Threshold Modeling for Inflation and GDP Growth

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ABSTRACT

The study has evaluated the relationship between the inflation rate and GDP growth of Pakistan using the annual data of inflation rate and GDP growth since 1972 to 2016 for Pakistan. The paper has used the different techniques like; OLS, FMOLS, TAR and dummy method threshold model, to estimate the true relationship between the concerned variables based on the previous studies those gives mixed results. The study has concluded the positive relationship between the inflation rate and economic growth of Pakistan at 5.5% to 9% threshold level of inflation and confirmed the nonlinear relationship between them. And low and double figure inflation rate are considered to have adverse effect on the economic growth of the Pakistan. So to stimulate the stable economic growth of Pakistan we need to have medium rate of inflation.

Key words: Inflation rate, GDP growth, threshold level, nonlinear relationship

JEL Classifications: C22; E00; O11

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1. INTRODUCTION

The macroeconomic policy aimed to achieve high and sustained growth of output along with low inflation. The nature of relationship between inflation and growth is subject of considerable interest and debate. The relationship between both variables is open for discussion but the literature and previous studies has uncovered some important things and wide consensus has been reached on few aspects of relationship between two variables. It is accepted that in long run higher rate of inflation is injuries to the economy. Inflation act as a signal of relative price change which help us to achieve efficient allocation of resources Fischer (1993). The higher inflation has negative impact on the economy, which emphasize the policy institutes to keep inflation at low rate but the question is how low inflation should be? That generates a question of that threshold point or level beyond which the inflation move downward in relation to growth and start damaging the economy. In that respect the major literature diverted to the point that we need to figure out whether relation is linear or nonlinear, at first. This implies that may be at low rate the relationship between both is positive or nonexistent but at higher level the relationship is negative. If relationship is proven to be nonlinear, it would be easy to calculate the threshold level for inflation. The possibility of existence of nonlinear relationship was first identified by Fischer in 1993 who observed that the relation between inflation and growth is positive at low rate but after inflexion point the curve bend back and the relationship between both become negative at higher inflation rate. To validate the results, another economist Sarel in 1996 revisited the relationship between both using structural breaks and found the results to be significant. The findings of the study state that the inflation has no or slightly positive impact on growth below 8% but beyond that point the relationship between both variables becomes negative.

There are few studies who tried to address the issue for both developed and developing countries. Khan and Senhadji (2000) worked on estimating threshold level of inflation for both developing and developed countries stated that for developing countries the threshold level lie in the range of 7-11 percent. Particularly talking about Pakistan, due to uncertainty in financial markets, Pakistan economy is facing real challenges of higher inflation rates and low growth rate. The investment in private sector also suffered a lot because of that reason and for that it is important to estimate the nexus among inflation, investment and economic growth. Few studies, in Pakistan, envisage the existence of nonlinear relationship between inflation and economic growth Ayyoub et al (2001) and Mubarik (2005)

The main aim of the study is to find the true relationship between the inflation and economic growth of the Pakistan, whether it is linear or nonlinear. As graphically we can clearly see the nonlinear curve between these two variables. There are also mixed results related to positive and negative relationship, some studies have suggested to keep inflation rate high to stimulate economic growth and some studies emphasis on low inflation rate for stability of the economy. So the study also aimed to find the true relationship. And also find the threshold level of inflation rate for economic growth of Pakistan by comparing different techniques. The study uses the simple linear OLS, FMOLS, Dummy method threshold regression and TAR method to fulfil the objectives of the study using annual data. After the brief introduction study comprises on literature review section, followed by methodology of the study, than results and analysis and finally conclusion and Policey recommendation of the study are given below.

2. LITERATURE REVIEW

Inflation and economic growth are very important indicators those are discussed in many ways and many studies has tried to calculate the relationship between them whether it is positive or negative and also calculated the threshold level for inflation at which economic growth can be stimulated. Khan And Schimmelpfennig (2006) examined the inflation rate that showed increasing trend after the longtime of low percentage. So inflation rate rises at 8 to 9% in 2005 that was 5% in 2000, so policy makers have main concern to control the inflation rate. Due to increase in the credit the inflation rate has increased from 2000 to 2006. Study examined the monetary factors which are responsible for high rate of inflation in the country, the model has generated by including standard monetary variable and also the supply factors are added in the inflation model. By using the ARDL model cointegration relationship has examined and indicated that monetary factors are more responsible than supply factors in affecting the inflation rate. Same like previous many studies Qaiser and Kasim (2009) examined the threshold level for inflation, in case of Malaysia. But used quiet different approach to find the threshold level, that is TAR (threshold Autoregressive), derived originally by Hansen (2000) by examining the model under two regime of TAR. The study has also discussed many papers like Malik and Chowdhary (2001), and originally derived the inflation determinant from the Tobin (1965), and Fisher (1993), Gomme (1993), Barro (1991) and Bruno and Easterly (1998), in detail including others studies. Analyzing the Malaysia inflation and economic growth it has been examined that there are two regime change in data of inflation such as 1973-74 high inflation and 1985-87 low inflation rate. Through the descriptive analysis of data it has been showed that there is high correlation between GDP and GCF. TAR model has formulated on two regime structure breaks and hypothesis has tested by critical values calculated through LM bootstrap method. So after the following general estimation

rules like;' stationarity found that all variables were stationary at level, and long run results showed that there are two regimes structure breaks in the inflation rate of Malaysia. So data has divided into two sets, the OLS estimation has done on complete data and also on separate data for regime effect inflation on economic growth and found that there is negative effect on the economic growth in one regime of inflation. And implies that nonlinear relationship in case of Malaysia and showed that below 3.89% of inflation rate is benefited for stimulation in economic growth. So need to keep the inflation rate at low level to increase the economic growth in case of Malaysia. Like many other studies those have examined the relationship between inflation and economic growth like Barro (1995), Bruno and Easterly (1995) and many others. They suggested to use cross sectional data to find the robust relationship between inflation and economic growth. Also the results differ for different countries depend upon their trend of inflation and economic growth. The study of Bhusal and Silpakar (2011) main focus to find the threshold level of inflation, from where the inflation rate could affect badly or could stimulate the economic growth also examined the positive and negative relationship between the variables that is significant or not. Many studies calculated the threshold level like Fisher (1993), Barro (1996) and Bruno and Easterly (1995) suggested the high inflation level at 20% to 40% for influencing the economic growth positively. Also Mubarik (2005) found inflation rate at 8% in case of Pakistan to increase the economic growth. And in case of Nepal khan and Senhadji (2011) showed 11% inflation rate with positive effect, so the study of Bhusal and Silkapar (2011) found the threshold level by dummy method at structure break points primarily examined through the graphically and found that 6% inflation is appropriate for the high economic growth and found positive relationship between them with one way causal relationship and suggested to have stable inflation rate and doesn't exceed to 6 % so it has to be controlled. Inflation is one of the most important macroeconomic factors that could be concern of policy

makers and growth purposes, in the study of Hussain and Malik (2011) the bivariate analysis has been done as due to multivariate analysis the other variable effect could intervene in the model that could effects the inflation. So the true relationship couldn't be found. The main purpose is to find the positive or negative relationship between the variables as in previous studies there is both positive and negative relationship between inflation and economic growth. In positive relationship when the inflation rate is high the economic growth increases due to increase in the capital formation. In case of Pakistan the economy suffered many ups and down so inflation and economic growth are remained non-stable. The study has used time series data since 1960-2010 on GDP and inflation rate. As previous many study used and suggested that crossectional data are more reliable in this context to give the robust relationship. Firstly through the stationarity test it has found that all variables are stationary at I (1). And by using Engle Granger cointegration test the long run relationship between variables has confirmed. Also the ECM has showed the short run relationship between the variables. There is positive relationship found between the variables and results were consistent with the study of Malik and Chowdhury (2001). Lastly the threshold level for inflation has calculated by dummy method at structure break point. And found that optimal inflation rate is 9% that is beneficial for economic growth in case of Pakistan. So need to keep inflation rate at 9% or above to stimulate the economic growth. As Pakistan is developing country and its facing fluctuation in the economic growth and in inflation rate. There are numerous resources like human and natural but these are not utilized optimally to get fruitful benefit from them. According to study of Ali (2014) due to high prices poor people are facing very adverse effect on their life, but high inflation is also beneficial in creating the capital in the economy. As previous studies like Barro (1998) showed negative relationship between these two indicators but Bruno et al (1995) suggested very high rate of inflation for economic growth. So due to these mix results we couldn't

find the concluding relationship between these variables. In case of Pakistan recent studies like Iqbal and Nawaz (2010), Ali (2014) and Ahmed et al (2013) also showed negative results but Mubarik (2005) said that there is positive relationship. Actually the high inflation is good for high income and business class population but bad low income population. The study of Ali (2014) tried find the dynamic relationship between the variables using time series analysis. The long run relationship has found between all the variables and positive relationship has found between inflation and economic growth those results was consistent with the Mubarik (2005). But need a stable rate of inflation. In case of U, Latin America some studies showed negative relationship some studies showed positive like Makil et al (2001) and some studies showed small and negative relationship of inflation with growth Mubarik (2005), following this confused results the study of M.W. Madurapperuma (2016) tried to find the degree of responsive between inflation and growth and its impact the results concluded the negative long run relationship between the variables. So in case of Srilanka inflation rate should be minimum to increase the economic growth, study has not calculated the threshold level for the inflation as previous many studies has done. The Shapan (2016) study has also examined the relationship between inflation and economic growth. And found the long run and short run relationship between the variable and found positive relationship in case of Bangladesh and results are consistent with Malik and Chawdhary (2001) and Mehmoud (2015).

Alkahtani et al (2014) conducted a research to estimate the threshold level of inflation for Saudi in order to estimate the impact of inflation on the economy. Hansen (2000) methodology was used to calculate the optimal level for the country. The results of the study revealed that the optimal level for Saudi economy is 3% to 4%. The policy making institutions need to build monetary policy and fiscal policy in line with the above finding in order to get stable growth rate for Saudi economy

and to boost economic activities in the country. The inflation once exceed 4% will produce negative impact for economy. Determination of inflation using similar technique was conducted in Pakistan by Ayyoub et al (2011) in order to analyze the statistics of relationship between inflation rate and economic growth. The time series data from 1972-1010 was used with simple OLS technique and the results of the studies showed that the inflation turns out to be bad for the economy beyond threshold level 7% so the policy should be adopted to keep inflation below 7% in order to keep economy at stable rate and get positive impacts of inflation. To analyze the sectorial growth impact of inflation in case of Pakistan a study was conducted by Chaudhry in 2013. The data was gathered from 1972 to 2010 for three major sectors of the economy that are agriculture, manufacturing and services. The results of the study revealed that the sectorial impact of inflation vary with each sector. As compare to services and agricultural sector, the manufacturing sector is suffering more due to high inflation. In order to avoid the sectorial impact of inflation, it is suggested that the inflation should be kept within single digit in order to keep positive impacts of inflation on growth for all three major sectors of the economy. It was also suggested by the study that very low level of inflation is also damaging for the economy particularly agriculture and services sector.

Another study was conducted in Tanzania using data set of 1990-2011 by using co-integration technique by Kasidi and Mwakanemela (2013). The objective of the study was to see whether inflation is negatively affecting the economic growth of country or not. The correlation coefficient and co-integration technique was used to test the responsiveness of GDP towards inflation. The results of the study revealed that the inflation has negative impact on the economic growth of country. The government should keep the inflation rates at lowest level in order to avail the opportunity of accelerating economic growth. The study also revealed that there is no long run

relationship between inflation and economic growth in case of Tanzania. Danladi et al (2013) attempted to calculate the threshold level for inflation in case of West African sub – region. The set of selected countries include Burkina, Faso, Ghana, Nigeria and Senegal for period 1980-2009. The findings of the study revealed that the threshold level for selected set of countries id 9%, beyond that the inflation is negatively impacting the growth of economy. In order to have a stable economic growth in West Africa, the government needs to keep a low and stable inflation rate in order to attain suitability and growth in the region.

Vinayagathasan (2013) tried to investigate the above relationship of inflation and economic growth in the selected set of Asian economies. The study has used dynamic panel threshold growth regression keeping in view the fixed effect and endogeneity issues. The results of study found a negative relationship between inflation and economic growth for selected set of 32 Asian countries for the period of 1980-2009. The threshold level found by study was 5.4%. the existence of positive relationship below given level is not evident from the study which show that below that point inflation is indifferent for the economy. Similar kind of study was done to analyze the impact of inflation and growth in three EAC member states found that threshold level for selected set is 8.5% beyond that inflation has negative impact on the economy. Estimating the threshold level for individual countries that study indicate that the optimal levels of inflation for Kenya, Tanzania and Uganda are 6.77 percent, 8.80 percent and 8.41 percent, respectively, beyond which inflation starts exerting cost on economic growth. Yabu and Kessy (2015) caring out this study suggested that countries need to keep the inflation within one digit in order to keep its negative impacts away from the economy and get economy on a stable track. The data set used for the study was from 1970-2013 and non-linear quadratic model was used to estimate the turning point for inflation beyond that, inflation turn out to be negative for the economy. Investment is another tool which

can be used to accelerate economic growth in the economy. Investment helps to minimize the negative impact of inflation on growth beyond threshold level. Another study was done by Iqbal and Nawaz (2010) in order to analyze the similar threshold level of inflation in case of Pakistan. The threshold level of Pakistan is found to be 7% beyond that inflation turn to be negative for the economy. Although the evidence of positive relationship below 7% is not found but still the policy institutions need to keep inflation below threshold level in order to avoid the negative impacts of inflation beyond that level. The data set used was from 1961-2008.

Similar study was used to analyze the impact of inflation on economic growth in case of Bangladesh using data set from 1976-2012. Granger causality test along with quadratic regression equation was used to estimate the relationship. The analysis validates the existence of nonlinearity in the model with the threshold level of 7-8% found by Younus (2015). The inflation is very hot topic and major issues faced by many Asian countries. Keeping this fact in mind, another study was done on ASEAN countries with set of 5 countries for the period of 1980-2011. Thanh (2015) used Panel Smooth Transition Regression (PSTR) along with GMM-IV specification for robustness check found that the non-linearity exist between inflation and economic growth and the threshold level found to be 7.84% for selected set of ASEAN countries. The monetary policy should keep this founding in light in order to keep economy on smooth track. Asian mainly comprises of developing countries and Pakistan is one of them. Pakistan monetary policy institutions should keep the inflation threshold level in mind, in order to keep economy on smooth track. To fulfill the objective a study was conducted by SBP official named Mubarik (2005) who estimated the threshold level of inflation in case of Pakistan which turns out to be 9%. The robustness of the model was done by conducting sensitivity analysis also validate the above results.

Another paper used data of 140 developing and industrialized countries for the period 1960-98 suggests the existence of a threshold level beyond which inflation exerts a negative effect on growth. The threshold level is lower for industrial than for developing countries Khan and Senhadji (2000). The relationship between GDP growth and inflation has been examined empirically with mixed results. Some studies show that the relationship between GDP growth and inflation is positive while others show a negative relationship between them. Another paper from Bangladesh has examined the relationship between economic growth and inflation with a threshold estimation method. Biswas et al (2016) study based on time series annual data over a sample period from 1977-2015, shows a threshold level of inflation at 6.25 percent implying that inflation higher than that level appears to have affected economic growth negatively. The paper suggests that controlling price above the threshold level is prerequisite of sustainable growth in Bangladesh.

3. METHODOLOGY

In the study we have aimed to find the relationship between the inflation rate and economic growth of the Pakistan whether positive or negative and linear or nonlinear relationship and have to find the threshold level of inflation for economic growth. So we have used following econometrics model for analysis.

$$GDP\ growth\ =\ f(inflation\ rate)$$

$$GDP\ Growth_t\ =\ \beta_0\ +\ \beta_1 INFLATION\ rate_t\ +\ \mu_t \qquad (1)$$

Where, GDP growth and Inflation rate is annual variables of Pakistan, μ_t is the error term of the model. $\beta_0\ and\ \beta_1$ are intercept and slope coefficients of model respectively. Annual time series data has been used for the analysis since 1972 to 2016 from the World Bank indicator (WDI).

To find out the threshold level of inflation we have applied three methods, firstly we have found the optimal threshold level by dummy method, than uses nonlinear regression estimated with FMOLS method, and finally estimated the Threshold regression as explained below. The threshold level of inflation has estimated previously by Mubarik (2005), Iqbal and Nawaz (2010) and Hussain (2005) by following method. We also used the same technique but using only two variable case inflation and economic growth, as adding other variables could intervene in true relationship between inflation and economic growth of the Pakistan. The threshold model with two regimes is given below:

$$GDP = \beta_1 + \beta_2(\text{inf})^*I(inf < \theta_1) + \beta_3(\text{inf})^*I(\theta_1 \leq inf \leq \theta_2) +$$

$$\beta_4(\text{inf})^*I(inf > \theta_2) + \mu_t \qquad \text{-------------------- (2)}$$

Where; β' s are intercept and slop parameters, θ_s are threshold level of inflation, which takes the value of one if the value lie between the brackets and zero otherwise. And μ_t is white noise error term $\mu_t \sim (0, \sigma^2)$. We identified the threshold level by dummy method taking inflation rate from 2.5 to 12% as used by Khan and Senhadji (2001) choosing the threshold level regression having maximum R square, and by Hansen (2000) we have taken the thresholds level which we can expect to exist or from the graph. And tested them through the hypothesis.

The model is developed by Khan and Senhadji (2001) for the analysis of threshold level of inflation for Industrialized and developing countries. Following this work, this study is based on bivariate analysis consisting of economic growth and inflation.

Threshold model with dummy method is given below in eq (3):

$$GDP = \beta_1 + \beta_2 inf + \beta_3 D(inf - k) + \mu_t \qquad \text{-------------------- (3)}$$

Where, GDP= GDP growth rate, INF= Inflation, K = the threshold level of inflation. It is the rate of inflation at which structural break occurs and μ_t= the random error term.

The dummy variable D is defined as:

$$D = \begin{cases} 1 \ if \ \text{inf} > k \\ 0 \ if \ \text{inf} \leq k \end{cases}$$

The K is the threshold level for the inflation to impact the economic growth, the impact of inflation on GDO growth is examined by β_2 coefficient, and when the inflation rate is high it is examined through $\beta_2 + \beta_3$ coefficient. For taking the threshold level we considered the breaks in the inflation data from low to high, (3% to 12.5 %), and examined on the basis of high R square and minimum RSS, residual sum of square.

The model is augmented to include the level of inflation. Since we are interested in checking whether there exists a non-linear impact of inflation on growth, we use a quadratic equation. The above derived theory reveal that there is a critical point that is b' after which the inflation has negative impact on growth which show that the relationship is nonlinear and we have to find out that critical threshold level beyond which the debt become deleterious for economy. So, the basic regression equation that is used to estimate the relationship between inflation and economic growth is therefore the eq (4):

$$Y_{i,t} = \alpha + \beta_1 Inflation_{i,t} + \beta_2 (Inflation_{i,t})^2 + \varepsilon_{i,t} \ \text{------------------} \ (4)$$

Where i is for cross-sections and t is for time dimension.

$Y_{i,t}$ = GDP Growth

$Inflation_{it}$ = CPI Inflation

$\varepsilon_{i,t}$ = error term

By using the following equation, we calculate the threshold level of the inflation. The equation is that the first order condition. The second step is to ensure that the turning point is the maximum point. For this purpose, a second-order condition is used. The optimal point will help us to calculate the threshold level for Pakistan.

$$\frac{dY_{i,t}}{dInflation_{i,t}} = \beta_1 + 2 * \beta_2 Inflation_{i,t} = 0$$

After the brief explanation of the methodology that has been used in the study, the results and discussion section is given below.

4. RESULTS AND DISCUSSION

In this section we will present and discus the analysis of our study. In which we have displayed the results of model estimated by given methodology and methods in previous section. As we have did the bivariate analysis, So that we can check the relationship between GDP growth and inflation rate more rigorously, as by adding other variable their effect could intervene in the model, and our aim is to determine true relationship between these two variables and finding the threshold level of inflation for GDP growth of Pakistan.

In table: 1, below we have describes the data summary of the variables and found that in case of Pakistan since 1972 to 2016 the average GDP growth rate is 4.79% and average inflation is 9.12% that is quite high rate of inflation as in case of Pakistan average GDP growth is not much higher. But we can see that in this time span Pakistan GDP growth also have maximum value in 1980 when it was 10.21% and also economy suffered with the worst GDP growth of 0.81% in 1972. In case of inflation Pakistan encounter high double figure inflation in 1974 about 26.66% and lowest

inflation in 2003 about 2.91%. In the study we have taken annual data since 1972 to 2016 that comprises upon 45 observations.

Table: 1. Descriptive Analysis

	GDP	INF
Mean	4.791405	9.218495
Median	4.719859	7.921084
Maximum	10.21570	26.66303
Minimum	0.813406	2.914135
Std. Dev.	2.120794	5.278541
Sum	215.6132	414.8323
Sum Sq. Dev.	197.9018	1225.972
Observations	45	45

In table: 2, given below the correlation between two variables GDP growth and inflation rate of Pakistan has been checked and found that there in negative correlation between the inflation rate and GDP growth. Which is consistent with many studies and according to the theory. There is also evidence that both variables have no issue of multicollinearity. As the values of correlation is quite low.

Table: 2. Correlation between Variable

	GDP	INF
GDP	1	-0.08267542871666162
INF	-0.08267542871666162	1

After the brief summary of data and correlation analysis we have taken GDP growth that is stationary at level of have order of integration I (0), but in case of inflation rate it is stationary at level at 10% but if we graph the inflation variable still there was volatility in the data. Therefore, it was further smoothed using Hodrick-Prescott filter, so both variables are now stationary and suitable for applying OLS for analysis, to avoid spurious regression.

For finding the relationship between the Inflation rate and GDP growth we regress a static long run model as given in column (1) and (2), Table: 3. In literature there are mixed results of relationship between GDP and inflation, some studies has given positive relationship and some has given negative relationship between inflation and GDP growth. In column (1) the OLS results are given with the intercept, which has showed the negative insignificant impact on inflation rate on the GDP growth of the Pakistan. This might be reason that inflation and GDP has nonlinear relationship. As the one percent increase in the inflation there will be 0.3% decrease in the GDP growth of Pakistan. In case of Pakistan high inflation always caused damaged to the economy as prices goes high the consumer demand will be low and consumption will be decreased and also the cost of production will also increase so the whole economy will have adverse effect so GDP growth will be effected. Results are consistent with the study of Munir et al (2009). The model's R^2 give very small variation in GDP growth cause by Inflation, but there is no hetroscadasticity problem and autocorrelation problem in the model has corrected by using AR term in the model.

The results of nonlinear model are quite consistent with the theory. First it is the positive and is negative which confirm the presence of non-linearity in the model. By putting values in the equation below, the threshold level for Pakistan turned to be 9%. The results are in-line with findings of Mubarik (2005).

Table: 3. GDP Growth and Inflation Rate Model Analysis

Method	OLS	FMOLS
Independent variable	Dependent variable = GDP Growth	
	(1)	(2)
Inflation rate	-0.003	0.02
	(0.96)	(0.00)
Inflation rate^2	-	-0.02
		(0.00)
Intercept	4.77**	-
	(0.00)	
Diagnostics		
F Stat	1.39	-
	(0.25)	
R^2	0.096	0.30
DW	2.11	1.76
AR(p)	AR (1)	-
ARCH Test	0.02	-
	(0.87)	

*, **, ***, denotes significant at 1%, 5% and 10% respectively.

Relationships between GDP and inflation do vary; past studies have witnessed positive or negative relationship between inflation and GDP growth. Inflation and GDP has nonlinear relationship that can be noticed through the table: 4 below. In case of Pakistan, high inflation always caused severe damages to the economy, because due to increase in prices results in low consumer demand with decline trend of consumption and as a result, the cost of production will also increase indicating adverse effect on GDP growth. The threshold level for inflation has estimated through the dummy method that many studies has used previously we have taken the different threshold level (k) from 3% to 12.5% to examine the optimal level of inflation for stable growth rate of the Pakistan, following the study of Bhusal & Silpakar (2011), the best threshold level which gives the minimum RSS; residual sum of square, and maximum R^2, so examining the results given below we have found that the threshold level for inflation in case of Pakistan is 5.5%. This threshold level

has statistically significant impact on the GDP growth. So below threshold level it has no significant impact.

Table: 4. Threshold Model by Dummy Method

K	Inflation rate	D(INF-K)	Intercept	R- Square
Dependent variable = GDP Growth				
3%	-0.03	0.24	4.88*	0.01
	(0.57)	(0.88)	(0.00)	
3.5%	-0.06	1.26	4.25*	0.04
	(0.33)	(0.25)	(0.00)	
5%	0.08	1.15	4.60*	0.04
	(0.27)	(0.22)	(0.00)	
5.5%	-0.11	1.85**	4.4*	0.10 (highest)
	(0.11)	(0.04)	(0.00)	
6%	-0.08	0.99	4.82*	0.03
	(0.27)	(0.26)	(0.00)	
7%	-0.06	0.48	5.04*	0.01
	(0.44)	(0.58)	(0.00)	
8%	-0.02	-0.13	5.07*	0.01
	(0.78)	(0.88)	(0.00)	
10%	0.02	-0.87	4.83*	0.02
	(0.77)	(0.41)	(0.00)	
12.5%	0.11	-2.93**	4.09*	0.09
	(0.23)	(0.05)	(0.00)	

Note: K= Threshold level, *, **, ***, denotes significant at 1%, 5% and 10% respectively.

In the table: 5 below the threshold model has estimated followed by the method used in study of Iqbal and Nawaz (2010), Mubarik (2005) in there study. The model has estimated using the methodology explained before. The threshold level are taken on the basis of Hansen (2000), in which rang of threshold level from 2.5 to 12 ha tested has on the minimum residual sum of square of selected the two threshold level 5.5 and 9, as our dummy method and FMOLS also gives this threshold level for inflation. The null hypothesis has tested against the two threshold level and we

found significant results of having two regime level of inflation rate in Pakistan by estimating the individual regression with one and two threshold level.

Table: 5. GDP Growth and Inflation Rate, Threshold Regression Model

Method	TAR
Independent variable	**Dependent variable = GDP Growth**
	Coefficient (p-values)
Inflation rate<5.5	-1.46[**]
	(0.05)
Inflation rate>=5.5 and <=9	5.42[*]
	(0.00)
Inflation>9	-1.71[**]
	(0.04)
Diagnostics	
R^2	0.13
DW	2.04
AR(p)	AR (1)
ARCH Test	0.11(0.73)

*, **, ***, denotes significant at 1%, 5% and 10% respectively.

In table: 5 above the final results are displayed with two regime. With low, medium and high inflation rate impact on the economic growth of the Pakistan. The results for low inflation rate from inflation < 5.5% suggested that there is negative and significant impact of inflation on the economic growth of Pakistan. And in medium inflation rate from 5.5 to 9% there is positive and significant impact on the economic growth as inflation can boost the economic growth and increase the capital formation and results are consistent with the study of Hussain and Malik (2011). But in case of high inflation rate more than 9% results shows negative and significant impact on the economic growth of the Pakistan, results are also consistent with study of Iqbal and Nawaz (2010) so high inflation rate can cause damage to the economy and need to inflation rate low at single digit.

5. CONCLUSION

Inflation and economic growth relationship is very well known phenomenon which has discussed by the many authors for different countries. Some studies suggested to have low inflation rate to stimulate the economic growth and few has emphasized on the high inflation rate for fast increase in the economic growth due to increase in the capital formation. There is also contradiction between the relationship of inflation and economic growth whether it is linear or non-linear. Many studies like Mubarik (2005), Hussain and Malik (2011) in case of Pakistan and many other international studies like; Bhusal and Silkapar (2011) has calculate the threshold level of inflation at which economic growth can be stimulated. So in this study we have tries to incorporate all above issues by using the different techniques to find the threshold level of inflation in case of Pakistan, by estimating the bivariate analysis as including other variables could change the true relationship between inflation rate and GDP growth of Pakistan.

The study has estimated the bivariate relationship by using the annual data of inflation rate and GDP growth since 1972 to 2016 for Pakistan. Through the OLS results, showed the negative insignificant impact on inflation rate on the GDP growth of the Pakistan that could be the reason of nonlinear relationship between the variables. The results of nonlinear model are quite consistent with the theory estimated by FOLS and the threshold level for Pakistan turned to be 9%. The results are in-line with findings of Mubarik (2005). Through the dummy method we have found that the threshold level for inflation in case of Pakistan is 5.5%. finally, by estimating the TAR model we have found the results for low inflation rate from inflation < 5.5% suggested that there is negative and significant, medium inflation rate from 5.5 to 9% there is positive and significant impact on the economic growth as inflation can boost the economic growth and increase the capital formation and results are consistent with the study of Hussain and Malik (2011). But in case of high inflation

rate more than 9% results shows negative and significant impact on the economic growth of the Pakistan, results are also consistent with study of Iqbal and Nawaz (2010) so high inflation rate can cause damage to the economy and need to inflation rate low at single digit. So all three techniques gives nonlinear relationship among inflation rate and GDP growth of the Pakistan, showing the single digit threshold level. But the TAR model results are more elaborated and brief than other techniques.

The results have few Policey recommendations, our results are inconsistent with the international policies that inflation rate should be minimum or zero, as during the inflation the economic growth can be fasten, due to increase in the capital formation so output will be increased that could stimulate the economic growth in case of Pakistan, so according to results the threshold level for inflation should be between 5.5% to 9% of we can say that for stable economic growth we need to have inflation rate at single digit that could affect positive on economic growth.

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