

The Impact of Trade Openness on Inflation: Evidence from Six South Asian Countries from 1980 to 2016

*Asst. Prof. Mohammad Nasir Nasrat
Deputy Dean of Economics Faculty, Kandahar University,
M.A. (Economic Governance and Development), OSCE Academy in Bishkek.*

Abstract

In recent four decades, the inflation rate in south Asian countries (Including India, Nepal, Pakistan, Sri Lanka, Bhutan, and Bangladesh) fluctuated between -18.10 and 26 range which has a huge difference with the natural rate of inflation. Meanwhile, the level of trade openness has been rapidly increased in this region. Therefore, this study attempts to examine the impact of trade openness on inflation rate. The study uses a panel data form for the time period 1980 to 2016. In further, the study includes money and quasi-money, exchange rate, gross domestic saving, and domestic credit providing by the financial sector as explanatory variables which almost all have a significant impact on the inflation rate of selected countries. The main objective of this study is to examine the existence of Romer's hypothesis in these countries. For this purpose, Fixed Effects, and Random Effects models have been applied to data, and the results show a significant and positive effect of trade openness on the inflation rate. Therefore, the study suggests to the governments of these countries that the negative effects of openness regarding inflation have to be considered and the policymakers should be aware of the side effects of openness of trade.

Keywords: trade openness, inflation, panel data, south Asian countries, fixed effects, and random effects.

Introduction

Nowadays, all over the world the countries are interconnected and integrated in terms of economic activities, and it is not possible for a country to have an absolute self-sufficient and independent economy. In particular, in today's world, there is no country either developing or developed that can afford to isolate itself from the integration process of the world economy. In fact, economic integration is a process of globalization which in turn refer to free trade and trade openness (Fischer, 2003). Stanley Fischer (2003), defined globalization as the "ongoing process of greater economic interdependence among countries reflected in the increasing amount of cross-border trade in goods and services, the increasing volume of international financial flows and increasing flows of labor" (Fischer, 2003). Moreover, Free Trade Zones (FTZ), Free Trade Agreement (FTA), Banking Institutions, such as IMF and World Bank, and regulating institution (WTO) are the most important features of globalization which in turn positively affected reduction on taxes level, improvement of privatization, and less involvement of government in trade process. However, the openness of trade is not a new phenomenon, but indeed the creation of General Agreement on Tariffs and Trade (GATT, 1947) and the World Trade Organization (WTO, 1995) was extensively stimulated the trade openness process (WTO, 1995).

Obviously, any organization whether regional or international have its pros and cons. Thus, the light side and the benefit of economic liberalization which is the main outcome of WTO is taking advantage of international trade and capital flows. Historically, after

the 1990s, economic integration and openness of the world economy had a distinctive shift, and economic liberalization, globalization, and particularly trade openness became as more important issues for many researchers. In addition, the question that how trade openness affects inflation rate and change in the onwads and the dynamics of inflation in the world level are important topics that have investigated by a large amount of research (Ashra, 2002). Openness to trade is one of the considerable topics of international trade which definitely has effects on various intra-national and international economic factors and also could be affected by many other factors. Import and export are the main elements of international trade, but it is contestable whether a country should support its export along with its import or only should support one of them. In any case, trade openness is closely related to both export and import which is mostly defined as the sum of exports and imports to the percentage of GDP of a country (Semančíková, 2016). It is historically proved that more internationally active countries are more productive than the countries that merely produce goods for their domestic needs and markets. Thus, trade openness can be beneficial in various ways for the overall economy of a country. Nevertheless, the openness of trade and trade liberalization have been criticized in many ways. For instance, on the basis of Protectionist arguments, infant industries will be forced out of the market by large ones. Trade imbalance and economic underdevelopment could be other side effects of trade openness, especially for countries with less competitive power (Hasan, 2010).

As it is earlier mentioned there are plenty of macroeconomic factors that could influence trade openness. Hence, openness – inflation and its relationship is a vitally important topic which has been examined by hundreds of papers. Now, there is a widespread argument among the economists, policymakers, and the public about the question that what the normal rate of inflation for a country is? Generally, a normal level of inflation rate can be defined as a situation that the inflation rate change between the inflation target and inflation objective (Meyer, 2001). Furthermore, some scholars discuss the natural rate of inflation at which the economy of a country can efficiently progress. Employment, economic and social stability, and greater growth of GDP are the most important benefits of a natural rate of inflation. In contrast, in an absence of a natural rate of inflation, its costs will be price fluctuations, wealth reduction, business uncertainty, and consequently negative impact on the overall economic health of a country. Many scholars argued that a moderate rate of inflation, in the 3 – 5 percent range is better and might be useful for smoother economic adjustment and economic development of a country (Labonte, 2011). Although, for many reasons too low or negative rate of inflation is also costly for an economy (Billi & Kahn, n.d.).

In general, south Asian countries have common features which mostly effect macroeconomic policy choices, outcomes, and stability. These factors include high population density, low per capita incomes, a large share of the population in agriculture, saving ratio, and inflation rate (Goyal, n.d.). In recent four decades, the inflation rate for south Asian countries (Including India, Nepal, Pakistan, Sri Lanka, Bhutan, and Bangladesh) fluctuated between -18.10 and 26 range which has a huge difference with the natural rate of inflation. In addition, this minimum and maximum rate also exceed the single-digit approach of the inflation rate. all selected South Asian countries for this study are under the category of low income and lower-middle-income groups, therefore, public people will seriously suffer from a higher inflation rate. Also, if we look at fluctuation of inflation rate in the last four decades it is not an acceptable rate for investors as well. Because in a running inflation rate domestic and as well as foreign investors will not invest. In one hand, the very high inflation rate will hurt investors, and on the other hand, there will be no any privilege and encouragement in case of a very low or negative rate of inflation in these countries. It is obvious, that instability of prices is not just an unfair situation for income groups and investment, but it is also a serious problem for overall economies, trade, and governments of these countries (Annex, 2013). As it is said above, many papers tried to verify the mechanism and the relationship of trade openness and inflation rate. Some papers confirm their results with Romer (1993) which was revealed that there is a strong and robust negative relation between openness and inflation rate. On the other hand, many other scholars provide evidence from different countries and discovered that inflation has negative

effects on trade openness which means that by increasing in openness level, the inflation rate will also rise by some percentage (Romer, 1993). In a study Mohammad Reza Lotfalipour et al, they discover a positive correlation between trade openness and inflation which is in contrast with the Romer (1993). The authors also explore that when there is a more open degree of international trade in a country, it will bring a higher inflation rate (Lotfalipour, Montazeri, & Sedighi, 2013). Hence, the results for the investigation of the relationship of openness to inflation are not similar for different countries and group of countries. To put it differently, the types, causes, and periods of inflation are different from one country to other countries. That is why it is considered to be a very complex economic phenomenon that has multiple dimensions. In this regard, the trend of inflation and its relation to trade openness is perceptibly differencing for South Asian countries (Lotfalipour et al., 2013).

The benefits of trade openness are numerous for the economy of a country. A negative relationship between openness and inflation is a very worthy situation for the economy of a country. Because from one hand the economy of the countries will take benefits from trade openness and from other hand, there would be no risk and negative consequences of inflation. But the existing of this relationship is still debatable among economists. As South Asian countries are developing countries and those members of WTO which has been provoked the level of openness, therefore, this relationship is yet to be examined. In fact, the high or growing rate of inflation is a common feature of many developing economies, and it has a close correlation with globalization capacity of inflation. Certainly, there will be different reason and factors that influence the inflation rate, but the most important one is the impact of the globalization process. Many scholars attempted to investigate this influence, and provided reasons (Sepehrivand & Azizi, 2016). In response to problems that is said previously, this study proposes to investigate the impact of trade openness on the inflation rate for these countries. In addition, the study also includes some other variables that are highly correlated with inflation, such as, money and quasi-money, exchange rate, gross domestic saving, and domestic credit provided by the financial sector. Moreover, we plan to carry out an all-inclusive investigation into options for these countries that would be very important and considerable for policymakers and the South Asian governments. Regarding selected countries for this research, except Bhutan, all other selected countries are members of the WTO and involve in the process of trade liberalization. Therefore, the paper theoretically and empirically considers numerous peer-reviewed papers on the openness – inflation relationship in order to express their difference with this paper. It should be recalled that before this research there is no any other study by the same characteristics and objectives for south Asian countries. Thus, this study will explore clear results to mitigate some or all of the problems noted above, such as the dark side of trade openness regarding inflation rate and its harmfulness for low

income and middle-income groups and investment. This study is also expected to contribute the policymakers in governments' levels such as the central bank and fiscal authorities in order to devise policies in combating inflation in selected countries. In addition,

the study will demonstrate the way for future studies to advance their study on the topic and include other south Asian countries as well.

Issues and Review of Related Literature

If we look at theoretical and empirical pieces of literature on inflation, it is a controversial economic term to define and its process has been a debatable issue among economists. The clarification of the precise nature of inflation and its relationship with other important macroeconomic variables has still remained an area of the argument for many scholars. Generally, this debate can be divided into two main categories, such as the debate on the inflationary process in the context of a closed economy, and the inflationary process in an open economic system (Thi & Thai, 2017). Monetarists believe that the main cause of an inflationary process is fiscal deficit, in result this fiscal deficit will affect money supply. Additionally, they argue that if the government reduce the rate of growth of base money, the rate of inflation could be brought down. For this purpose, in most cases, it is essential for a government that cutting down the financial needs in order to reduce the inflation rate. In contrast, The Structuralist School argues that in a closed economy system the crucial sources of price rise are structural rigidities. In their opinion, excess demand drives up the price level to the inflationary process. For example, an imbalance growth of sectors, especially a rapid growth of the industrial sector could lead to an excess demand for wages, goods and consequently, it can result in rising in agricultural prices (Ashra, 2002). In brief, on the context of the closed economy, an inflationary process might have two main causes: the fiscal deficit that affects money supply and excess demand while there is an imbalance growth between agricultural and industrial sectors (*Library t., n.d.*).

However, in an open economy, the above-mentioned relationships might experience significant changes and probably weaken the influence of described variables. As it is a multiple dimension economic term, therefore, there are many other ways to define the openness of an economy. For instance, the terms of trade to the percentage of GDP, no barriers on trade, and no barriers to foreign investment also can define the concept of openness of an economy (Ashra, 2002). Definitely, there are many factors within an open economy that could influence domestic price level, but the most important one is the degree of economic integration of the domestic economy with the global economy. In this context, two situations could be possible: those commodities which are sold at lower prices in the domestic economy than international prices. If this is the case, then economic integration could result in increasing pressure on domestic prices. The opposite situation will happen for those commodities, which generally their domestic prices are higher than international prices. Therefore, in a domestic economy, the interaction of overall effect on

prices of different goods and services will affect on the domestic aggregate price level. So, the impact of openness of an economy on the rate of inflation depends on the degree of integration, in terms of various commodities (Ashra, 2002). Typically, the important effects of openness on inflation and other interrelated factors could be lower prices, monopoly prevention, and improvement of investment climate (Drozd, 2011). However, the mentioned points regarding the benefits of openness are not in line with the situation of every country. In some cases, it might have an inverse effect on inflation and price related issue.

In the issue of the relationship between trade openness and inflation, the (Romer, 1993) conducts an extensive research using a cross-country data. The paper intends to test that how the absence of pre-commitment in monetary policy leads to an inefficiently high inflation rate. The paper explains that the models of the inefficiently high rate of inflation predict that the inverse relationship between trade openness and inflation arise in case of absence of pre-commitment of monetary authorities. This paper, presents empirical evidence that there is a statistically significant, and quantitatively large negative relationship between openness and inflation which confirm the prediction of the theory. In addition, the paper demonstrates a robust openness-inflation relationship for the countries which are less politically stable and have dependent central banks. Moreover, it is mentioned that the results for linkage of openness and inflation hold for almost all types of countries, but a small group of countries which includes the most highly developed countries with a low average rate of inflation is an exception from this results (Romer, 1993). Later on, many scholars try to establish a link between inflation and trade openness. (Mário & Cardoso De Mendonça, 2006) using modern panel data techniques and includes 152 countries for the period of 1950-1992. The econometric results of the study support a negative relationship between inflation and openness which is presented by (Romer, 1993). (Mário & Cardoso De Mendonça, 2006) sum up that an increase in openness will reduce the inflation level of the countries.

(Lotfalipour et al., 2013), collect unbalanced panel data from the Middle East and North African (MENA) countries in the period of 1990 – 2010, in order to examine the impact of trade openness on the inflation rate. The result of the paper sum up that the consequences of a more open degree of international trade in a country will be a higher inflation rate which is in contrast to (Romer, 1993). The paper explains that the MENA countries are almost all oil-producing countries and so vulnerable in terms of external factors, such as external oil shocks. To empirically test the

effects of trade openness on the inflation rate of five south Asian and three South East Asian economies (Munir, Hasan, & Muhammad, 2015) estimate a panel data for the period of 1976 to 2010. Basically, the authors attempt to examine the Romer's hypothesis for selected economies. The results of fixed effects and random effects estimation show that there is no relationship between the rate of inflation and trade openness, which is in contradict with the Romer's hypothesis. Moreover, the results of this study are amazingly different from many other papers that have done for South Asian and the Middle East. For instance, the study which is conducted by (Lotfalipour, M. R., Montazeri, S., & Sedighi, 2013) is in contrast with Romer's hypothesis and in the other hand, (Mukhtar, 2015) confirm the Romer's hypothesis but this study support none of them.

Estimating a time series data for Pakistan in the period 1960 – 2007, Tahir Mukhtar (2015) uses time series econometric techniques such as multivariate Counteraction and Vector Error Correction Model (VECM) to examine the Romer's hypothesis in Pakistan. In particular, the empirical findings of the study show that there is a significant negative long-run relationship between inflation rate and trade openness, which confirms the existence of Romer's Hypothesis in Pakistan (Mukhtar, 2012). However, in another study about Pakistan, Sehar Munir and Adiq Kausar Kiani (2011) analyses the relationship between trade openness and the inflation rate, and therefore they collect annual time series data for the period of 1976 to 2010. For this purpose, they apply the Co-integration approach of Johansen (1998), and Johansen and Juselius (1990) (Munir & Kiani, 2011).

Raja Gopal (2007) conducted a research for eleven Latin American countries under the title of "Trade Openness and Inflation in Latin American Countries".

Methodology

The main objective of this research is to estimate the impact of trade openness on the inflation rate in the economy of South Asian countries. Panel data is constructed for the selected south Asian countries. The study plan to use fixed effects or random effects estimation method which are two appropriate estimation methods for panel data. But before that, the study will use the Hausman Test in order to carry out the best option for the data. For all these Econometric methods and techniques, the study will use Stata software to carry out reliable results.

Analysis Procedure

In this study, we have used trade openness, exchange rate, money and quasi-money, gross domestic saving, and domestic credit provided by the financial sector as independent variables which may have a positive or negative impact on inflation. Therefore, to examine the impact of trade openness on inflation in 37 years' time span, the paper empirically tests econometric methods.

The result of the study explores a robust relationship between trade openness and the general price level as an indicator of inflation. This result has a similarity with the studies that conducted in Asian countries. Christopher Bowdler and Luca Nunziata (2006) studied trade openness and inflation episodes in the OECD, using data from 19 OECD countries for the period 1961–93. In this paper, binary variables indicate one in years during which inflation starts occurred and zero for the period which inflation is stable or declining during that years. By using dummy variable, the study tried to specify the effect of openness on inflation regarding different time. The paper summarizes that there is a negative link between trade openness and the probability of a large upturn in inflation which is empirically supported by a range of Probit regressions fitted using OECD data (Bowdler & Nunziata, 2006).

Overall, regarding the relationship of trade openness and inflation, there are three types of results: the first category are the studies that have supported the (Romer, 1993) hypothesis which was the foremost study in this regard and propose that there is a negative relationship between trade openness and inflation. But in the other hand numerous studies such as (Mohammad Reza Lotfalipour, 2013), (Munir & Kiani, 2011), (Sepehrivand & Azizi, 2016), provided a positive relationship between openness and inflation. However, there are also studies such as (Munir et al., 2015) that found out no relationship between openness and inflation. These results created a debate both in empirically and theoretically context and therefore, lead the relationship of openness and inflation to remain as a contestable topic. It should be recalled that there are plenty of studies about south Asian countries that scrutinized this topic, but none of them has the same characteristics and objectives as the present paper.

This study empirically tests the existence of Romer's Hypothesis:

H₀: There is no relationship between trade openness and inflation.

H₁: There is a relationship (negative/ positive) between Trade openness and Inflation.

The Variables and Econometric Model

Model

In this paper, a multi-variable equation has been used to estimate the impact of trade openness, exchange rate, gross domestic saving, money and quasi-money, and domestic credit provided by financial sector on inflation rate for south Asian countries. I have borrowed the model from a study by Mohammad Reza Lotfalipour, et al. (2013) which have used for the Middle East and North African countries. I modified the mentioned model for South Asian countries by adding four other variables as explanatory variables in their model. Thus, the new form of the model is as below:

$$\text{Inf}_{it} = \alpha + \mu_i + \beta_1 \text{open}_{it} + \beta_2 \text{Monquasi}_{it} + \beta_3 \text{Exchr}_{it} + \beta_4 \text{Grodomsav}_{it} + \beta_5 \text{Domcredit}_{it} + U_{it}$$

i: 1, 2,... N (6)

t :1, 2,...T (37)

α: intercept

μ_i: country – specific

U: stand for the stochastic error term

In the above equation:

Inf: inflation rate

Open: trade openness

Monquasi: money and quasi-money

Exchr_{it}: exchange rate

Grodomsav: gross domestic saving

Domcredit: domestic credit provided by the financial sector

Variables Description

The variables which included in the model are extensive economic phenomena, but here we will briefly explain them in below table:

Table 1: Summary of the Variables

Code	Variable	Formula	Units/ measure	Source
Inf	Inflation	$CPI_L = \frac{\sum_i P_{it} Q_{i0}}{\sum_i P_{i0} Q_{i0}}$ Where: P _{i0} is the price of item i at time 0 (the base period) P _{it} is the price of item i at time t Q _{i0} is the quantity consumed of item i at time 0	Consumer prices (annual %)	WDI
Toppen	Trade openness	Exports + Imports ÷ GDP	% of GDP	WDI
Monq	Money and quasi-money	currency outside banks + demand deposits + savings + foreign currency deposits of resident sectors (M2)	% of GDP	WDI
Exchr _{it}	Exchange rate	National Currency per US Dollar, Period Average	Calculated as unit	IFS of IMF
Grodomsav	Gross domestic saving	Grodomsav = GDP – final consumption,	% of GDP	WDI
Domcredit	Domestic credit provided by the financial sector	Sum of provided credit by the financial sector	% of GDP	WDI

Estimation Methods and Techniques

Correlation Tests

In econometrics, the correlation is used to determine the degree of association between variables. In other words, correlation is another way of assessing the relationship of variables which measures the level of correspondence between them. There are a variety of measures and methods of correlation testing; this study has been used the following tests of correlations in order to illustrate the extent of correspondence between variables.

Pairwise Correlation Test

Pairwise correlation test allows us to display the correlation matrix or covariance matrix for a group of variables at the same time. Mathematically, the

calculation of the correlation coefficient is as follow (Kurihara, 2013):

$$r = \frac{\Sigma(X-X)(Y-Y)}{\sqrt{\Sigma(X-X)^2(Y-Y)^2}} \quad \text{OR} \quad r = \frac{\Sigma xy - n \bar{x} \bar{y}}{(n-1)SD(x)SD(y)}$$

X: represent the values of the independent variable

Y: represent the values of the dependent variable

The pairwise correlation test also provides significance of the association which mathematically can be shown as below:

$$t = r \sqrt{\frac{n-2}{1-r^2}}$$

Where:

T: it represents the statistical value of t
 R: correlation coefficient
 n-2: represents (n) minus two degrees of freedom

Variance Inflation Factor (VIF)

The Variance Inflation Factor (VIF) is a measure of the degree of multicollinearity of the independent variables in a regression model (Billi & Kahn, n.d.). Between all other, "one way to estimate multicollinearity is the VIF, which assesses how much the variance of an estimated regression coefficient increases when predictors are correlated." (Akinwande, Dikko, & Samson, 2015). In testing VIF the following situations will occur:

VIF = 1: if no factors are correlated
 $5 < \text{VIF} < 10$: it indicates a high correlation between variables that may be problematic as well.
 $\text{VIF} > 10$: it indicates a high multicollinearity problem which can be assumed that the regression coefficients are poorly estimated.

However, if the VIF is less than 5, then we can run the regression and there is no serious problem of multicollinearity. Therefore, in this study, we expect that the VIF would be less than 5 and it will allow us to run the regression.

Panel Unit Root Tests

In this stage and before going to the estimation methods of the model, we ought to test the stationarity of the data. A stationary process is one whose all its statistical properties such as mean, variance, autocorrelation, etc. do not vary with the time process, and on the other hand, the process whose statistical properties do change is referred to as a non-stationary data. As stationarity test is a precondition and necessary for running co-integration test, in this study, we will use, Levin, Lin, Chui test for testing the unit root and stationarity of data. Moreover, if time series variables appear nonstationary then we have to stationarize them. Because, if the variable is not stationary, spurious regression problems may occur. It means that in this type of regression, however, there may be no relationship between the variables, but the results show a high coefficient and as consequences, the researcher may conclude misconceptions about the relationship between variables (Sepehrivand & Azizi, 2016).

Panel Co-Integration Tests

In general, co-integration shows the existence of a long-run relationship between two or more variables. As in this research, we included 37 years as time span for the selected south Asian countries, therefore, we intend to know about the long run relationship of variables (Sepehrivand & Azizi, 2016). For the purpose of testing the long-run relationship between variables, the important model is panel autoregressive distributed lag model (ARDL) which includes two panel estimators, such as, pooled mean group (PMG) and mean group (MG). The usual practice of MG estimation method is to have N separate regressions and calculating the

coefficient means for the all N group and T number of times, or to pool the data and assume that the slope coefficients and error variances are identical which we called PMG (Wooldridge, 2009). The basic assumptions of the PMG estimator are as follow (Panels, 1998):

1. The error terms are serially uncorrelated and are distributed independently of the regressors, that is, the explanatory variables can be treated as exogenous;
2. There is a long-run relationship between the dependent and explanatory variables;
3. The long-run parameters are the same across countries.

However, the major difference between PMG and MG estimators is that for PMG the long run results remain the same for all countries, companies, or cross-sectional. But error correction terms and short-run results may be changed due to time, policy and whatever. On the other hand, the MG estimation test is not so restricted. It estimates separate regression for each country and calculating the coefficients and unweighted means of the estimated coefficients for the individual country. It allows for all coefficients to vary and be heterogeneous in the long run and short run (Panels, 1998).

Fixed Effects Model

A fixed effects model is a statistical model in which the model parameters are fixed. This is in contrast to the random effects model and mixed model in which all or some of the models' parameters are considered as random variables. In a fixed effects model, the unobserved variables are allowed to have any associations whatever with the observed variables. This model control for the effects of time-invariant variables with time-invariant effects (Williams & Dame, 2018). Therefore, the main purpose of using the fixed effects model is to remove the individual time invariant-effects from the model which create endogeneity problem. The equation for the fixed effects model becomes (Damodar.N.Gujarati, n.d.):

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it}$$

Where:

α_i (i=1... n) is the unknown intercept for each entity (n entity-specific intercepts)

Y_{it} : is the dependent variable (DV) where i = entity and t = time.

X_{it} : represents one independent variable (IV),

β_1 : is the coefficient for that IV,

U_{it} : is the error term

Random Effects Model

Random effects model is used to estimate a panel data, while assumes that there are no fixed effects. In contrast to the fixed effect model, it views individual specific constant terms as randomly distributed across cross-

sectional units. This would be appropriate if we believe that sample cross-sectional units were drawn from a large population. We also use the random effects model for the purpose of having unbiased, consistent and efficient estimation results (Damodar.N.Gujarati).

The main assumption of the random effects model is that the covariance of α_i and X_{it} has to be zero. Not just X_{it} , but if there are other independent variables, all ought to be equal to zero.

$$\text{Cov}(\alpha_i, X_{it}) = 0$$

In short, if someone thinks that there are no omitted variables or the omitted variables are uncorrelated with the explanatory variables, then a random effects model is probably best. Conversely, if we believe that there are omitted variables, and these variables have a correlation with the variables in the model, then fixed effects estimation method may provide a means for controlling for omitted variable bias. However, in practice, there is no need to think about omitted variables and their correlation with the explanatory variables. Instead, using the Hausman test is the best way to choose whether fixed effects or random effects method is appropriate for our model.

Hausman Test

In order to select an appropriate method of estimation between fixed effects and random effects, we intend to apply the Hausman test. Because to select a model for

panel data there must be information about the individual specific components and the exogeneity of the independent variables. So, the Hausman test is the only test which determines whether fixed effects or random effects model is appropriate. This test identifies the presence of endogeneity in the explanatory variables, and we can define the null and alternative hypotheses as below (Sheytanova, 2014).

H₀: The appropriate model is Random effects.

It means that there is no correlation between the error term and the independent variables in the panel data model.

$$\text{Cov}(\alpha_i, x_{it}) = 0$$

H₁: The appropriate model is fixed effects.

The correlation between the error term and the independent variables in the panel data model is statistically significant.

$$\text{Cov}(\alpha_i, x_{it}) \neq 0$$

The Hausman statistic is calculated from the formula (Sheytanova, 2014):

$$H = (\hat{\beta}^{RE} - \hat{\beta}^{FE})' [\text{Var}(\hat{\beta}^{RE}) - \text{Var}(\hat{\beta}^{FE})]^{-1} (\hat{\beta}^{RE} - \hat{\beta}^{FE})$$

Where $\hat{\beta}^{RE}$ and $\hat{\beta}^{FE}$ are the vectors of coefficient estimates for the random and fixed effects model respectively.

Table 2: Summary Statistics for Variables

Variables	1	2	3	4	5	6
	Mean	P50, Median	Minimum	Maximum	Range	CV*
Inflation	8.239814	8.089659	-18.10863	26.14541	44.25404	.5282063
Trade openness	47.71233	42.55311	12.35209	113.5973	101.2452	.4981298
Money and quasi	42.89534	40.98925	14.19689	87	72.80311	.3675516
Exchange rate	69.89986	63.4574	10.20977	202.3533	192.1435	.6474289
Gross domestic savings	17.9964	16.46249	-.5037107	43.59722	44.10093	.5131356
Domestic credit provided by financial sector	40.48377	43.31285	-5.73486	77.91685	83.65171	.4563393
Observations	222					
Countries	6					
Time period	37					

Source: Computed from WDI data via STATA

*coefficient of variation

As shown above, this study consists of six countries for the period of 37 years and the data is strongly balanced. The results show, in the selected time period the inflation rate has been varied between (-18.10863) and (26.14541) that indicate a big range from the minimum to maximum rate of inflation. However, this result is derived from a panel of data for the South Asian region which does not show the range of inflation rate in each country. At the same time comparing the mean value (8.239814) and median (8.089659) of the inflation rate, it shows a close result to a symmetrical situation. In addition, Coefficient of variation of inflation is .5282063 which means the standard deviation approximately includes 52% of the mean. The difference between the lowest and highest value of trade openness and the exchange rate is 101.2452 and 192.1435 respectively and display a huge range between all other variables. Though the coefficient of variation for trade openness is equal to .4981298 and

show less variability in trade openness than the inflation rate, but relatively the standard deviation of exchange rate contains 64.74% of the mean. Moreover, the coefficient of variation of money and quasi-money, gross domestic savings, and domestic credit provided by the financial sector are .3675516, .5131356, and .4563393 respectively. As can be seen in the above table the more difference between the minimum and maximum value demonstrate the more dispersion in the set of the data value.

Multicollinearity Tests

There are a variety of tests to check the collinearity of independent variables. However, among all, we used pairwise correlation method, variance inflation factor, and Spearman correlation test, which we will compare the results of each test in turn.

Pairwise Correlation Method

Table 3: The Results of Pairwise Correlation Test

	Inflation	Openness	Money and quasi-money	Exchange rate	Gross domestic saving	Domestic credit provided by the financial sector
Inflation	1.000					
Openness	0.0572	1.000				
Money and quasi money	-0.1813*	0.1594*	1.000			
Exchange rate	-0.1402*	0.1869*	0.4356*	1.000		
Gross domestic saving	-0.2247*	0.3584*	0.4162*	0.1072	1.000	
Domestic credit provided by financial sector	-0.0106	-0.1777*	0.7197*	0.4535*	0.1759*	1.000
	0.8748	0.0080	0.0000	0.0000	0.0086	

Source: Computed from WDI data via STATA

According to the pairwise correlation test, there is a correlation between inflation and trade openness, but at the same time, it is neither too strong and nor significant. However, as there is too much outlier within the countries and as well as in the data that is

constructed for the all group. Hence, the problem of weak correlation and insignificance between inflation and trade openness is rooted from this point. Though, according to (Rana, 2013) we should eliminate the variables from the model that has a high correlation

(correlation coefficient is greater than 0.8 and 0.9) (Rana, 2015). But in the Pairwise correlation method which its coefficients are equal to the Pearson matrix

method, none of the variables exceed this limit. It means there is not a serious problem of multicollinearity in the model and still, we can estimate it.

Spearman Correlation Test

Table 4: The Results of the Pairwise Correlation Test Vs. Spearman Correlation Test

Spearman correlation test		Pairwise correlation test	
	Inflation		Inflation
Trade openness	0.1006 0.1351	Trade openness	0.0572 0.3967

Source: Computed from WDI data via STATA

The Pairwise correlation evaluates the linear relationship between two continuous variables. While the Spearman correlation method evaluates the monotonic relationship between two continuous or ordinal variables. The results in table 3 showed a weak and insignificant correlation between inflation and trade openness. However, the study examines the correlation between inflation and trade openness via the Spearman correlation test which is based on the ranked values for each variable rather than the raw data. Therefore, its results in the above table show a stronger correlation than the results of the Pearson correlation coefficient. In particular, this test increases the correlation coefficient

from 0.0572 to 0.1006 and decrease p-value from 0.3967 to 0.1351. But still, the coefficient is low and insignificant.

Variance Inflation Factor (VIF)

In contrast to the Pairwise correlation method, according to the variance inflation factor test if the VIF of the variables is more than 10, then there is a serious problem of collinearity. But as Table 5 below shows, in this case, the coefficients are much lesser than 10.

Table 5: The Results of VIF

Variance inflation factor		
Variables	VIF	1/VIF*
Domestic credit provided by the financial sector	2.81	0.355533
Money and quasi-money	2.81	0.356404
Trade openness	1.47	0.678961
Exchange rate	1.42	0.706416
Gross domestic saving	1.38	0.723810
Mean VIF	1.98	

Source: Computed from WDI data via STATA

*VIF is equal to $1/1-R^2$ while $1/VIF$ is the inverse of that.

In the above table, the results of the VIF test is sorted as the greater to the smaller value for the independent variables. The value for both domestic credits provided by the financial sector and money and quasi-money is 2.81 that show a small degree of variance of inflation factor. For the rest of the variables, the results show a

smaller VIF than 1.5 and meanwhile the overall mean of VIF is equal to 2. In consequence, the results of the VIF test shows that the degree of VIF is not very high, even it is smaller than moderate rate, thus, there is an unproblematic correlation between the variables.

Panel Unit Root Tests

Table 6: The Results of Variables Stationarity Test

Variables	1	2	3
	Levin, Lin, Chui test	Probability	Stationarity results
Inflation	-3.8292	0.0001	1(0)
Trade openness	-5.5985	0.0000	1(1)
Money and quasi	-7.1933	0.0000	1(1)
Exchange rate	-6.9957	0.0000	1(1)
Domestic saving	-6.0223	0.0000	1(1)
Domestic credit	-5.8135	0.0000	1(1)

Source: Computed from WDI data via STATA

The panel unit root test results show that the Levin–Lin–Chu t statistic for inflation is -3.8292 which is significant at 1% level, therefore, we reject the null hypothesis and conclude that the inflation is stationary at level 1(0), however all other variables in the model are stationary with a time difference 1(1).

Co-Integration Tests

Table 7 shows the results of PMG model. This regression method delivers information about the long run and short run cointegration of dependent variable with independent variables.

Table 7: The Results of Pooled Mean Group Regression

Variable	PMG					
	Long run			Short run		
	Coef.	Std. err.	Prob.	Coef.	Std. err.	Prob.
Openness	.0933647	.0404993	0.021	-.0264953	.0452172	0.558
Money and quasi money	.0201066	.0606143	0.740	-.5173618	.2222234	0.020
Exchange rate	-.0283542	.011539	0.014	.2191751	.0464471	0.000
Gross domestic saving	-.228883	.0732836	0.002	-.0708489	.1083114	0.513
Domestic credit provided by financial sector	.0214693	.0500438	0.668	.0675059	.1303639	0.605
Error correction term	-.6923356 0.000					

Source: Computed from WDI data via STATA

According to the rules of this model, the coefficient of error correction term (ECT) should be between 0 and -2, and p-value must be significant, as they are in the above table. The result of PMG shows that there is a long run and significant relationship between inflation and trade openness, but in the short run, they are not cointegrated. The results also express a significant long run and short-run relationship between inflation and exchange rate, however, for the gross domestic saving there is a long run relationship but in short period the relationship is not significant. Money and quasi-money shows a short-run impact on the inflation rate while the results of PMG show that there is not a long run relationship. Finally, the results show no relationship of

domestic credit provided by the financial sector with inflation rate for both long run and short run.

However, we still believe that there is a long run relationship between inflation rate and all independent variable in the model. Therefore, later the study will estimate the model based on the fixed effects and random effects models. Moreover, it is important to mention that if we estimate the model for each country, then the long run relationship remains the same as the above table, but the short run relationship may change due to nature of each country, like policy change and etc.

Fixed Effects and Random Effects

Table 8: Results from Fixed Effects and Random Effects (*dependent variable: inflation*)

Variable	Fixed effects			Random effects		
	Coefficient	Std. Error	Prob.	Coefficient	Std. Error	Prob.
Openness	.0841777	.0328437	0.011	.0591498	.0138209	0.000
Money and quasi money	-.1086004	.045824	0.019	-.0976187	.0287562	0.001
Exchange rate	-.0144008	.0088711	0.106	-.0213489	.0071159	0.003
Gross domestic saving	-.1492946	.050179	0.003	-.1167936	.0344509	0.001
Domestic credit provided by financial sector	.0799655	.0396235	0.045	.1049576	.0245709	0.000
Constant	9.338022	1.148706	0.000	.0591498	.0138209	0.000
R ²	0.1387			R ²	0.1646	
F - prob.	0.0000			Prob. > chi2	0.0000	

Source: Computed from WDI data via STATA

In Table 8 the results of the fixed effect model show a significant and positive relationship between trade openness and inflation rate. As can be seen, the results indicate an insignificant relationship between the exchange rate and the dependent variable. However, the rest of the variables show a significant association with the inflation rate. The results of the random effects model show a significant correlation between all

independent variables and inflation. The sign of the coefficients of the variables remained as before but their size changed compare to the results of the fixed effects regression model. However, before the interpretation of the results of the model, we have to decide between these regression methods and choose an appropriate one for our model.

Hausman Test

Table 9: the results of the Hausman test

Test type	Statistic	Probability	Result
Hausman	14.86	0.0110	Fixed effect is appropriate

Source: Computed from WDI data via STATA

The hypothesis of the Hausman test is as below:

Null: the random effects model is appropriate

Alternative: the fixed effects model is appropriate

According to the Hausman test results, χ^2 is equal to 0.0110 and smaller than 0.05 thus, we reject the null hypothesis. So, the alternative hypothesis is preferred in favor of the null hypothesis and consequently for the estimation of the model the fixed effects estimation model is favored in this case.

Overall, there are two approaches to the relationship between inflation and trade openness. The first category explains a negative correlation between inflation and trade openness. One of the most popular studies that confirm the negative relationship of inflation and openness is (Romer 1993). This is not a single study that shows an inverse correlation between trade openness and inflation, there are plenty of literature which confirms the (Romer 1993) hypothesis, such as

(Sachsida 2015), (Mukhtar 2012), (Nunziata 2003), (Turner 2017), and some other which is previously mentioned in review of literature. On the other hand, numerous studies found out a positive relationship between inflation and openness of trade, such as (Mohammad Reza Lotfalipour 2013), (Munir 2011), and (Azizi 2016).

In this study, the results show a positive and significant association between inflation and trade openness. In particular, the coefficient for openness is equal to 0.0841777 which tells us that 1 percent increment in the level of openness in the South Asian region will increase the inflation rate by 0.0841777%. The standard error is 0.0328437 which is smaller than the coefficient and good in this case. Therefore, these results confirm the rejection of (Romer 1993) hypothesis and accept the second category above.

In general, if the demand considers constant, then the money supply would positively impact the rate of

inflation. Many studies found out a significant and positive effect of money and quasi-money on inflation. For instance, (Ashra 2002) and (Strano, 2005) (Strano, n.d.), explain that money growth has a positive effect on the inflation rate. However, in this study, the results show a negative and significant relationship with the inflation rate. The coefficient of money and quasi-money is (-.1086004) and significant at 5 percent level of significance which shows that 1% increment in money and quasi-money brings out approximately 0.1086004% decrease in the inflation rate. There are also several papers that confirm this results, such as (Asaduzzaman Sikdar 2013), (Kiani 2011), and (Ramzan 2013). Moreover, the results for gross domestic saving carries out a negative sign of coefficient and statistically significant with p-value 0.003 at 5 percent level of significance. Specifically, these results indicate that if the gross domestic saving rate as a percentage of GDP increases by 1 percent, then the inflation rate will be decreased by about 0.1492946 percent. The negative sign of the coefficient was expected and meanwhile, the result is economically feasible. This result is supported by studies such as

(Gashe, 2017) and (Abay, 2015). The p-value for domestic credit provided by financial sector is 0.045 that is statistically significant at 5 percent significance level. The sign of the coefficient is positive as it is expected and as well as the result seems economically feasible because by providing more credit there will be more supply of money and consequently the inflation rate will increase by some percentage. Finally, the coefficient of exchange rate carries a negative sign but statistically insignificant at 5 percent level of significance. This is in line with the findings of a study that conducted by (Thurner, 2017). However, the p-value is not very high and still, it could have an impact on the inflation rate.

In essence, the regression results show that the significance level 0.000 is even less than 1%, which tells us that model is a good fit. Moreover, the R squared is 0.1387 which shows that 13.87% changes in the inflation rate of the selected South Asian countries is due to independent variables. In other words, R squared tells us that 13.87% changes are explained by these variables.

Conclusion and Recommendations

This paper empirically examines the impact of trade openness on the rate of inflation in six South Asian countries for the period of 1980 to 2016. Panel data is constructed and to select between fixed effects and random effects estimation methods we used the Hausman test in order to carry out the best option for the data. According to the results of the econometric model, there is a positive and significant relationship between trade openness and inflation rate. In particular, the results of the fixed effects model show that a 1 percent increase in the level of openness will increase the inflation rate by 0.084%. Actually, most of the South Asian countries are importers of goods and services, hence, this might take the influence of imports prices. In addition, the study also includes money and quasi-money, exchange rate, gross domestic saving, and domestic credit providing by the financial sector as explanatory variables which almost all of them have a significant impact on the inflation rate of these countries. Thus, the empirical results of this study suggest to the governments of South Asian countries (Including, India, Nepal, Pakistan, Sri Lanka, Bhutan, and Bangladesh) that should be aware of negative consequences of trade openness regarding increment in

the rate of inflation. Trade openness is important for the purpose of the economic globalization process and economic development of South Asian countries. On the other hand, as inflation is a supersensitive economic issue and a vitally important topic for the governments of these countries. Therefore, the results of this study have important policy implications to policymakers that they should consider the side effects of trade openness on the rate of inflation.

In fact, openness is an issue of international trade and at the same time a related topic to the WTO. Because by getting membership in the WTO a country confirms to be more open in terms of trade than the countries that are not members of this organization. Therefore, future studies can break the time period and examine the impact of trade openness on inflation for a different time such as, before the membership in WTO and after the membership. In addition, there are eight countries in South Asian region, but because of the lack of data we included six of them and excluded Afghanistan and Maldives from the model. It will be better for future studies if include all the countries in the region.

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