Impact of Debt Threshold Level on Real Effective Exchange Rate: A Scenario of Developing Countries

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Abstract

The aim of this study is to analyze the relationship between public debt threshold and real effective exchange rate of developing countries for the period of 2001 to 2016. This study relies on panel threshold regression model which provides the non-linear nexus between variables and suggests threshold effects in the model. The finding shows the non-linear relationship between public debt and real effective exchange rate and found a single threshold effect. Public debt to GDP ratio is used as a threshold variable in the model and suggests a threshold level of 54.486%. The single threshold effect split the observations into two regimes to check the effect of public debt on real effective exchange rate once the public debt reached the threshold level. The finding suggests that public debt has significant negative impact on both regimes of real effective exchange rate. Additionally, a set of explanatory variables are used in the study including terms of trade, net export, net foreign asset, inflation and reserves. The study found significant negative effect of terms of trade, net export, and inflation on real effective exchange rate while net foreign assets and reserve has positive effect on real effective exchange rate.

Keywords: Real effective exchange rate; Public debt; Threshold effects; Panel threshold regression, Developing countries

Introduction

Public debt has traditionally played vital role in developing countries crises; often imparting substantial impact on exchange rate. The developing countries default happens at the much high debt levels that appear to be quite feasible by the typical standard of most other developed countries. During the times of high debt close to threshold, sharp depreciation in exchange rate occurs as debt intolerant, local and international investors flee from country currency and other financial assets, rebalancing their investment portfolios toward less risky and more liquid securities. The objective of this paper is to investigate the public debt and threshold effect on real effective exchange rate.

It is widely accepted that public debt is worldwide phenomenon for both developed and developing countries and most of the countries across world borrow funds for their development, budget deficits or both [1-3]. The stock of public debt can promote investment and growth at a certain level after reaching to close default threshold, debt overhang and monetization of debt begins to weaken investor’s confidence to supply further capital. This may have negative effect on output growth and debt sustainability and in turn put more pressure on exchange rate.

In this paper, the study investigates the nonlinear relationship between public debt and real effective exchange rate of developing countries. Adopting a panel threshold regression approach, to find the threshold effects and a set of explanatory variables includes in the model. Finding of the study suggests that high and low level of public debt has negative effect on real effective exchange rate.

The Nexus between Public debt and Exchange Rate

Several studies are conducted to investigate the relationship between debt and exchange rate by different scholars [4-7]. The finding of these papers revealed the significant negative relationship between debt and exchange rate. While Galstyan and Velic [8], Couharde et al. [9] and Wu et al. [10] have studied debt threshold level and exchange rate of emerging, euro area and OECD countries respectively.

Debt threshold and exchange rate

Galstyan and Velic studied the relationship between public debt threshold and real effective exchange rate of 10 emerging countries over the period of 1990 to 2011 [8]. The study found threshold level at 52% for exchange rate. Likewise, the study revealed that after reaching a large debt close to default threshold, public debt is negative associated with exchange rate as 1% increase in debt leads to exchange rate depreciation by 0.11%.

Wu studied the role of debt threshold level on exchange rate by using the 22 OECD countries for the period of 1994 to 2013. They stated that up to 36.62% of threshold level of public debt has positive and a very minuet effect on the exchange rate using debt ratio as transition variable to evaluate the exchange rate pass-through. After crossing this threshold level, negative relationship is found between debt ratio and exchange rate.

Couharde et al. revealed the effect of public external debt on real effective exchange rate adjustment in 11 Euro areas countries using quarterly data during 2003-Q3 to 2012:Q3 [9]. They stated that debt has significant positive effect on exchange rate at a threshold level of 223% but once it is reached that threshold level, no positive effect is significant after this. But many researchers suggested that magnitude of debt affect and public debt threshold may vary across countries and time [11-14].

But the question is raised for developing countries that most of the

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developing countries rely on public debt to finance their budget deficit therefore debt threshold level is differ for developing countries than those for developed countries. Therefore, it will be of great importance to evaluate the threshold level for developing countries and its magnitude effects on real effective exchange.

Empirical Approach

Panel threshold regression model

Panel threshold regression model are attractive among other regression model as they allow for regression of splitting the observations with threshold values. Hansen proposed a threshold method for estimation of threshold level by likelihood ratio test. Panel Threshold regression model is superior to other model using nonlinear function [15].

The equation of the interest is given below:

\[ y_{it} = \beta_1 I(q_{it} > \gamma) + \beta_2 I(q_{it} \leq \gamma) + \mu_i + \epsilon_{it} \] (1)

Where the data is from the balanced panel with \( y_{it}, q_{it}, x_{it}: 1 \leq i \leq n, 1 \leq t \leq T \). The dependent variable \( y_{it} \) is scalar, the threshold variable \( q_{it} \) is scalar, and the explanatory variable \( x_{it} \) is a \( k \) vector. \( I(.) \) is the indicator function equal to 0 or 1. The error \( \epsilon_{it} \) is assumed to be independent and identically distributed (iid) with mean zero and finite variance.

Estimation

\( q_{it} \) is the threshold parameter that dividing the observation into two regimes (assuming the single threshold model). The regimes are split by differing regression slopes, \( \beta_1 \) and \( \beta_2 \). We now need to know whether the threshold effect is statistically significant. The null hypothesis of threshold effect is represented by the linear constraint \( H_0 = \beta_1 = \beta_2 \). The threshold value is determined by least square estimation proposed by Hansen and value of threshold that minimized the sum of squares residuals. Likelihood ratio test is used for construction of confidence interval of \( \gamma \). Estimation for slope parameter \( \beta_1 \) and \( \beta_2 \) on the sample split for estimation of \( \gamma \).

Data

This study consists the balanced panel data of seven developing countries over the period of 2001 to 2016. Subject to availability of data, all the data are employed annual.

The real effective exchange rate is constructed using consumer price index and nominal effective exchange rate obtained from World Development Indicators. Public debt as a share of GDP is taken from World Economic Outlook. Terms of trade is country export prices to import prices is obtained from UNCTD Database. Net export as share of GDP, inflation and reserve as share of GDP is taken from World Development Indicators.

Panel Result

Stationarity test

The first step before data analysis is to check whether the data are stationary or not to avoid getting bogus results. For this purpose, this study use Levin-Lin-Chu stationary test. Levin-Lin-Chu stationary test is only used when data are strongly balanced [15,16].

- Null hypothesis: Panel data contain unit roots
- Alternative hypothesis: Panel data are stationary.

First of all, we have to check stationery of panel data of different variables. A unit root test is undertaken using Levin Li Chi test. The result presented in Table 1 suggested that all variables are stationary at level.

Fixed effect and random effect model

Panel data can be analyzed by using 2 models, namely by fixed effect model and random effect model. In this study, fixed effects model is used to determine the relationship between real effective exchange rate and public debt. The justification of using fixed effect model is that each country has a distinctive macroeconomic environment of variables that may or may not affect dependent variable. The main assumptions of fixed effect model are predictor variables are correlated with error terms. While, Random effect model suggest difference across countries to be random and the assumption of random effect model are error term are not correlated with independent variables (Table 2).

Hausman test

Hausman test was conducted to select either fixed effect model or random effect model. The test is based on hypothesis as given below,
null hypothesis: Errors are not correlated with regressors. Use Random effect model.

Alternative hypothesis: Errors are correlated with regressors. Use Fixed effect model.

When Prob>chi2 is less than 0.05 use fixed effect model.

Result presented in Table 3 Hausman test indicated the rejection of null hypothesis that fixed effect model is appropriate and consistent.

Panel threshold regression model

This study implies the panel threshold regression model proposed by Hansen to determine the number of threshold and its effect on dependent variable.

Result of Debt threshold and its impact on real effective exchange rate is presented as follows.

Threshold estimator in single threshold model: First of all, we find the threshold number in the model. Null hypothesis \( H_0: \beta_1 = \beta_2 \) (No threshold effect) and alternative hypothesis is \( H_1: \beta_1 \neq \beta_2 \) (threshold effect exist). The result reveals a single threshold model is 54.486% with 95% confidence interval (49.936; 55.8450).

Threshold significance in single threshold model: The significance level of single threshold model with p value is 0.000. The F statistic is 13.09 as larger the critical value at 1% significance level (12.2669). As a result, the null hypothesis is rejected and found non-linear relationship between debt and exchange rate and threshold effect exist.

In the next step, study determines the threshold number in the model with one, two or three thresholds effect.

Estimation of Double threshold model

Threshold significance in Double threshold model: In Tables 4 and 5 to determine the single threshold effect in the model with \( H_2 \): Linear model and \( H_2 \): Single threshold model. The result reveals a high significant p-value suggests single threshold model. In the next step, to find the threshold effect in double threshold model, we re-estimate model with two threshold number in the model with \( H_2 \): Single threshold model and \( H_2 \): Double threshold model. Tables 6 and 7 shows the result of two threshold estimators as 54.49% and 27.26% but double threshold model is not significant as p-values (0.333). The implication of the above result indicated a single threshold in the model. The impact of debt on real effective exchange rate (Single threshold model) was mentioned in Table 8

Explanatory variables and real effective exchange rate: Table 9 indicates the estimation of regression slope in the model shows the effect of Debt in the two regimes as follows:

When Debt ≤ 54.4860, the coefficient value (-0.31165) shows the negative relationship between debt and real effective exchange rate that 1% rise in debt would result decrease in real effective exchange rate by 0.31165%. The results are in line with the wealth effect on debt when at the time of low debt, the wealth of nation increases and encourage spending due to low interest rate and spend more on importing of goods and services resulting deteriorating position in current account balance causes more depreciation of real effective exchange rate.

When Debt > 54.4860, the coefficient value (-0.1436) also indicates the negative relationship between debt and real effective exchange rate that 10% increase by debt leads to real effective exchange rate depreciation by 0.1436%. The results are in line with the wealth effect on debt when at the time of high debt, the wealth of nation decreases, so the agents cut their consumption. This results in decline in current accounts deficits and stabilization of real effective exchange rate.

The model suggests the current debt threshold level for select developing countries is 54.4860 and beyond the threshold level, debt is also significant negative effect on real effective exchange rate.

Explanatory variables: The result in Table 9 shows the estimation result between real effective exchange rate and explanatory variables as terms of trade, net foreign asset, net export, inflation and reserve.

Terms of trade and real effective exchange rate

Terms of trade has negative effect on real effective rate of developing countries with coefficient value (-0.2708) indicates that one percent
increase in deteriorating position of terms of trade will cause 0.2708% depreciation in real effective exchange rate. Deteriorating position in terms of trade shows decrease in the export prices of domestic country or increase in import prices of trading partners would negative effect on real effective exchange rate.

**Net foreign asset and real effective exchange rate**

Net foreign asset position has significant relationship with real effective exchange rate of developing countries. Net foreign asset coefficient (0.4624) value shows positive relationship with real effective exchange rate that ten percent raise in net foreign asset leads to 0.4624% raise in real effective exchange rate. The study reveals that changes in balance of payment causes changes in net foreign asset due to foreign direct investment inflow; attract high interest rate causes improvement in real effective exchange rate of developing countries.

**Net export and real effective exchange rate**

Net export coefficient (-1.005) indicates a significant negative relationship with real effective exchange rate of developing countries. The coefficient value indicates that one percent increase in deficit of net export would result 1.005% real effective exchange rate depreciation. The finding of the study revealed those countries with negative net export balance means high import of goods and service and less export of goods and service leads to negative effect on real effective exchange rate.

**Inflation and real effective exchange rate**

Inflation is significant negative effect on real effective exchange rate with coefficient (-1.029) value shows that one percent increase in inflation due to expansionary monetary policy or money supply would result 1.029% depreciation in real effective exchange rate of developing countries. Finding of the study indicated that a country with expansionary monetary policy would result increase in inflation which will reduce the buying power of consumer and increase the cost of production would result more fluctuation in real effective exchange rate.

**Reserve and real effective exchange rate**

Reserve is positive effect on real effective exchange rate but does not produce significant result in the model. The coefficient (24.155) value indicates that one percent increase in reserve position would result real effective exchange rate appreciation by 24.155%. Large holding of reserve allows a country to borrow funds from different sources for their development. In case of developing countries, they do not have sufficient reserve to finance their needs. These countries are relying on borrow funds for their deficits and trying to hold the stable position of reserve. Due to low reserve position in developing countries, reserve does not produce significant impact on real effective exchange rate for developing countries.

**Conclusion**

This study examines the nonlinear relationship between public debt and real effective exchange rate of seven developing countries by employing the fixed effect panel threshold regression model. In order to find a threshold level, public debt to GDP is used as a threshold variable in model. We find the threshold level of public debt is 54.4860%. The estimation result indicates that public debt threshold is lower and higher than 54.4860% found negative impact on real effective exchange rate. Moreover, the study provides significant relationship in both regimes and entire sample is divided into two regimes suggests a single threshold model but the magnitude of public debt impact on both regimes is not similar. It reveals that public debt has significant potential impact on real effective exchange rate in regime 1 and slightly low the impact in regime 2.

The estimation result explains if the economy is highly dependent on borrow funds beyond its capacity may face serious consequences near the future. Both domestic and external debt borrowing have serious impact on economy due to unproductive use of debt resources. Poor debt management may leads to crowding out effect, debt overhang and monetization of debt etc. and country might bog in debt and high indebtedness become the fate of that country. High indebtedness leads to transform of resources from borrower country to lender country may lose their sovereignty and further faces deteriorating situation in overall economy, decline in economic growth, and increase in current account deficit would result depreciation in real effective exchange rate.

In order to summarize the results of explanatory variables of the study, terms of trade, net export, net foreign asset, inflation found significant relationship with real effective exchange rate while reserve does not produce significant result in the study. Terms of trade, net export and inflation exhibit a negative relationship with real effective exchange rate while net foreign asset and reserve have positive relationship with real effective exchange rate.

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