pakistan. Time series data of fifty-year starting from 1972 reveals that the relation is symmetric. The expansionary monetary policy leads to higher inflation in the same magnitude as the contractionary monetary policy decreases the price level. This result was derived first by employing Autoregressive Distributive Lag technique for checking relation in the long run among the variables. The autoregressive distributive lag technique shows linear relationship hence there was a need for asymmetry analysis. therefore, Nonlinear Autoregressive Distributive Lag technique was used. Which justified the linear and symmetric relation of money supply and inflation in Pakistan. while there are possibilities of degenerate cases. To solve the issue an additional F test was conducted. For this purpose, the current study used Augmented Autoregressive Distributive Lag test. Which supported the idea of long run relationship with F-value to be higher than the value of upper bound. To counter the effect of fiscal side government consumption expenditure was taken into account but this proxy came out to be insignificant. The study further found that Increase in GDP decreases inflation and imports contribute positively to inflation in Pakistan. Through WALD test the symmetric nature of the relationship is justified.*

Keywords: Asymmetric Nature, Monetary Policy, Inflation, Distributive Lag, GDP

1 INTRODUCTION

1.1 Background of the Study

In current times the central banks focus on the dual goals of maintaining a low unemployment rate that is sustainable and ensuring price stability. Central banks employ both contractionary and expansionary monetary policy for this reason. Contractionary monetary policy is employed by central banks to contain increasing inflation, whereas expansionary monetary policy is thought to be useful in lowering unemployment. However, there is disagreement over these policies' efficacy. Apart from the effectiveness of the policy another important point is regarding the nature of the monetary policy shocks. Whether expansionary monetary policy has the same impact as the contractionary monetary policy has been in debate in current time. This debate is about the symmetric or asymmetric impact of the policy on different variables in the economy (Abdelsalam,2018). As Leahy (1993) considers the structure of investment and consumption changes with the variations in these two monetary policy measures. Shocks of varying magnitude occur in the economy due to changes in the monetary policy. In the literature these shocks manifest themselves in asymmetric manner as pointed out by Cover (1992), Morgan (1993), Hayford (2006) and others.

The argument of inflation a monetary phenomenon (Lee & Yu, 2021) manifests linear relation between supply of money and general price level. Asymmetry is demonstrated by the variable effectiveness of monetary policy. The actions and expectations of investors (lenders and borrowers) and consumers are thought to be reason of the asymmetry effect of monetary policy. In addition to this, other aspects include the state of the economy, the prevalent business cycle, etc. When prices are rising, inflation gets greater attention of the central bank authorities since it is a social and economic evil that affects everyone and has a lasting impact on the economy. This pattern may have different effects on different economies.

But, without understanding the fundamentals of their economies, developing nations have a propensity to copy the economies of rich nations. Because of this blind following, shocks are not properly absorbed. One of the factors in this blind following is inflation targeting. In several developed countries in the 1990s, this tactic was employed to combat growing inflation. With inflation targeting, monetary policy nowadays is used to rein in growing commodity prices. Other concerns like economic growth, unemployment, and exchange rate fluctuations are sometimes viewed as factors of secondary importance.

Similar to inflation targeting adopted by developed nations, another policy is currency devaluation, this practice likewise has a detrimental impact on emerging nations. Most of the time, the effect follows the J-curve situation, which states that the exchange rate's effects manifest themselves over time. Because of this, the trade deficit widens before eventually closing. Threshold level of any currency is an indication that central banks need to respond. While currency value rates below the threshold level are permitted, currency depreciation above the threshold level receives more attention (Benlialper et al. 2015). Investment and exports both have an impact on exchange rates and economic growth. Ibrar et al. (2020) used NARDL model to identify a long-term link between currency depreciation and economic growth. Currency strength accelerates economic growth. Therefore, Ibrar et al. (2020) propose a regulation of currency depreciation for resuming economic growth. Hence the nature of these shocks have varied effects on countries.

The causes of the economic shocks that affect different nations around the world have long been disputed in the field of economics by many schools of thought. Although economic stability has long been desired, cyclical fluctuations cause economic instability. Politicians look to monetary policy to restore stability to the economy after shocks, especially arising from the monetary side. From 2003 until the financial crisis, the Turkish economy grew quickly while experiencing consistently low inflation (Aslanoglu and Deniz, 2017). While responding tightly throughout the expansionary phase of the economic cycle, central banks place a greater emphasis on production and stabilization during recessions. When inflation is strong, central banks in emerging nations tend to favor it more (Aslanoglu and Deniz 2017).

The monetary system is employed to "control" the economy. Because of this, it significantly affects macroeconomic factors including inflation, unemployment, economic growth, and stability. Fiscal policy is also important for macroeconomic stabilization in the economy. Ibrar et al. (2014) discovered that in Pakistan's central bank's strategy of targeting inflation, the fiscal policy directly affects the monetary policy, which then has an impact on inflation. The primary causes of inflation are the subject of discussion between monetarists and non-monetarists. For monetarists, the issue with excessive inflation in the economy is always the money supply, whereas for non-monetarists, the problem is the budget deficit. Inflation and the fiscal deficit have an uneven relationship over the long run. Petroleum prices and the current account deficit are two other elements that are more significant in Pakistan's inflationary problems (Ibrar et al., 2014). Guidelines for comprehending the consequences of shocks from various economic factors are provided by monetary policy. Only timely implementation of these rules is required. Any misappropriation could negatively affect the system of the economy. For instance, changing exchange rate

can benefit export, growth, and the balance of payments, but if done so without considering the country's current situation of low exports and high imports, the policy may backfire and cause the economy's efficiency and balance of payments to worsen (Naser et al., 2016). Similarly, Inflation also follows different dynamics in economy.

Theoretically, the dynamics of supply and demand within the economy control inflation. Both supply and demand-side factors play a role in the shift from interest rates to inflation. In theory, decreasing customers' purchasing power through higher interest rates discourages consumption in order to fight inflation. Taking into consideration this lowered demand, the investment is reduced to reflect the lower aggregate demand. This mechanism lowers prices. This may be the case when the economy is not vulnerable to external shocks. However, it is uncommon to find a country in the modern era of globalization that is unaffected by foreign influences of any kind. As a result, the theory-recommended course of action of simply hiking interest rates to curb inflation is futile.

Inflation is caused by a discrepancy between supply and demand. Because of this imbalance, governments and central banks believe they can control inflation by influencing the system's supply or demand side dynamics. Therefore, they employ tools for monetary and fiscal policy, respectively. The desired results may be attained if both policies are applied concurrently and accordingly. Because of the political repercussions of fiscal policy factors, this frequently doesn't occur. For instance, tax increases are one fiscal policy tool for influencing the economy's demand side. But since they worry about hurting their political appeal, policymakers are typically unwilling to do this. This might help to lower prices of commodities by lowering investment and consumption, but politicians pay a large opportunity cost when they raise taxes. If lawmakers choose to increase taxes, the government will use the extra revenue to fund more public spending, which would result in further improvement. Because of this, governments only use monetary policy tools to reduce inflation when working with central banks. Interest rates and supply of money on hand are the two monetary policy tools available to central banks.

The monetary policy's primary instrument for containing and stabilizing inflation has been interest rates. In Poland, having an interest rate that is too low is a serious concern (Vasicek, 2010). Lower interest rates are preferred to prevent contraction of the growth. A higher interest rate is an undesirable variable if the issue is output growth. While a higher interest rate is desirable if the issue is price stability (Vasicek, 2010). However, in a nation like Pakistan, there has always been disagreement over this policy's efficacy. At 22% right now, the interest rate is the highest in nation's history due to strong inflation. However, it doesn't appear that this effort has reduced inflation. Instead, it has sparked a number of economic ills like growing debt and exchange rate depreciation without stimulating exports. This policy is carried out under the presumption that the interest rate and growing prices have a linear relationship.

As discussed above, the variables may be associated in a non-linear or asymmetric way, previous researches have only taken into account their linear relationship. This is because a linear relationship may produce inaccurate results when a nonlinear relationship is also present. It was necessary to rethink the relationship using this new lens after looking into the studies on the asymmetric relationship. The use of nonlinear models to comprehend economic monetary events is on the rise. For the Canadian central bank's response to monetary policy, Komlan (2013) offers a non-linear model. The parameters alter in the presence of asymmetric behavior and model breaks. This is often referred to as having inconsistent parameters. Their parameters likewise fluctuate as a result of the changing conditions, which makes the model's assumption of a linear relationship invalid.

1.2 Objectives of the Study

This study aims to find the symmetric or asymmetric effect of monetary policy variables i.e. money supply on inflation in Pakistan.

The objective can be simplified as whether the monetary shocks have symmetric or asymmetric effects on rising prices for Pakistani economy. The monetary shocks can be divided into positive monetary shocks and negative monetary shocks.

2. REVIEW OF LITERATURE

During the depression of 1930s, the concept of an unequal effect of monetary policy first emerged. It soon became clear that expansionary monetary policy was useless during recessions. Prior to this time, it was widely held that monetary policy effects in symmetric way. The economy would be stimulated by falling interest rates, and it would be stopped by rising interest rates (Morgan 1993). But the conviction in the asymmetry of monetary policy has fluctuated over the course of economic history. Particularly when Freidman argued in the 1960s about the tight monetary policy he perceived to have existed throughout the Great Depression. Both loose and tight monetary policy concentrates on the tools needed to accomplish their goals. The tools of monetary policy that are employed to restrain rising prices have been around for a while. However, the type and extent of their impacts differ.

2.1 Relation of Monetary Policy Variables and Inflation

The shocks of Monetary policy manifest themselves on manufacturing sector immediately and hence effect the economic growth, according to Bonga (2017). However, many researchers suggest that using interest rates is a superior way to reach the goal of reducing inflation. Interest rates were found by Masih, Al-Hajj, and Umar (2008) to be a key factor in controlling inflation in closed economies. They arrived at the conclusion that exchange rates may be a preferable alternative for open economies to manage inflation by using the ARDL method. Cioran (2014) concurs with this. Interest rates were identified by Cioran (2014) as a key tool for controlling price growth in Romania. As a result, the central bank can efficiently employ interest rates to control economic inflation. It's not always this easy, though.

Prior to Malaysia's 1997 currency crisis, Ma and Park (2005) discovered that the relation of general price level and interest rates followed lead-lag. However, after the crisis, this relationship changed. Thus, before the crisis, interest rates were ineffectual at containing inflation; nevertheless, once the crisis hit, interest rates took the lead and inflation rates the backseat.

In addition to interest rates, the money supply is a key tool of monetary policy. Simsek (2022) discovered a reciprocal link between money supply and income. According to the study, income rises when there are favourable shocks to the money supply. whereas the money supply grows as income rises. Friedman contends that a prudent flow of money supply would have prevented the depression of 1930s. According to Friedman and Schwartz (1963), changes in the money supply are to blame for changes in the business cycle. They go on to claim that the Great Depression of the 1930s could have been avoided if the abrupt decline in the money supply in the 1920s had been properly addressed.

The business cycle varies due to money supply changes. Since monetary policy is independent of political decision-makers and their influence, it can be a more effective tool for fostering economic stability. As money supply is controlled by central banks, Zarnowitz (1996) believes that any economic instability is a failure of the monetary authority.

Money supply influences the price level and the length of the lag may have an impact, a strict monetary policy will manage inflation. The position is made easier by expansionary monetary policy, and prices may increase. This is done in order to revive a slow growing economy.

2.2 Symmetric or Asymmetric Effects of Monetary shocks

The assumption that positive monetary policy shocks and negative monetary policy shocks have the same effect when creating linear models is common, yet non-linearity or asymmetry has always existed when describing monetary policy shocks in the channels of

transmission. In comparison to expansionary monetary policy, contractionary monetary policy has a different kind of impact. In 1936, Keynes proposed the concept of asymmetry and argued that positive shocks had less of a real impact than negative shocks. Negative monetary shocks can also be stated to have an impact on actual variables.

Cover (1992) started the investigation of the asymmetry of monetary shocks. He proposed that on many variables the monetary policy has asymmetric impact. According to Cover (1992), positive shocks to output have a smaller impact than negative shocks. Asymmetries in the monetary shocks were also identified by Morgan (1993), Delong, and Summers (1998). For the Nigerian economy, Abiodun and Ogun discovered asymmetries in monetary policy on output and prices. Zakir and Malik (2013) discovered asymmetries for Pakistani economy. They applied an altered form of the cover methodology. According to research by Branichon, Matthes, and Sablik (2016), contractionary policy is more influencing than the expansionary policy. As opposed to expansionary monetary policy, which reduces unemployment to a lower extent, contractionary policy reduces unemployment in greater extent.

In a similar vein, monetary growth and contraction were also discovered to have an asymmetries effect by Debortoli, Forni, Gambetti, and Sala (2020). It was found that an expansionary policy affects prices more and real factors less. Additionally, prices are little impacted by the contraction in money, which beings change in real factors in greater extent. According to Wises (1999), when the rate of GDP growth is low, it influences real growth in a greater amount. Though it could not discover any proof of asymmetry brought on by negative and positive shocks.

NARDL approach was utilized by Abuodyn et.al (2019) and determined the short-term negative shocks have a greater impact than short-term positive shocks on growth but little control on prices. Over time, positive shocks had a higher impact on pricing and output than negative shocks, which were barely noticeable. Morgan (1993) discovered asymmetries for USA. According to historical evidence. In 1988–1989, the monetary policy was tightened, and in 1990, it was loosened. While both monetary policy iterations responded in quite different ways. Tight monetary policy had greater impact than the easy monetary policy. According to Ravn and Sola (1996), the monetary shocks are actually symmetrical in character. The analysis comes to the conclusion that even while negative shocks have genuine effects, but hard to find any symmetry in case of growth. This is due to the reason that monetary policy hardly effects overall economic activity.

Empirical investigation of monetary shock transmission gives mixed results. Hence the literature is divided regarding the true nature of monetary shocks on the macroeconomic variables. This gap provides opportunity to explore more in this area.

3. METHODOLOGY

3.1 Theoretical framework

Variables are affected by monetary policy through a variety of transmission mechanisms. The most powerful of them are changes in supply of money and changes in rate of interest. These policy instruments have varying effects depending on the mechanisms. The symmetry effects of monetary policy are therefore questionable. The expansionary strategy can aid in enhancing economic growth during a recession. Therefore, a reduced interest rate will motivate people to increase their investments, thereby boosting economic growth. The same manner, expanding the money supply will help the struggling economy.

While the economy benefits from monetary policy contraction during periods of economic overheating. When the economy is producing beyond its potential level, a tightening of monetary policy will help lower inflation, which lowers aggregate demand, bringing economy back to its equilibrium level. Similar results will be achieved by increasing interest rates, which will decrease investment and hence growth. Money will become more expensive and consumers would find it difficult to invest if the money supply is reduced.

However, the severity of these effects on the level of prices is the problem. Because increase in supply of money may have lag effect on prices and instead takes time to take effect. While decrease in supply of money may have greater control on prices. Second, a tight monetary policy may instantly limit people's ability to spend. Because of this, contractionary policy becomes more influential.

The rate of transmission of monetary policy is different. Time lag (the effects are not immediate or instantaneous but rather gradual), price rigidities downward (producers may take time to reduce the prices of their goods as shown by menu cost), expectations (people may expect prices to increase by less percentage that's why easy monetary policy may be less effective), and outlook of consumers and producers (Morgan, 1993) are some of the factors contributing to this asymmetric effect.

3.2 Data sources and Variable specification

This study considers the time series annual data of 50 years from 1972 to 2021 for Pakistan. The data has been taken from World development indicator (WDI). Consumer price index is used to denote Inflation, which captures the true effect of rising prices on consumers and economy as a whole. consumption spending of government taken as percentage of gross domestic product represent fiscal policy variable for Pakistan. similarly, Broad money represents money supply, which is an instrument of monetary policy. The following table 1 shows the specification of the variables and the sources of these data collected.

Table 1. VARIABLE SPECIFICATION

SERIAL NO.	NAME OF VARIABLE	PROXY USED	UNIT OF THE VARIABLE	SOURCE OF THE VARIABLE
1	INFLATION	CONSUMER PRICE INDEX	ANNUAL PERCENT GROWTH	WDI
2	GOVERNMENT EXPENDITURE	GENERAL GOVERNMENT FINAL CONSUMPTION EXPENDITURE	PERCENTAGE OF GDP	WDI
3	GDP	GDP GROWTH RATE	ANNUAL PERCENT	WDI
4	IMPORTS	IMPORTS OF GOODS AND SERVICES	PERCENT OF GDP	WDI
5	MONEY SUPPLY	BROAD MONEY GROWTH	ANNUAL PERCENT GROWTH RATE	WDI

Consumer price index in annual percentage growth is represented by inflation. This is the dependent variable and its determinants include imports, government expenditure, GDP growth rate and money supply. Imports as percentage of GDP is another variable. consumption expenditure of government is also taken as percentage of gross domestic product, represents the fiscal side effect on inflation. Broad Money is another determinant of inflation as is represented by growth rate of money supply. Hence the effect of both monetary and fiscal policy has been considered in the analysis.

3.3 Process

The variables were tested for stationarity. The variables CPI, import, money supply and GDP are stationary at their level forms. While the government consumption expenditure percent to GDP is stationary at its first difference. the equation is tested through ARDL technique to check the long run relationship through long run form and bound test. While coefficients of short run and long run adjustment ECM test was performed. For finding any asymmetric effect the NARDL technique was used and the above process was repeated for this method as well. While prior to NARDL, to remove any degenerate case the augmented ARDL technique was also used. Different diagnostic tests like WALD Test, RAMSEY RESET, CUSUM, CUSUM OF SQUARE tests, Serial Correlation LM and Breusch-Pagan-Godfrey test for heteroscedasticity were also performed to check the validity of the model.

3.4 Stationarity of variables

Two tests—the PP, ADF are run to verify

stationarity. The Philip-Perron test is useful in identifying both autocorrelation and heteroscedasticity in the data, whereas the ADF test is used to assess autocorrelation in the variables, due to advantages of different tests of stationarity, these two tests have been used in the study for stationarity check.

3.5 ARDL, Augmented ARDL and NARDL Technique

The study used the ARDL technique, which does not require stationary variables. Through F-TEST, ARDL provides the long-term relation of variables. The ARDL technique produces coefficients for these long run co-integrated variables after determining the long run relationship.

The ARDL method takes the symmetric effects of variables, or the linear relationships between variables, into account. The symmetric effect explains why equilibrium recovers from a disturbance at a constant pace. If the first variable changes, the second variable will also change in a symmetric way. For ARDL, it is not necessary for the variables to be stationary, hence this technique is free from the weaknesses of Johanson Julius co-integration test for finding long run relationship. Apart from this, ARDL technique is equally used for small and large samples with effective results.

ARDL functions in two steps. First step involves use of F-test, which determines association of the variables in the longrun. The F-statistics (F-calculated) is compared within a range of lower and upper values which are determined by Pesaran et al. (2001). This requires F-calculated to lie below the lower value for no long run relation. However, for a relationship in the long run the F-calculated must lie above the value of upper bound. There may be another possibility where the F-calculated may lie in between the upper and lower value range which represents an inconclusive relationship. Second step involves estimation of the coefficients of the variables. For relation in the short run Error Correction Model is conducted. Which explains two points. The short run relation and long run adjustment after a shock in a variable. Finding exogenous and endogenous factors in the data set under examination is the next stage. The ECT is significant in this sense. If the ECT reaches a considerable level, endogeniety of the dependent variables is identified. It implies that ECT is a dependent variable. Similar to this, if ECT is not significant, the dependent variable is not endogenous but rather exogenous. The ECT coefficient also demonstrates the rate of adjustment. A lower number indicates slower adjustment whereas a higher value indicates faster convergence. A negative sign indicates convergence to the equilibrium.

The Augmented ARDL bound test is useful for better comprehension of the cointegration in the model. The Augmented ARDL is a bound test for cointegration and improvisation of ARDL. If the order of integration is of different order whether they may have long run relationship or not, for such determination ARDL is used. The ARDL equation gives both short and long run parameter estimates. Coefficient of first the differenced variables give the short run estimates while the normal coefficients give long run coefficients. The long run coefficients will make sense if there is long run cointegrating relation.

The Augmented ARDL uses three tests to reach at the conclusion whether cointegration exists or not. The first test includes a bound testing with an F-test for cumulative significance of lagged variables. A value lower than lower bound means no cointegration. A value greater than the upper bound means cointegration while a value in between shows inconclusive results. The second test includes a T- test, which tests dependent variable for lagged values. This test is conducted to remove the degenerate cases in dependent variable. Normally, the overall significance through F-test may occur due to lagged independent variable hence this t-test is used in second step. The null hypothesis is no cointegration. The null hypothesis will be rejected when t value is above the upper bound. The third test is given by (McNown et al. 2018), where again an F-test is conducted on independent variables for their lagged values. This is done in order to remove the condition of dependent variable to be I (1). For this the F calculated needs to be above the upper bound.

These three tests conclude accurately the matter of cointegration. Table 3 below shows the results of the test of Augmented ARDL. Aug ARDL results indicate long run cointegration and free from above mentioned degenerate cases.

In order to determine the possibility of non-linearity in the relation the NARDL technique is also employed. This technique will be helpful to understand the asymmetric nature of the relationship.

The study conducts all these test to reach at a conclusion regarding the nature of relationship of the models under study.

3.6 Econometric Models and Empirical Framework

The current study uses the model of Yen Chee Lim and Siok Kun Sek, *(2015)* with some modification. The current study uses time series data for Pakistan while the above study uses panel data for cross country analysis of the problem at hand. Further in place of national expenditure the current study uses government consumption to show fiscal side.

The general equation of the MTPL model is

$IN_t = \alpha_0 + \alpha_1 MP + \alpha_2 X_t + \varepsilon_t$

The monetary policy variables include money supply and interest rate. But the current study uses money supply to represent the monetary policy.

$IN_t = \beta_0 + \beta_1 MS + \beta_2 X_t + \varepsilon_t$ ……. (1)

Xt represents control variables which are GDP, consumption expenditure of government and imports.

$IN_t = f(MS, IMP, GDP, GEXGDP)$

$IN_t = \beta_0 + \beta_1 MS + \beta_2 IMP + \beta_3 GDP + \beta_3 GEXGDP + \varepsilon_t$ …… (2)

$$\Delta IN_t = \alpha_0 + \sum_{i=1}^{q_1} \alpha_{1i}\, \Delta IN_{t-i} + \sum_{i=0}^{q_2} \alpha_{2i}\, \Delta MS_{t-i} + \sum_{i=0}^{q_3} \alpha_{3i}\, \Delta IMP_{t-i} + \sum_{i=0}^{q_4} \alpha_{4i}\, \Delta GDP_{t-i} + \sum_{i=0}^{q_5} \alpha_{5i}\, \Delta GEXGDP_{t-i} + \beta_1 IN_{t-1} + \beta_2 MS_{t-i} + \beta_3 IMP_{t-i} + \beta_4 GDP_{t-i} + \beta_4 GEXGDP_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots (3)$$

Equation 3 shows the linear ARDL model.

If the relationship is linear the results of LARDL are enough but normally the time series variables are non-stationary. Most of the variables are stationary of different orders. The relation may not be linear hence NARDL technique is most appropriate.

The monetary policy variables are further decomposed into two type of shocks i.e. negative shocks and positive shocks. This way money supply will be decomposed into contractionary monetary policy and expansionary monetary policy action. Hence lowering money supply represents contractionary monetary policy, which can be interpreted as positive shock. Similarly, the increase in money supply represents expansionary monetary policy, this can be interpreted as negative shock.

$MS = [MS^+, MS^-]$

Keeping in view the above policy actions the equation will be

$INt = F(Xt, MS^+, MS^-)$

X_t represents other explanatory variables effecting inflation.

The Nonlinear ARDL equation can thus be written as

$$IN_t = \alpha_0 + \sum_{c=i}^{q_1} \lambda_c \, X_{t-c} + \sum_{d=0}^{q_2} \lambda_d \, MS^+{}_{t-d} + \sum_{e=0}^{q_3} \lambda_e \, MS^-{}_{t-e} + Ut \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

If $\lambda_d = \lambda_e$ it will mean symmetric effect of positive and negative money supply shocks. If above coefficient vary in their magnitude, this will represent monetary policy has asymmetric effect. Further, if the value of $\lambda_d > \lambda_e$, will mean that the positive shocks of money supply will have greater asymmetric effect than the negative money supply shock on inflation and vice versa.

The final NARDL equation no. 5 to be estimated will be in the following form.

$$\Delta IN_t = \alpha_0 + \sum_{i=1}^{q_1} \alpha_{1i} \, \Delta IN_{t-i} + \sum_{i=0}^{q_2} \alpha_{2i} \, \Delta MS^+{}_{t-i} + \sum_{i=0}^{q_3} \alpha_{3i} \, \Delta MS^-{}_{t-i} + \sum_{i=0}^{q_4} \alpha_{4i} \, \Delta IMP_{t-i} + \sum_{i=0}^{q_5} \alpha_{5i} \, \Delta GDP_{t-i} + \sum_{i=0}^{q_6} \alpha_{6i} \, \Delta GEXGDP_{t-i} + \beta_1 IN_{t-1} + \beta_2 MS^+{}_{t-i} + \beta_3 MS^-{}_{t-i} + \beta_4 IMP_{t-i} + \beta_5 GDP_{t-i} + \beta_6 GEXGDP_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots (5)$$

4. RESULTS AND DISCUSSION

The results start with the stationarity check of the variables. Table 2 below shows the situation of the stationarity of the variables.

While the ARDL technique reduced the restrictions and assumed that only the dependent variable should of integrated of order one and secondly there are no degenerate cases in the

Table 2 Unit Root Test results.

Variables	ADF				Philips-Perron			
	Constant		constant & Trend		Constant		constant & Trend	
	Level	Δ	Level	Δ	Level	Δ	Level	Δ
INF	**-3.47****	**-8.27***	-3.23	-8.24*	-3.65*	-8.27*	-3.67**	-8.24*
IMP	**-4.25***	**-7.07***	**-4.50***	**-7.03***	**-4.28***	**-7.59***	**-4.50***	**-7.51***
GEXGDP	-1.74	**-6.03***	-1.74	**-5.95***	-1.90	**-6.02***	-1.91	**-5.95***
GDP	**-5.65***	**-7.59***	**-6.44***	**-7.50***	**-5.78***	**-19.82***	**-6.45***	**-19.35***
MS	**-5.64***	**-9.38***	**-5.66***	**-9.35***	**-5.57***	**-29.31***	**-5.56***	**-31.23***

Note: *, **, and *** symbolize significance at 1%, 5% and 10% respectively.

The unit root test indicates inflation, imports, GDP and money supply are stationary at level while government expenditure is integrated of order 1 and non-stationary in level form. Both the ADF and PP test verify the above statement regarding stationarity. This way the application of ARDL technique is justified.

With the development of ARDL technique by Pesaran et al. (2001) the restrictions of the previous techniques were removed as the cointegration of Engel Granger and Johanson-Julious were too restrictive to perform different cointegrating analysis. The economic models usually have mixed order of integration which cannot be proceeded with these techniques. model. These show the insignificance of the lagged dependent or lagged independent variables in the error correction term. Degenerate case 1 occurs when lagged levels of independent variables show insignificance. When lagged level of dependent variables show insignificance then that is degenerate case 2. The degenerate cases will make the ECT unable to reduce the existence of any gap among dependent and independent variables. This results in no cointegration in the model.

In augmented ARDL one more F-test is conducted on the independent variables in their lagged form. The advantages of using this technique is the relaxation of dependent variable

to be integrated of order 1. Similarly, it provides estimation of the cointegration analysis through these tests (Chung, McNown & Goh, 2019).

Though ARDL test has advantage of running the regression with mixed or unknown order of cointegration, nonetheless, there is always possibility of degenerate cases. Same goes with the F statistics, which is not sufficient to reach on a conclusion of cointegration. Hence in this regard Augmented ARDL is appropriate approach to conduct the analysis.

Table 3 Augmented ARDL Results					
	calculated value	**5%**		**10%**	
		I(0)	I(1)	I(0)	I(1)
F-stat (ALL)	**10.1337**	3.178	4.45	2.638	3.772
T-stat(lagged dependent variable	**-6.560885**	-2.86	-3.99	-2.57	-3.66
F-stat (lagged independent variable	**4.948758**	2.55	4.49	2.06	3.74
I(0) represents the lower bound value I(1) represent upper bound value					

The long run and short run estimates of the models are presented in the following tables. The augmented ARDL test in the above table 3 show the long run cointegration. It is further concluded that there is no degenerate case issue in the model. With this the study proceeds to use the NARDL technique. Both the values of the F-statistics for lagged dependent and lagged independent i.e. 6.560885 and 4.948758 are greater than the upper bound values 3.66 and 3.74 in absolute term respectively.

Table 4. Long Run Estimates, Inflation is Dependent Variable							
	ARDL			NARDL			
Variable	Coefficient	t-Statistic	Prob.	Variable	Coefficient	t-Statistic	Prob.
IMP	0.586227	2.872361	0.0074	IMP	-0.132569	-0.272539	0.7879
GEXGDP	0.096362	0.428538	0.6713	GEXGDP	0.676584	1.721331	0.0999
GDP	-0.920897	-3.168975	0.0035	GDP	-0.243181	-0.340811	0.7366
MS	0.338581	3.318206	0.0024	MS_POS	0.349893	2.072399	0.0507
C	-4.738621	-1.449248	0.1576	MS_NEG	0.336587	2.090489	0.0489
				C	3.511817	0.55229	0.5866

The table 4 shows the long run estimates of the ARDL and NARDL model. The long run results of ARDL model suggest a positive significant relation of money supply and inflation with coefficient of 0.33. This result is in line with theory. While NARDL result shows that both shocks effect the inflation in almost same magnitude as depicted by the coefficient values of 0.34 and 0.33 for positive shock (contraction of money supply) and negative shock (expansion in money supply) respectively. The coefficients are almost similar which justifies the long run symmetric effect of shocks of monetary policy on inflation for Pakistan.

The long run NARDL model comes up with negative relation of imports with inflation. While the ARDL approach came up with positive relation of imports and inflation in the long run. In a developing country like Pakistan which is import dependent the prices rise with rise in import. While the negative sign in NARDL model makes it weak argument. And this makes it controversial. Taking into account these arguments it can be justified that in the long run the relation of money supply, which represents monetary policy, and inflation is not asymmetrical in nature rather it behaves symmetrically.

Table 5 Short Run Estimates							
ARDL				NARDL			
Variables	Coefficient	t-Statistic	Prob.	Variable	Coefficient	t-Statistic	Prob.
D(INF(-1))	0.278978	2.735359	0.0104	D(INF(-1))	0.070803	0.690367	0.4975
D(INF(-2))	0.279865	3.032697	0.005	D(INF(-2))	0.080521	0.808494	0.4279
D(INF(-3))	0.256896	2.87904	0.0073	D(INF(-3))	0.359067	3.915443	0.0008
D(GEXGDP)	-0.576136	-1.577011	0.1253	D(IMP)	0.615407	3.472572	0.0023
D(GEXGDP(-1))	-0.558509	-1.450336	0.1573	D(IMP(-1))	0.593805	3.147539	0.0049
D(GEXGDP(-2))	0.94891	2.478649	0.019	D(IMP(-2))	0.602368	3.345724	0.0031
D(GDP)	-0.25313	-1.755227	0.0894	D(GEXGDP)	-0.20376	-0.526817	0.6038
D(GDP(-1))	0.540394	3.009605	0.0053	D(GEXGDP(-1))	-0.570955	-1.430915	0.1672
D(MS)	0.057706	1.101616	0.2794	D(GDP)	-0.142527	-0.915831	0.3702
D(MS(-1))	-0.211818	-4.306231	0.0002	D(GDP(-1))	0.1991	1.073044	0.2954
CointEq(-1)*	-0.956956	-7.71825	0.0000	D(GDP(-2))	-0.307282	-1.745406	0.0955
				D(MS_POS)	-0.036068	-0.516151	0.6111
				D(MS_POS(-1))	-0.34495	-4.273422	0.0003
				D(MS_NEG)	0.077604	1.108156	0.2803
				D(MS_NEG(-1))	-0.249315	-4.11392	0.0005
				D(MS_NEG(-2))	-0.148845	-2.143276	0.044
				D(MS_NEG(-3))	-0.165631	-2.858381	0.0094
				CointEq(-1)*	-0.753281	-6.76426	0.0000

Table 5 shows the short run relationship of inflation with the independent variables. In the short run the ARDL model shows significant relation of inflation with money supply after a lag period. While no immediate effect is detected by the model. While the ECT term is in line with the theory i.e. negative and less than one. 95 percent of the shocks are adjusted back to equilibrium annually according the ARDL model.

The NARDL approach shows insignificant relation of inflation and money supply in the short run while in the first lag shows significant relation.

The symmetric or asymmetric nature of the relationship is established with the help of Wald test. Table 6 provides the results of the asymmetry.

Table 6 long Run Asymmetry Results			
Wald Test:			
Equation: LRFORM02			
Test Statistic	Value	Df	Probability
t-statistic	0.715244	21	0.4823
F-statistic	0.511574	(1, 21)	0.4823
Chi-square	0.511574	1	0.4745
Null Hypothesis: C(6)=C(7)			

Table 7 Short Run Asymmetry Results			
Wald Test:			
Equation: LRFORM02			
Test Statistic	Value	Df	Probability
t-statistic	0.537074	21	0.5969
F-statistic	0.288448	(1, 21)	0.5969
Chi-square	0.288448	1	0.5912
Null Hypothesis: C(19)+C(20)=C(21)+C(22)+C(23)+C(24)			

The Wald test results indicate that the null hypothesis cannot be rejected if the p value is greater than 0.05. According to Table 6's Wald test, it is not possible to reject the null hypothesis that positive and negative shocks are symmetric over the long term. Thus, it can be said that, in the case of Pakistan, the money supply has a symmetric long-term impact on inflation. Likewise, the model's short run asymmetry results are displayed in Table 7. Similarly, the table 7 shows the short run asymmetry results of the model. The Wald test also finds no asymmetry in the short run. From Wald test it can be concluded that there is no evidence of asymmetry for this relation for Pakistan.

The models of both ARDL and NARDL were passed through various diagnostic tests. The results of these diagnostic tests are presented in tables below.

Diagnostic Testing

Table 8 RAMSEY RESET TEST				
	ARDL		NARDL	
RAMSEY RESET TEST	Value	Probability	Value	Probability
t-statistic	0.786516	0.4379	2.684388	0.0143
F-statistic	0.618608	0.4379	7.205941	0.0143
Likelihood ratio	0.970921	0.3245	13.84664	0.0002

The Ramsey Reset Test results indicate that there is specification error in the NARDL model while the ARDL model does not suffer from the regression and specification errors. That's why the results of NARDL cannot be trusted in this analysis. This way we can conclude that the model is suffering from wrong functional form.

Table 9 SERIAL CORRELATION LM TEST						
SERIAL CORRELATION LM TEST	ARDL			NARDL		
F-statistic	1.183657	Prob. F(2,28)	0.321	3.148771	Prob. F(2,19)	0.0659
Obs*R-squared	3.585976	Prob. Chi-Square(2)	0.1665	11.20225	Prob. Chi-Square(2)	0.0037

From the results of LM serial correlation test it is visible that the NARDL model has serial correlation while ARDL model does not suffer from the serial correlation issue.

Table 10 HETEROSKEDASTICITY						
HETEROSKEDASTICITY	ARDL			NARDL		
F-statistic	0.88	Prob. F(15,30)	0.584	1.288091	Prob. F(23,21)	0.2816
Obs*R-squared	14.13	Prob. Chi- Square (15)	0.5151	26.33373	Prob. Chi-Square(23)	0.2854
Scaled explained SS	5.78	Prob. Chi-Square (15)	0.9831	7.222135	Prob. Chi-Square(23)	0.9993

Table 9 shows the heteroscedasticity test and both the ARDL and NARDL model qualify the test and show that the variance is same across the data.

The CUSUM test and CUSUM OF SQUARE test for both ARDL and NARDL models are presented in the appendix.

5. CONCLUSION AND POLICY RECOMMENDATION

Monetary policy shocks effect inflation positively. Thus the expansionary monetary policy rises the price level and contractionary policy reduces the price level. But the debate in current times has been on the nature of the positive and negative monetary policy shocks on inflation. The current study finds symmetric effect of shocks in monetary policy on inflation. The shocks in the long run are symmetric in nature. The LARDL model shows linear relationship of the variables but to test whether there is any asymmetry exists or not, the monetary shocks are divided into positive and negative shocks i.e. contractionary monetary policy and expansionary monetary policy respectively. For this NARDL approach was also used. Even the NARDL approach did not support asymmetries in monetary policy shocks for Pakistan. Wald test confirmed the symmetric nature of the monetary policy. The possibility of existence of symmetrical relation of money supply and inflation in Pakistan is may be due to policy makers' decision of discretionary policy adopted by monetary authority i.e. State Bank of Pakistan as Malik & Ahmad (2010) have found out that the monetary authority has not been following rule based policy since long.

In order to find out whether the model suffers from any sort of degenerate case the Augmented ARDL test was conducted. Which uses additional F- test to check the long run relation. This augmented ARDL conforms no issue of degenerate cases. Hence NARDL test was conducted.

It is suggested that money supply contraction be used to manage inflation based on the study's findings. The amount that prices rise in response to an increase in money supply is equal to the amount that prices fall in response to a drop in money supply.

The study took into account the government expenditure as proxy for fiscal side effects. But the study finds insignificant relation of this variable with inflation. Hence, the results strengthen the idea of inflation to be a monetary phenomenon.

The results of this study show symmetric impact of money supply on general price level. This relation occurs because the financial market news penetrates the market and reach people in no time. Both the monetary authority and people react immediately. While the shocks in goods market take time to show their effect. Therefore, in the event of a change in monetary policy, both positive and negative shocks are swiftly addressed.

It is therefore recommended that government should focus on monetary policy as the most suitable option for controlling inflation. The study leaves room for further studies whether government should use discretionary or rule based monetary policy in order to deal with the menace of inflation.

REFERENCES

Abdelsalam, M. A. M. (2018). Asymmetric effect of monetary policy in emerging countries: The case of Egypt. *Applied Economics and Finance*, *5*(4), 1-11.

Ahmad, M. J., Sheikh, M. R., & Tariq, K. (2012). Domestic debt and inflationary effects: An evidence from Pakistan. *International Journal of Humanities and Social Science*, *2*(18), 256-263.

Alavinasab, S. M. (2016). Monetary policy and economic growth: A case study of Iran. *International Journal of Economics, Commerce and Management*, *4*(3), 234-244.

Aslanoglu, E., & Deniz, P. (2017). Asymmetry in inflation targeting. *Topics in Middle Eastern and African Economies, Proceedings of Middle East Economic Association*, *19*.

Barnichon, R., Matthes, C., & Sablik, T. (2017). Are the effects of monetary policy asymmetric?. *Richmond Fed Economic Brief*, (March).

Baum, A., & Koester, G. (2011). The impact of fiscal policy on economic activity over the business cycle-evidence from a threshold VAR analysis.

Benlialper, A. (2013). *Asymmetric exchange rate intervention under inflation targeting regimes: the case of Turkey, 2002-2008* (Master's thesis, Middle East Technical University).

Bonga-Bonga, L. (2017). Assessing the effectiveness of the monetary policy instrument during the inflation targeting period in South Africa. *International Journal of Economics and Financial Issues*, *7*(4), 706-713.

Çekin, S. E. (2018). Inflation targeting, fiscal policy, and the exchange rate regime. *Emerging Markets Finance and Trade*, *54*(9), 2093-2116.

Cioran, Z. (2014). Monetary policy, inflation and the causal relation between the inflation rate and some of the macroeconomic variables. *Procedia Economics and Finance*, *16*, 391-401.

Cover, J. P. (1992). Asymmetric effects of positive and negative money-supply shocks. *The Quarterly Journal of Economics*, *107*(4), 1261-1282.

Davide, D., Forni, M., Luca, G., & Luca, S. (2020). Asymmetric Effects of Monetary Policy Easing and Tightening. *GBR DISCUSSION PAPER SERIES*.

Debortoli, D., Forni, M., Gambetti, L., & Sala, L. (2020). Asymmetric effects of monetary policy easing and tightening.

DeLong, J. B., Summers, L. H., Feldstein, M., & Ramey, V. A. (2012). Fiscal policy in a depressed economy [with comments and discussion]. *Brookings Papers on Economic Activity*, 233-297.

Elahi, N., Salimi, F., & Masoomzadeh, E. (2016). Investigating asymmetric effects of monetary shocks on the exchange rate and trade balance, with an emphasis on inflation targeting. *Procedia Economics and Finance*, *36*, 165-176.

Gokal, V., & Hanif, S. (2004). *Relationship between inflation and economic growth* (Vol. 4). Suva: Economics Department, Reserve Bank of Fiji.

Goshit, G. G., Jelilov, G., Iorember, P. T., Celik, B., & Davd-Wayas, O. M. (2022). Asymmetric effects of monetary policy shocks on output growth in Nigeria: Evidence from nonlinear ARDL and Hatemi-J causality tests. *Journal of Public Affairs*, *22*(2), e2449.

Hamzah, N. H., & Masih, M. (2018). Revisiting effectiveness of interest rate as a tool to control inflation: evidence from Malaysia based on ARDL and NARDL.

Hamzah, N. H., & Masih, M. (2018). Revisiting effectiveness of interest rate as a tool to control inflation: evidence from Malaysia based on ARDL and NARDL.

Hayford, M. D. (2006). Asymmetric effects of monetary policy. *The Journal of*

Economic Asymmetries, *3*(1), 59-86.

Hussain, I., Rafiq, M., & Khan, Z. (2020). INVESTIGATING ASYMMETRY IN FISCAL THEORY OF PRICE LEVEL: INSIGHTS FROM PAKISTAN. *Pakistan Economic and Social Review*, *58*(2), 207.

Khalid, A. M. (2005). Economic growth, inflation, and monetary policy in Pakistan: Preliminary empirical estimates. *The Pakistan Development Review*, 961-974.

Komijani, A., Sargolzaei, M., Ahmad, R., & Ahmadi, M. (2012). Asymmetric effects of monetary shocks on economic growth & inflation: Case study in Iran. *International Journal of Business and Social Science*, *3*(9).

Komlan, F. (2013). The asymmetric reaction of monetary policy to inflation and the output gap: evidence from Canada. *Economic Modeling* , *30* , 911-923.

Lee, C. W., & Yu, H. Y. (2021). Money supply, inflation and economic growth in China: An ARDL bounds testing approach. *Journal of Applied Finance and Banking*, *11*(1), 73-80.

Lim, Y. C., & Sek, S. K. (2015). An examination on the determinants of inflation. *Journal of Economics, Business and Management*, *3*(7), 678-682.

McCallum, B. T., & Nelson, E. (2005). Monetary and fiscal theories of the price level: the irreconcilable differences. *Oxford Review of Economic Policy*, *21*(4), 565-583.

Morgan, D. P. (1993). Asymmetric effects of monetary policy. *Economic Review-Federal Reserve Bank of Kansas City*, *78*(2), 21.

Nchor, D., & Darkwah, S. A. (2015). Inflation, exchange rates and interest rates in Ghana: An autoregressive distributed lag model. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, *63*(3), 969-977.

Olayiwola, A. S. (2019). Asymmetric effect of monetary policy shocks on output and prices in Nigeria. *African Journal of Economic Review*, *7*(1), 238-248.

Ravn, M. O., & Sola, M. (2004). Asymmetric effects of monetary policy in the United States. *Review-Federal Reserve Bank of Saint Louis*, *86*, 41-58.

Sam, C. Y., McNown, R., & Goh, S. K. (2019). An augmented autoregressive distributed lag bounds test for cointegration. *Economic Modelling*, *80*, 130-141.

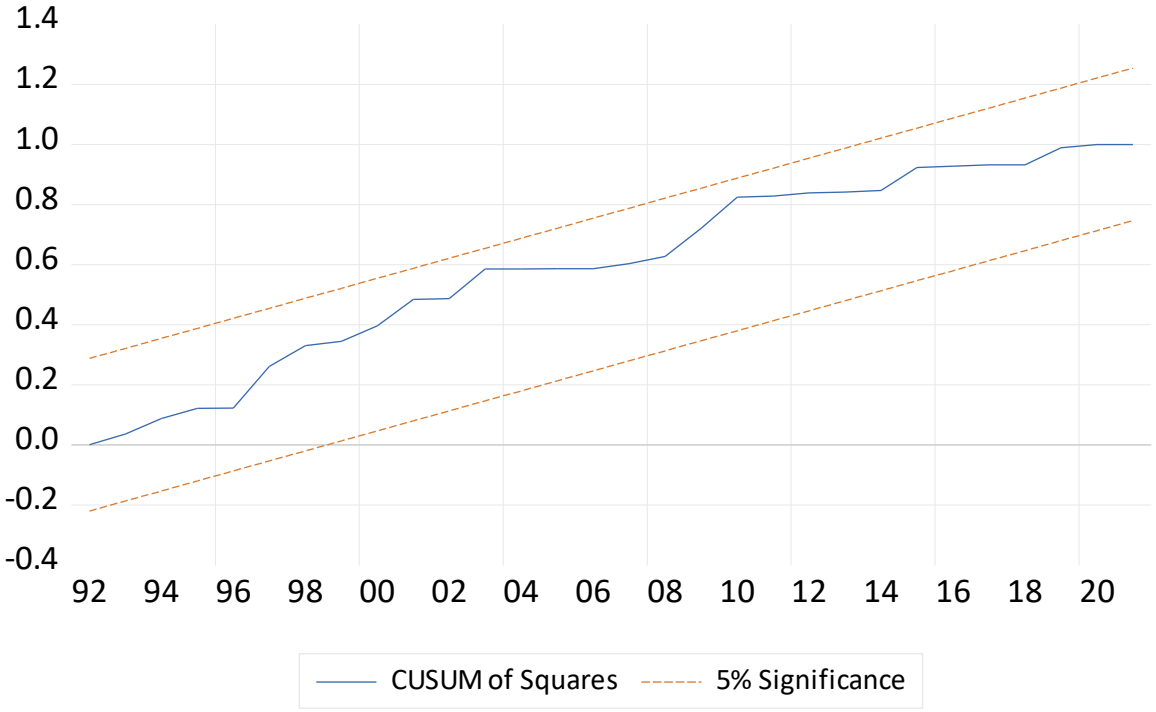
Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. *Festschrift in honor of Peter Schmidt: Econometric methods and applications*, 281-314.

ŞİMŞEK, T. (2023). AN ASYMMETRIC ANALYSIS OF THE RELATIONSHIP BETWEEN MONEY SUPPLY AND REAL INCOME: A TEST OF MONETARY AND REAL BUSINESS CYCLE HYPOTHESES FOR MIST COUNTRIES. *Uluslararası Ticaret ve Ekonomi Araştırmaları Dergisi*, *6*(2), 43-51.

Vašíček, B. (2010). Monetary policy rules and inflation processes in open emerging economies: evidence from twelve new EU members. *Eastern European Economics*, *48*(4), 36-58.

Zakir, N., & Malik, W. S. (2013). Are the effects of monetary policy on output asymmetric in Pakistan?. *Economic Modelling*, *32*, 1-9.

ARDL model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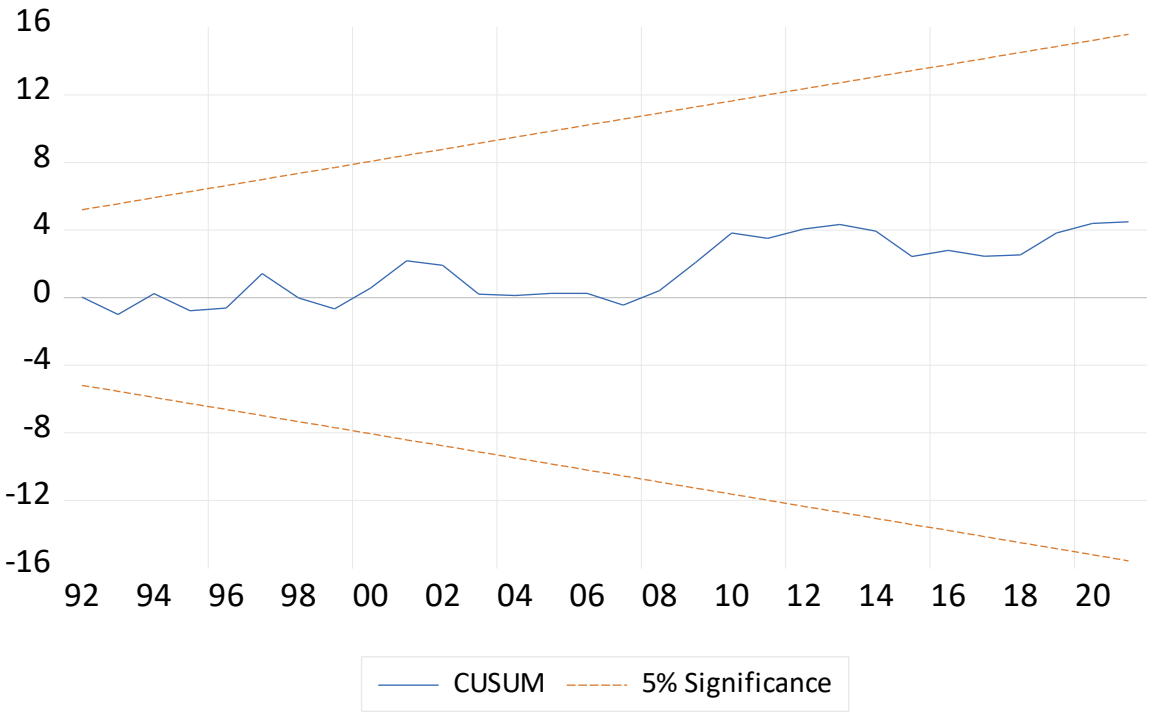
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