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TRADE OPENNESS AND ECONOMIC GROWTH: ESTIMATING THE INFLATION THRESHOLD FOR PAKISTAN'S ECONOMY

Abstract

Objective: This paper examines inflation and growth: revisiting the estimation of the threshold level of inflation for Pakistan.
Research Design & Methods: The study uses time series data from 1985 to 2015. It employs the Generalized Least Square (GLS) and Conditional Least Square (CLS) methods with the aim of determining the impact of trade openness on economic growth and estimating the threshold level of inflation for the economy of Pakistan.
Findings: The findings of the study revealed that there is a significant positive impact of trade openness on economic growth because the coefficient of trade openness improved

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from 4.26 before trade liberalization to 4.98 after trade liberalization. Secondly, the threshold level of inflation was estimated at 7% for the Pakistan economy.
Implications/Recommendations: The study therefore recommends, among others, that Pakistan should liberalize its economy through a decrease in taxes on international trade as a percentage of tax revenue. Secondly, policymakers and the state bank should try to keep inflation below or at 7% for the good health of the economy.
Contribution: It was observed that trade openness had a significant impact on the economic growth of Pakistan ($R_{(2;\ 11)} = 4.98$, $p < 0.05$) accounting for 77.6% of its variance (Adj. $R^2 = 0.776$). Invariably, trade openness significantly contributed to Pakistan's economic growth between 2002 and 2015. However, it is evident that after trade liberalization the coefficient of trade openness significantly improved from 4.26 between 1987 and 2001 to 4.98 between 2002 and 2015. This implies that trade liberalization significantly and positively affects economic growth in Pakistan ($p < 0.05$). The analysis to assess the impact of trade openness on economic growth was carried out using data before and after the structural break between 2001 and 2015 to capture whether trade liberalization could affect economic growth differently before and after liberalization. The study found that trade openness had a significant positive impact on economic growth because the coefficient of trade openness improved from 4.26 before trade liberalization to 4.98 after trade liberalization. Secondly, the Khan and Senhadji model (2001) for estimating the threshold level of inflation for developed and developing countries was adopted to estimate the threshold level of inflation for the Pakistan economy. The study revealed a threshold level of 7% for the Pakistan economy.

Keywords: inflation and growth, trade openness, economic growth, threshold level of inflation.
JEL Classification: C12, C13, C22, C82, E58, E62.

1. Introduction

The main effort of policymakers and the central bank is to attain and maintain high and sustainable economic growth along with low and stable inflation. But these twin objectives of low inflation and sustainable economic growth for policymakers depend on the relationship between economic growth and inflation and other macroeconomic variables. Trade openness is one of these factors. It plays an important role in promoting economic growth. It helps in the diffusion of technological knowledge, in helping countries to specialize in different sectors, and in the sharing of ideas apart from trade in commodities. The wave of trade liberalization began in Pakistan after 1985, and by 2001 Pakistan was considered an open economy in a study conducted by Wacziarg and Welch (2008). Based on this, we analyze whether trade liberalization has acted as an engine promoting economic growth in Pakistan.

Inflation plays an important role in promoting economic growth beyond trade openness. According to Mankiw and Reis (2007), inflation is a crucial macroeconomic variable, defined as the persistent increase in the general price level throughout the economy over time. It is an index of economic growth, but harmful also when it is high, as it creates uncertainties; as a result, investment and saving are discouraged, and the cost of capital increases.

Empirical studies draw evidence-based conclusions on the relationship between inflation and economic growth, i.e. positive, negative, or no relationship. Most empirical studies conducted before the 1970s revealed a positive impact of inflation on economic growth, and inflation has not been deemed a threat to economic growth due to the modest inflation rate. In comparison, the negative impact of inflation on economic growth was observed in empirical studies conducted after the 1970s due to rising inflation (Sarel 1996). De Gergorio's (1993) and Fischer's (1993) empirical results found a negative impact of inflation on economic growth. This negative impact became a concern for policymakers and researchers. But, over time, researchers and policymakers concluded that moderate and stable inflation helped to promote economic growth, while high inflation restricted it (Mubarik 2005, Singh 2010, Leshoro 2012, Iqbal & Nawaz 2010a). Therefore, it is of interest to note that a low level of inflation, known as the threshold level of inflation, promotes economic growth; above this level, inflation restricts economic growth. In this regard, Khan and Senhadji (2001) carried out studies to estimate the threshold level of inflation for developed and developing countries. The estimated threshold level of inflation ranges from 1–3% for developed countries to 7–11% for developing countries. The present study has used Khan and Senhadji's (2001) methodology to estimate the threshold level of inflation in Pakistan.

Our study is different from other studies conducted in the context of Pakistan in two ways; first, it uses, as the measure of trade openness, taxes on international trade as a percentage of tax revenue, which is the trade restrictions/barriers aspect of trade openness rather than trade volume; and the analysis is carried out before and after trade liberalization. Secondly, the study uses taxes on international trade as a percentage of tax revenue to estimate the threshold level of inflation. Other studies on Pakistan, by contrast, use the trade volume aspect of trade openness such as exports plus imports as a percentage of GDP, exports/GDP ratio, and imports/GDP ratio, etc., which show trade volume rather than trade restrictions/barriers.

The paper has two objectives: first, to analyze the impact of trade openness on economic growth before and after trade liberalization; and second, to estimate the threshold level of inflation for Pakistan using data from 1987 to 2015. In this context, the following questions are posed:

– What is the impact of trade openness on economic growth?

– What is the threshold level of inflation for Pakistan?

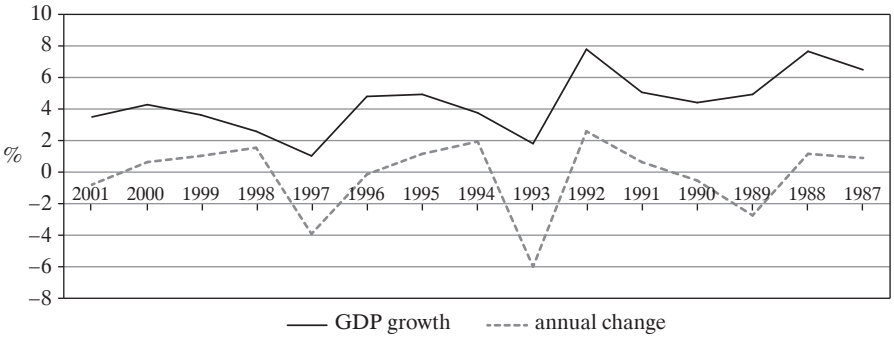

Fig. 1. An Overview of Pakistan GDP Growth Rate from 1987–2001

Source: World Bank, https://www.worldbank.org/en/home.

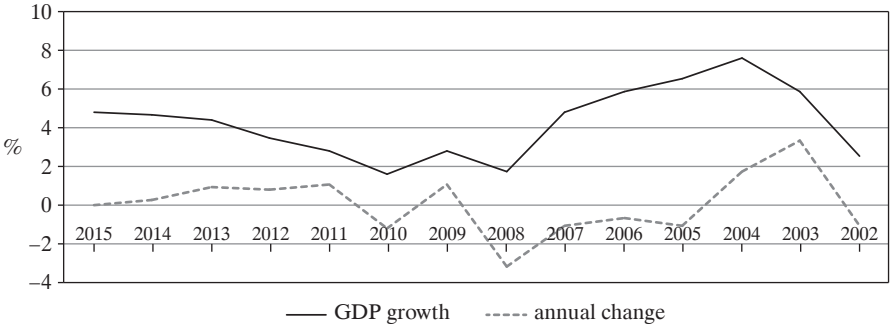

Fig. 2. An Overview of Pakistan GDP Growth Rate from 2002–2015

Source: World Bank, https://www.worldbank.org/en/home.

The remainder of the paper is ordered as follows: section 2 discusses related studies; section 3 deliberates on the methodology used; section 4 analyzes and discusses the findings; and section 5 offers conclusions.

2. Review of Related Studies

2.1. Trade Openness and Economic Growth Nexus

There is a vast body of empirical literature on the relationship between trade openness and economic growth, which reveals both the positive and the negative impacts of trade openness on economic growth.

Ramzan, Asif and Mustafa (2013) scrutinized the impact of trade openness and other macroeconomic variables such as FDI, the employment rate, and the exchange rate on economic growth for the economy of Pakistan. The study measured trade openness as the ratio of total imports plus exports to GDP. The findings showed that trade openness negatively affects the GDP growth rate, while the exchange rate, employment rate, and FDI positively impact economic growth.

Salinas and Aksoy (2006) conducted empirical analyzes for a set of 39 countries. The study's purpose was to analyze the economic growth of those countries before and after trade liberalization, which occurred between 1970 and 2004, to see whether economic growth increased or decreased over the period concerned. The results showed a positive impact of trade liberalization on economic growth as growth increased by 1.2 times after trade liberalization.

Ali and Abdullah (2015) investigated the impact of trade openness on economic growth in Pakistan for the period between 1980 and 2010. The findings showed the negative impacts of trade openness on economic growth in the context of Pakistan's economy for the period concerned.

Bayar (2016) explored the impact of trade openness, measured as exports and imports of goods and services as a percentage of GDP and economic freedom, on economic growth for the transition economies of the European Union between 1996 and 2012. The study's empirical results showed that trade openness and economic freedom positively impacted economic growth in these European Union countries over the period concerned.

Siddiqui and Iqbal (2005) looked at the impact of trade openness on economic growth from 1972 to 2002. Trade openness was proxied as the sum of exports and imports divided by real GDP. The results showed the negative impacts of trade openness on the economic growth of Pakistan.

Javed *et al.* (2012) explored the impact of trade openness, terms of trade, total exports to GDP ratio, and ratio of imports to GDP on economic growth between 1973 and 2010 for the economy of Pakistan. Using the Ordinary Least Square (OLS) method, they examined the relationship between

dependent and independent variables. The results showed the positive impacts of trade openness and of the other independent variables under study.

Wacziarg and Welch (2008) analyzed data from a group of 141 countries. They showed that countries that liberalized their trade experienced an average annual growth rate of 1.5% to 2.0% higher than before liberalization. Secondly, the post-liberalization average trade-to-GDP ratio increased by about 5% points. The countries were considered open based on certain criteria, with Pakistan being considered an open economy in 2001. The results of the study showed that openness significantly affected economic growth based on these criteria after liberalization.

Chatterji, Mohan and Dastidar (2013) researched the connection between trade openness and economic growth from 1970 to 2010 for the Indian economy. They used four measures of trade openness to carry out the analysis. Further in the study, trade volume and barriers were used as proxies for trade openness. The authors concluded that the impact of trade openness on economic growth was positive in the case of trade volume measures, while in the case of trade restrictions it was inconclusive.

Mecran *et al*. (2013) analyzed the impact of trade openness on economic growth for a group of developing countries from 1989 to 2010. The trade openness variable is measured as the rate of external trade, i.e. the ratio of exports and imports, to GDP. The results showed the positive impact of trade openness on economic growth – a 1% increase in trade openness led to an increase in the economic growth rate by 0.27%.

2.2. Inflation and Economic Growth Nexus

Khan and Senhadji (2001) analyzed panel data for both developed and developing countries. The study analyzed data from 1960 to 1998 and investigated the inflation threshold above which economic growth is slowed down by inflation. The analyzed data comprised a group of 140 countries. The authors used Nonlinear Least Square (NLS) econometric techniques to carry out their analysis. They calculated the threshold level separately for developed and developing countries. For developing countries, based on the analyzed data, the estimated inflation threshold point was given in the range of 7% to 11%; and for developed countries, the estimated threshold point of inflation was given in the range of 1% to 3%. The results of the study suggested that these countries should keep inflation in that range to avoid the harmful effects of inflation on the economic growth of these countries.

Lee and Wong (2005) analyzed quarterly data separately for the Taiwanese and Japanese economies. The authors used the approach devised by Tong (1978) and Hansen (1996). They estimated the inflation threshold for Japan and Taiwan. For Taiwan, the inflation threshold was estimated at 7.3%, while for Japan, the first threshold was estimated at 2.5% and the second at 9.7%. Based on the study results, it was suggested that these countries should keep inflation below that level.

Sergii (2009) examined the Commonwealth of Independent States (CIS). The study used data from 2001 to 2008 and estimated the inflation threshold at 9% for CIS countries. Danladi (2013) analyzed four West African countries, including Burkina Faso, Nigeria, Ghana, and Senegal from 1980 to 2009. The study used Khan and Senhadji's (2001) methodology for threshold estimation. The empirical findings revealed that these countries' optimal level of inflation was estimated at 9%. The findings suggested that the Central Banks of these four countries should keep inflation below the target 9% level to avert any damage to economic growth.

Espinoza, Leon and Prasad (2010) used panel data from 1960 to 2007 for a group of 165 countries to approximate the threshold stage of inflation for these countries. For the analysis, the authors used the Smooth Transition Model (STR). The countries were divided into three groups – advanced, emerging, and oil-producing economies. For emerging economies, including Pakistan, the authors estimated the threshold level of inflation, which was 10%. In the case of the advanced economies, the calculated threshold point of inflation was at the low level of 1%. For oil-producing economies, the results of study the were not robust, but suggested that the effect of high inflation is stronger for these economies compared to the others.

Yilmazkuday (2013) analyzed panel data from 1965 to 2004 for a group of 84 countries. The five-year average standard variables for these 84 countries were used. Pakistan was also included in the analysis. The empirical findings of the study revealed that: a) growth is promoted by human capital positively when inflation does not exceed 15%; b) economic growth is promoted by financial development when inflation does not exceed the 10% optimal level of inflation; c) trade yields positive consequences for growth when inflation does not exceed the optimal level of 8%; d) government expenditure exerts negative effects on growth when inflation is below 10%; and e) the impact of the catch-up effect is positive when inflation is below the target optimal level of 12%.

Seleteng, Bittencourt and van Eyden (2013) used panel data from South African Development Community (SADC) countries between 1980 to

2008 to estimate the inflation threshold. The study used the Panel Smooth Transition Regression (PSTR) model and estimated these countries' inflation threshold at 18.9%.

Kremer, Bick, and Nautz (2013) conducted an analysis of panel data for a set of 124 countries consisting of both developed and developing countries. The study analyzed data between 1950 and 2004. The authors estimated 2.5% and 17% inflation thresholds for developed and developing countries, respectively.

Eggoh and Muhammad (2012) investigated 102 countries between 1960 and 2009. The authors used a PSTR model for threshold estimation. They divided the countries into four groups based on income level. For the global sample, the threshold occurred at 12.4%. For subgroups, i.e. lower-middle--income countries, high-income countries, upper-middle-income countries (including Pakistan), and low-income countries, the inflation threshold occurred at 3.4%, 10%, 12%, and 20%, respectively.

Vinayagathasan (2013) analyzed 32 Asian economies from 1980 to 2009. The study used dynamic panel threshold growth regression for threshold estimation. It estimated the inflation threshold at 5.43% for these countries.

Yabu and Kessy (2015) analyzed data from three East African Community (EAC) countries – Kenya, Tanzania, and Uganda. The study estimated 6.8%, 8.8%, and 8.4% inflation thresholds for these countries, respectively.

Singh and Kalirajan (2003) analyzed data for the Indian economy from 1971 to 1998 to estimate the inflation threshold. They used the techniques of Sarel (1996). The authors did not identify any threshold level of inflation for the Indian economy.

Sweidan (2004) examined the economy of Jordan from 1970 to 2000. The study estimated the inflation threshold at 2% for the Jordanian economy. Seleteng (2005) analyzed quarterly data from 1981 to 2000 for the Lesotho economy and the estimated the threshold level of inflation at 10% for the country's economy.

Ahmed and Mortaza (2005) used Khan and Senhadji's (2001) methodology for threshold estimation. They used data from 1981 to 2005 and estimated the inflation threshold at 6% for the economy of Bangladesh. Mehrara (2007) analyzed Iran's annual time series from 1959 to 2004 and estimated the threshold level of inflation to be in the range of 9% to 12%. Munir and Mansur (2009) used Hansen's (2000) methodology for the Malaysian economy from 1970 to 2005 and estimated an inflation threshold of 3.89% for the Malaysian economy.

Singh (2010) analyzed the Indian economy from 1971 to 2009. The study used the specification of Sarel (1996) and Khan and Senhadji (2001), and estimated the inflation threshold at 6%. Salami and Kelikume (2010) used two periods, i.e. 1970 to 2008 and 1980 to 2008. Their study used Khan and Senhadji's (2001) methodology and estimated the inflation threshold at 7% and 8%, respectively, for these two periods. Frimpong and Oteng--Abayie (2010) analyzed data between 1960 and 2008 for Ghana's economy; an estimated inflation threshold of 11% was observed. Hasanov (2011) used data from 2001 to 2009 for the Azerbaijan economy. The study used Khan and Senhadji's (2001) methodology and estimated the inflation threshold at 13%. Bhusal and Silpakar (2011) analyzed Nepal's economy using Khan and Senhadji's (2001) methodology and estimated the inflation threshold at 6%. Mohanty *et al*. (2011) carried out an analysis of the economy of India. The study used Sarel (1996), Khan and Senhadji (2001), and Espinoza, Leon and Prasad's (2010) specifications and estimated inflation in the range of 4% to 5.5% for the Indian economy. Leshoro (2012) analyzed South Africa's economy from 1980 to 2010 and estimated the inflation threshold at 4% for the country. Younas (2013) carried out an analysis of the economy of Bangladesh from 1976 to 2012 and estimated the inflation threshold to be between 7% and 8%.

Cooray (2013) analyzed the economy of Sri Lanka and estimated the threshold level of inflation at 11%. Phiri (2013) analyzed data for the economy of Zambia from 1998 from 2010 and estimated the inflation threshold at 22.5%.

Sehrawat and Giri (2015) used quarterly data from 2004 to 2014 for India. They used Sarel's (1996) and Espinoza, Leon and Prasad's (2010) specifications and, through the PSTR model, estimated the inflation threshold to be 6.75% for India.

Mubarik (2005) used Khan and Senhadji's (2001) methodology for data between 1973 and 2000, and estimated the inflation threshold at 9% for the Pakistan economy. Hussain (2005) analyzed data from 1973 to 2005 for Pakistan and suggested a 4% to 6% inflation threshold for Pakistan. Iqbal and Nawaz (2010b) analyzed annual time series data for Pakistan from 1961 to 2008. The study estimated two threshold levels of inflation for economic growth, the first at 6% and the second at 11% for the economy of Pakistan. Ayoub, Chaudhry and Farooq (2011) used data from 1972 to 2010 to estimate the threshold level of inflation, which was 7% for the economy of Pakistan.

3. Methods and Materials

3.1. Design

To estimate the threshold level of inflation between 1987 and 2015, this study analyzed the association between economic growth and other explanatory variables such as inflation and trade openness. Specifically, the study assessed the threshold phase of inflation for growth in Pakistan's economy. The data was divided into two sub-groups: before and after the structural break. The data collected from 1987 to 2001 and 2002 to 2015 were analyzed separately, and the results before and after trade liberalization were compared.

3.2. Sources of Data

For this study, data was collected from World Development Indicators (WDI), the World Bank, and various editions of the Pakistan economic survey. Time series data on ratio scales were taken for the period from 1987 to 2015. The data was referred for assessment to time series properties tests for robustness.

3.3. Method of Data Analysis

The study used descriptive statistics, which helped explain the econometric analysis and involved the use of mean, median, minimum, maximum, standard deviation, skewness and kurtosis, providing a base for further analysis. The study also used the Generalized Least Square (GLS) and Conditional Least Square (CLS) methods as inferential statistics at a 0.05 level of significance to measure before and after the structural break and estimate the threshold level of inflation.

3.4. Model Specification

Linear Specification

The model in linear form is given in equation 1:

$$GDP = \alpha_0 + \alpha_1(inf_t) + \beta_1(open_t) + \varepsilon_t, \quad (1)$$

where α_0 is the intercept and > 0 and α_1, β_1 symbolize coefficients of independent variables and ε_t represents an error term in equation (1), where: *GDP* represents the economic growth rate, *inf* represents the inflation rate (CPI), and $open_t$ represents trade openness measured as taxes on international trade as a percentage of tax revenue.

When the model in linear form was estimated through OLS, the results were insignificant. For this purpose, when a Chow test was performed for the structural break, the results of the Chow test were significant at a 5% level of significance in 2001.

Chow test for the structural break at observation 2001.

Null hypothesis: There is no structural break.

Alternative hypothesis: There is a structural break.

Test statistic = 2.76101, p-value = 0.0463027.

So the null hypothesis of no structural break is rejected and the alternative hypothesis of structural break is accepted. The data was then divided into two groups and analyzed before and after the structural break.

4. Results

The analyzes were carried out through GLS separately before and after the structural break in 2001.

Table 1. Summary Statistics of Variables CPI, GDP, and Trade Openness, 1987 to 2015

Variable	CPI	GDP	OPEN
Mean	8.6588	4.3514	16.351
Median	8.8379	4.4586	12.979
Minimum	2.5395	1.0144	6.7127
Maximum	20.286	7.7059	30.706
SD	3.9927	1.9120	8.6921
C.V.	0.46112	0.43939	0.53158
Skewness	0.59206	0.16517	0.43976
Ex. kurtosis	0.72381	–0.75700	–1.4470
5% percentile	2.7268	1.3105	6.7228
95% percentile	17.084	7.6866	30.528
Interquartile range	6.1288	2.5098	16.715
Observations	29	29	29

Source: authors' estimation.

Table 1 represents the summary statistics derived from 29 observations between 1987 and 2015. It shows the average values of the data series as mean and median. The mean and median for CPI and GDP are close to one another, which reflects minor symmetry, while the mean and median values for OPEN are not too close, reflecting minor asymmetry. The value of the

standard deviation for GDP is 1.91, which implies less dispersion of values from its mean. The values for CPI and OPEN are 3.99 and 8.69, respectively, which implies more dispersion of values from its mean. The covariance value for all variables is positive, showing that the variables are positively correlated. The value of skewness is given for each variable of the data series. The value of skewness indicates the symmetry and asymmetry of the data set. The symmetric distribution has a value of skewness equal to zero. A glance at the table shows that CPI, GDP, and OPEN are positively skewed, which means that these distributions have a long right tail.

The kurtosis value for each variable is given. In the table, the kurtosis value for the CPI, GDP and OPEN series is less than 3, which means that these series have a flat distribution and are platykurtic. However, from the simple values of kurtosis and skewness, it cannot be easily concluded whether the given data series is normally distributed or not. The last rows present the 5% percentile, 95% percentile, and interquartile range values. This is further illustrated in Figure 3.

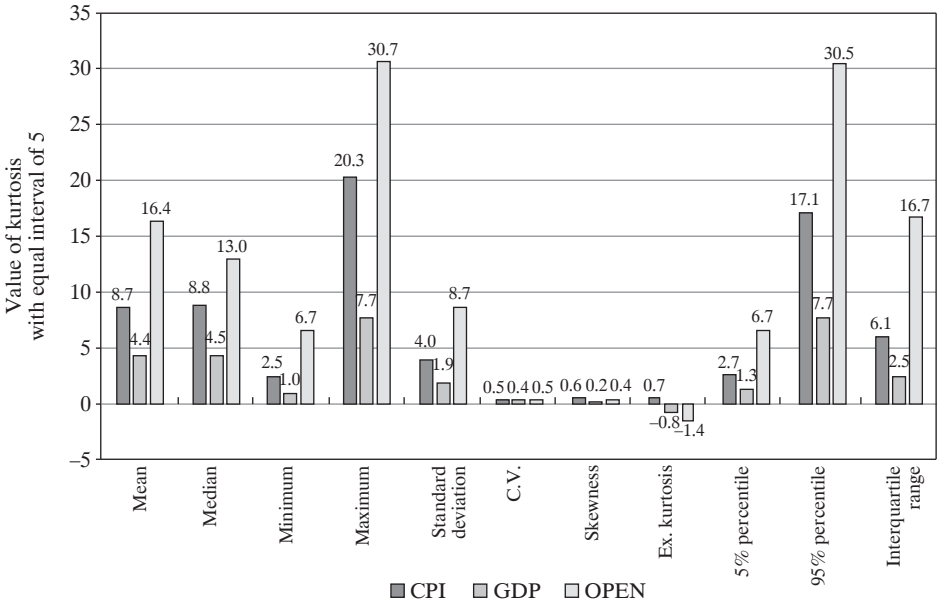

Fig. 3. Summary of Data for CPI, GDP, and Trade Openness

Source: authors' estimation.

Table 2. Heteroskedasticity-corrected, Using Observations 1987–2001 ($T = 15$), Dependent Variable: GDP_

Variable	Coefficient	Std. error	*t*-ratio	*p*-value
Const	–7.27965	1.68225	–4.3273	0.00098***
l_OPEN	4.26434	0.533596	7.9917	<0.00001***
CPI	–0.183993	0.0711885	–2.5846	0.02389**
R-squared	0.845220	–	–	–
Adjusted *R*-squared	0.819423	–	–	–

Statistics Based on the Weighted Data			
Sum squared resid	26.78253	SE of regression	1.493947
R-squared	0.845220	Adjusted *R*-squared	0.819423
F(2, 12)	32.76470	*p*-value (*F*)	0.000014
Log-likelihood	–25.63183	Akaike criterion	57.26365
Schwarz criterion	59.38780	Hannan-Quinn	57.24103
Rho	–0.160026	Durbin-Watson	2.312791
Statistics Based on the Original Data			
Mean dependent var	4.335675	SD dependent var	1.990471
Sum squared resid	37.29628	SE of regression	1.762959

Note: (**) and (***) mean 5% and 10% level of significance respectively.
Source: authors' estimation.

Table 2 shows the impact of trade openness on the economic growth of Pakistan from 1987 to 2001 using GLS. It was observed that trade openness had a significant impact on the economic growth of Pakistan ($R_{(2; 12)} = 4.26$, $p < 0.05$), accounting for 81.9% of its variance (Adj. $R^2 = 0.819$). Invariably, trade openness significantly contributed to the economic growth of Pakistan between 1987 and 2001.

Table 3 shows the impact of trade openness on the economic growth of Pakistan from 2002 to 2015 using GLS. It was observed that trade openness had a significant impact on the economic growth of Pakistan ($R_{(2; 11)} = = 4.98$, $p < 0.05$), accounting for 77.6% of its variance (Adj. $R^2 = 0.776$). Invariably, trade openness significantly contributed to the economic growth of Pakistan between 2002 and 2015. However, it is evident that after trade liberalization the coefficient of trade openness improved significantly from 4.26 between the years 1987 and 2001 to 4.98 between the years 2002 and 2015. This implies that trade liberalization significantly and positively affects economic growth in Pakistan ($p < 0.05$).

Table 3. Heteroskedasticity-corrected, Using Observations 2002–2015 ($T = 14$), Dependent Variable: GDP_

Variable	Coefficient	Std. error	*t*-ratio	*p*-value
Const	–3.77949	2.80104	–1.3493	0.20435
CPI	–0.303167	0.0507247	–5.9767	0.00009***
l_OPEN	4.98279	1.31486	3.7896	0.00300***
Statistics Based on the Weighted Data				
Sum squared resid	28.23264	SE of regression	1.602062	
R-squared	0.810527	Adjusted *R*-squared	0.776078	
F(2, 11)	23.52794	*p*-value (*F*)	0.000106	
Log-likelihood	–24.77509	Akaike criterion	55.55018	
Schwarz criterion	57.46735	Hannan-Quinn	55.37271	
Rho	0.154439	Durbin-Watson	1.489614	
Statistics Based on the Original Data				
Mean dependent var	4.368277	SD dependent var	1.899037	
Sum squared resid	11.24903	SE of regression	1.011256	

Note: (***) means 10% level of significance.

Source: authors' estimation.

Threshold Model Specification and Estimation

Linear equation 1 is presented in its nonlinear form in equation 2:

$$GDP = \alpha_0 + \alpha_1(inf_t) + \alpha_2 \times D_t(inf_t - k) + \beta_1(open_t) + \varepsilon_t. \quad (2)$$

In the above equation (2), D_t is incorporated. It is a dummy variable which shows that:

– $D_t = 1$ in the case when $inf > k$ and

– $D_t = 0$ in the case when $inf \leq k$

and k shows the threshold inflation stage above which inflation yields inimical effects on growth. The parameter k shows that the association between both variables of inflation and growth is given by α_1 when inflation is low and $\alpha_1 + \alpha_2$ when inflation is high. High inflation has significance; here, it means in the case when in the long-run the inflation estimate becomes significant so that both α_1 and α_2 are added up and their combined impacts would be seen on economic growth; as a result, this will be the optimal stage of inflation. In order to identify the inflation threshold stage, different values of k (ranging from 2, 3, 4, and so on) are incorporated in the model for k and

the regression model is estimated through Conditional Least Square for each value of k, and the inflation threshold value is selected from the regression one which maximizes the value of R^2 (Coefficient of Determination) for the estimated regression or minimizes the residual sum of square (RSS).

Table 4. Results of Threshold-level Estimation through Conditional Least Square by Incorporating Different Values of k in the Model

k	Variable	Coefficient	Std. error	t-statistic	p-value	R^2	RSS
3	Const	3.3281	2.05829	1.6169	0.11844	0.139818	88.04635
	l_CPI	–0.73026	0.823041	–0.8873	0.38339		
	l_OPEN	1.21556	0.680005	1.7876	0.08598*		
	Inf_3	–0.763431	1.67035	–0.4570	0.65158		
4	Const	4.09522	2.06685	1.9814	0.05865*	0.195719	82.32447
	l_CPI	–1.93466	0.98984	–1.9545	0.06191*		
	l_OPEN	0.885353	0.680076	1.3018	0.20484		
	Inf_4	2.1534	1.53775	1.4004	0.17369		
5	Const	5.28966	2.21371	2.3895	0.02473**	0.240177	77.77385
	l_CPI	–3.0059	1.28762	–2.3345	0.02790**		
	l_OPEN	1.13392	0.63162	1.7953	0.08471*		
	Inf_5	2.88559	1.53399	1.8811	0.07166*		
6	Const	5.28966	2.21371	2.3895	0.02473**	0.240177	77.77385
	l_CPI	–3.0059	1.28762	–2.3345	0.02790**		
	l_OPEN	1.13392	0.63162	1.7953	0.08471*		
	Inf_6	2.88559	1.53399	1.8811	0.07166*		
7	Const	6.25456	1.99908	3.1287	0.00442***	0.371482	64.33375
	l_CPI	–3.99188	1.16175	–3.4361	0.00207***		
	l_OPEN	1.24826	0.57483	2.1715	0.03959**		
	Inf_7	4.05084	1.31423	3.0823	0.00495***		
8	Const	2.18337	2.55328	0.8551	0.40060	0.145443	87.47056
	l_CPI	–0.419561	1.0841	–0.3870	0.70202		
	l_OPEN	1.27735	0.69326	1.8425	0.07729*		
	Inf_8	–0.703994	1.14987	–0.6122	0.54591		
9	Const	1.44922	2.30384	0.6290	0.53503	0.194768	82.42178
	l_CPI	0.128466	1.0191	0.1261	0.90069		
	l_OPEN	1.25958	0.653346	1.9279	0.06530*		
	Inf_9	–1.45299	1.04611	–1.3890	0.17710		

Table 4 cnt'd

k	Variable	Coefficient	Std. error	*t*-statistic	*p*-value	R^2	RSS
10	Const	1.57354	1.98253	0.7937	0.43484	0.276001	74.10690
	l_CPI	0.395539	0.876476	0.4513	0.65568		
	l_OPEN	0.988175	0.621545	1.5899	0.12443		
	Inf_10	–2.09734	0.942622	–2.2250	0.03534**		
11	Const	1.82188	1.91704	0.9504	0.35103	0.290848	72.58726
	l_CPI	0.441497	0.861498	0.5125	0.61282		
	l_OPEN	0.8487	0.624698	1.3586	0.18641		
	Inf_11	–2.25854	0.956314	–2.3617	0.02629**		
12	Const	2.74903	2.0036	1.3720	0.18224	0.177362	84.20342
	l_CPI	–0.3422	0.850197	–0.4025	0.69074		
	l_OPEN	0.952234	0.682365	1.3955	0.17514		
	Inf_12	–1.30637	1.12045	–1.1659	0.25465		

Note: (***), (**) and (*) mean 5%, 10% and 1% level of significance respectively.
Source: authors' estimation.

Based on estimation using Khan and Senhadji's (2001) methodology, the threshold level of inflation is estimated at 7% for the Pakistan economy, because at that level the coefficient of determination (R^2) is maximized or the residual sum of square is minimized. At that level of inflation, the summation of coefficient exerts maximum positive effect on economic growth, and when inflation rises to 8%, the impact of the summation of the coefficient becomes negative.

5. Conclusions

The objectives of this study were to assess the impact of trade openness on economic growth before and after trade liberalization and to estimate an exact threshold level of inflation for the economy of Pakistan. The analysis was carried out using data before and after the structural break between 2001 and 2015 to capture whether trade liberalization could affect economic growth differently before and after liberalization. The study found that trade openness had a significant positive impact on economic growth because the coefficient of trade openness improved from 4.26 before trade liberalization to 4.98 after trade liberalization. Secondly, the Khan and Senhadji (2001) model for estimating the threshold level of inflation for developed and developing countries was adopted to estimate the threshold level of inflation

for the Pakistan economy. The study revealed a threshold level of 7% for the Pakistan economy. Based on the above results, it was recommended that Pakistan should liberalize its trade by decreasing taxes on international trade as a percentage of tax revenue in order to achieve better economic growth and development. Finally, policymakers and state banks should try to keep inflation below or at the level of 7% to ensure Pakistan's sustainable economic growth and development.

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