

Okun's Law in SAARC nations

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ABSTRACT

This study intends to test Okun's Law in SAARC nations and if job creation is associated with economic growth. The sample includes seven SAARC nations – Bangladesh, India, Pakistan, Maldives, Nepal, Bhutan and Sri Lanka. The annual data considered the period in this study is from 1991-2018. This paper uses the ARDL method to test the law for individual country both in the long-run and short-run. This study used the gap model - HP filter and BK filter is used for de-trending the components. CUSUM test is used to check the stability of the estimation. The finding reveals that Okun's law is valid in four SAARC nations out of seven SAARC nations in the short-run – Bangladesh, Bhutan, India and Maldives and therefore job creation is related to output of the nation. Even though the effect of real GDP on the unemployment rate is weak in these nations.

Key words: Okun's law, SAARC nations, ARDL method, HP filter, BK filter.

Introduction

This study focuses on the estimation of the Okun coefficient for the seven SAARC nations using the data real GDP and unemployment rate across the nations. SAARC countries together take up to 3% of the world's area which is around 2million square miles- with a population of more than 1.7billion, that is, 21% of the world's total population, as of 2019. These countries consist of the abundance of skilled and unskilled labors but the economies of these regions have not been able to devise adequate jobs for their emerging population. This inability to create jobs, especially for the young generation in the reason behind the current turmoil in these developing South Asian nations- which is acting as a threat to the region socially, politically and economically.

We know- workers who are employed, produce goods and services and who are not, do not. So, the increase in the unemployment rate has an association with the decrease in economic growth. The inverse association between unemployment rate and economic growth is called the Okun's Law, named after Arthur Okun (he first studied the situation in 1962). Okun's law also states that a rise of the unemployment rate by 1% results is a fall of the real GDP by 3%. Although after the

oil shock in the 1970s, a fall in output was related to the loss of jobs compared to Okun's original estimation.

This study is conducted to answer three main questions: firstly, validation of Okun's law in the seven South Asian nations, individually and if creation of job is related to economic growth; secondly, if the estimations done individually give a similar result with other estimation models and methods; lastly, if the analysis are stable all through the time period considered in the paper- in the short-run as well as the long-run dynamic.

Sample used in this study includes Bangladesh, India, Pakistan, Bhutan, Maldives, Nepal and Sri Lanka. This study consists of annual time series from 1991 to 2018 and because of data unavailability, Afghanistan is not included in this sample. According to Table 1 -which consists of the labor force, participation rate of Labors and the unemployment rate across the different regions of the world- Nepal has the highest rate of labor participation and lowest rate of unemployment, in comparison to the other regions. Pakistan has the lowest labor participation among these seven SAARC nations but has a low rate of unemployment compared to others.

This paper is arranged in the following order: chapter one shows the literature review for this studies which demonstrates the past studies conducted to test the validation of Okun's Law in different regions; chapter two presents the methodology that are used in this paper; chapter three shows the sources and the analysis of the data; chapter four states the findings of the paper; and finally, conclusion is presented in chapter five of the study.

Region/ Country	Labor Force (million)	Participation Rate (%)	Unemployment Rate (%)
Bangladesh	68.37	61.09	12.00
Bhutan	0.37	69.35	9.58
India	509.95	54.25	10.42
Maldives	0.26	67.84	17.29
Nepal	16.27	85.34	2.14
Pakistan	73.91	41.86	6.04
Sri Lanka	8.68	56.80	23.17
Middle Income Countries	2553.08	65.01	13.70
South Asia	691.88	55.75	9.82
East Asia & Pacific	1264.67	74.60	10.07
Middle East & North Africa	151.12	50.81	26.10
World	3456.88	66.95	12.78

Table 1: Labor Market Statistics in seven SAARC nations in comparison to the other regions of the world in 2018

Literature Review

Many previous studies have been conducted to check the validation of Okun's law in different regions with different time period. Estimations and methods varied with each of the studies. Although, one of the most common methods is the gap version which examines the impacts of GDP gap (deviation from the actual GDP and the potential GDP) on the unemployment gap (deviation from the actual unemployment and the potential unemployment). The percentage change between the two gaps is the Okun's coefficient that represents the effect of economic growth and unemployment (Alamro and Al-Dalaien 2014). Hamia (2016) tested Okun's law for the Middle East and North Africa Region and found that the validity of Okun's law is confirmed for six MENA nations – Algeria, Turkey, Jordan, Lebanon, Iran and Egypt, and the estimated coefficients are stable over the chosen period. In addition, the GDP growth is relatively frail to create jobs in the region.

Elshamy(2013) conducted a study in Egypt which shows that both in long-run and short-run, the relationship between the unemployment gap and output gap is statistically significant with a negative sign over the years from 1970-2010. A study done by Alamro and Al-Dalaien (2014) stated that even though Okun's law is valid in Jordan, economic growth does not have a robust effect on the unemployment rate over the period 1980-2011, which contradicts the study done by Hamia (2016). This study shows that a 1% increase in the economic growth of Jordan results in 0.007% decrease in the unemployment rate in the long-run and relatively same in the short-run.

The results are slightly different on studies by Adanu (2005) on Canada and Villaverde and Maza (2007) on Spain. Adanu (2005) investigated on ten Canadian Provinces and this was done for the first time where it stated that the cost of unemployment to the loss in the real GDP, which is basically the Okun coefficient, is greater in the larger and the industrial regions than in the less one's. Whereas in Spain, Villaverde and Maza (2007) show that the Okun coefficient is relatively lower than the ones calculated by Okun (1962) and the other authors. Kitov (2011) investigated in developed countries such as the United States of America, France, United Kingdom, Australia, Canada, and Spain. This study used GDP per capita as a replacement for the real GDP which provided the statistical link between the GDP per capita & unemployment with the coefficient of Okun's law between 0.40 and 0.84 for Australia and the United States of America respectively.

Lee (2000) stated that Okun's law is valid in sixteen OECD countries and Kargi (2014) estimated the Okun coefficient for twenty-three OECD countries, out of which, fourteen of them have validated for long-term co-integration. This study explained that despite the validity of the law, the estimation was not as robust as other's- it reflected some structural changes in Okun's relationship such as smaller output loss increases the unemployment rate. Zanin (2015), on the other hand, estimated the Okun coefficient for different age groups in the OECD countries where it said that the young group of people tends to be more affected by the economic fluctuations than the elderly group of people.

Lal, Muhammad, Jalil and Hussaid (2010) investigated five Asian countries- Pakistan, India, Bangladesh, Srilanka and china- and stated that Okun's law is not valid in some of the mentioned countries because of the asymmetry and political instability and that it may not be applicable for the developing countries. Hanusch (2012) found that in East Asia, the effect of economic growth on unemployment in the short-run has created occupations for the labor force and Okun's law is valid both during the economic contractions and expansions in this region.

A study was done by Prabagar (2015) in Srilanka stated that despite the limitations and flaws, the empirical evidence shows that GDP and unemployment both have long-run and short-run equilibrium relationship.

Most of the pieces of literature above state the negative relationship between economic growth and the unemployment rate. The aim of this paper is to show the validation of Okun's law for seven SAARC countries- Bangladesh, India, Pakistan, Bhutan, Maldives, Nepal and Sri Lanka. The next chapter shows the methodology used to determine the validation of Okun's Law in the seven countries.

Methodology

Generally, the okun's law states that a rise in GDP growth rate decreases the rate of unemployment and creates job in the region. The variables in this paper are the unemployment rate and the real GDP where unemployment rate is the dependent variable and real GDP is the independent variable. Therefore the relationship between unemployment rate and the real GDP is expected to be negative. So we can say that:

$$U_t = b + a Y_t + e \quad (1)$$

Where Y_t is the unemployment rate, b is the intercept, U_t is the real GDP, a is the coefficient which measure the change in Y_t due to the change in U_t and e is the residual.

To test the validation of Okun's law, this study estimates the gap version of Okun's law because this method provides an accurate finding and is suitable for analysis of real data. Gap version was used by a number of literatures as this version shows the deviation between the actual unemployment rate and the potential unemployment rate, as well as the deviation between the actual real GDP and the potential real GDP. This deviation between the actual and potential components captures the cyclical component. Therefore it can be said that:

$$U_t^C = U_t - U_t^T \quad (2)$$

$$Y_t^C = Y_t - Y_t^T \quad (3)$$

Where U_t^C is the cyclical unemployment rate, U_t^T is the potential unemployment rate, Y_t^C is the cyclical output and Y_t^T is the potential output. In this paper, trends in the long-run are U_t^T and Y_t^T and these cyclical and trend components are separated using two different filters: band-pass filter and Hodrick-Prescott filter.

Band-pass filter was proposed by Baxter and king in 1999 to remove the high frequency (cyclical) and slow moving components (trend) by applying a moving average to the series. BK filter separates the cyclical component by:

$$Z_t^C = \sum \alpha_k Z_{t-k} \quad (4)$$

Here, Z_t^C is the cyclical component for the variables in this study. When this filter is applied, the data of first two years and last two years are surrendered.

Hodrick-Prescott filter is also used to extract the cyclical component and the trend component from a time series where this trend component may contain a stochastic trend:

$$X_t = X_t^C + X_t^T \quad (5)$$

Where X_t is the time series that is being observed in the paper, X_t^C is the cyclical component and X_t^T is the trend component. This filter is used to find out the solution where the trend component is optimized using:

$$\min \|\sum_{-\infty}^{\infty} (X_t - \rho_t)^2 - \theta \sum_{-\infty}^{\infty} ((\rho_{t+1} - \rho_t) - (\rho_t - \rho_{t-2}))^2\| \quad (6)$$

where θ is the smoothing parameter, ρ_t is the trend in the long-run.

So the equations above shows that the cyclical component of unemployment rate (U_t^c) shows the difference between the actual unemployment rate (U_t) and the long-run trend component of unemployment rate (U_t^T) and the cyclical component of real GDP (Y_t^c) shows the gap between real GDP (Y_t) and the long-run trend of real GDP (Y_t^T). So, the gap model states that if the actual unemployment rate is higher than potential component, then it can be said that all the resources are not fully utilized and the real GDP is lower than the long-run trend of real GDP. On the other hand, the actual unemployment rate is lower than its trend component in the long-run, then it can be said that all the resources are fully utilized in the production, so it can be said that the real GDP is higher than the long-run trend of real GDP. This can be stated in the following equation that:

$$U_t^c = \gamma + \varphi Y_t^c + \epsilon_t \quad (7)$$

Where, φ is the coefficient that shows the effect of cyclical component of real GDP on the cyclical component of unemployment rate and it is expected to be negative and the variables are negatively related, γ is the intercept and ϵ_t is the residual.

The above equation is used to derive the long-run relationship between the variables. According to Hamia (2016), autoregressive distributed lag model (ARDL) method is used to find out the short-run dynamics for the samples. As we know that the previous estimation does not include the lagged values of the real GDP and the unemployment rate. Whereas, ARDL includes more independent variables. This approach is appropriate for the estimation of co-integrating relationships in smaller samples. The equation below shows the ARDL for the okun's law which includes the gap version as well.

$$U_t^c = \omega + \sum_{i=1}^x \beta_i U_{t-i}^c + \sum_{i=1}^y \mu_i Y_{t-i}^c + \epsilon_t \quad (8)$$

Where, β_i is the coefficient that shows the effect of the lagged values of the unemployment rate (U_{t-i}^c) on the cyclical component of the unemployment rate, μ_i is the coefficient that shows the effect of the lagged values of the real GDP (Y_{t-i}^c) in the cyclical component of the unemployment rate. ARDL can be applied on both stationary and non-stationary variables.

Lastly to test the stability of the values for the estimated coefficients are tested by using CUSUM test. The following chapter shows the data sources and the analysis of the data for the paper. The following chapter demonstrates the analysis and investigations of the data in the paper.

Data Analysis

This paper works with two variables, real GDP and unemployment rate. The annual data from 1991-2018 is collected from World Bank (World Development Indicator) data base, International Labor Organization (ILO) and IMF (World Economic Outlook).

In the methodology chapter, it is said that this paper uses the gap model to estimate the long-run dynamics for the model in equation 1 and 7. This model requires the cyclical components of the variables (unemployment rate and real GDP). To obtain the cyclical components, this paper uses two filters of de-trending – HP filter and BK filter.

To extract the cyclical component using HP filter, the smoothing parameter θ is set to 100, suggested by Backus and Kehoe (1992) as it is appropriate for annual data. While using BK filter, the moving average is set to 2 so that two data at the beginning and two data at the end is surrendered. Both the variables, unemployment rate and the real GDP is taken in percentage (%), so the differences are also in percentage (%).

ARDL method can be used for both stationary and non-stationary variables which means the variables can be both integrated of order 0, $I(0)$ and integrated of order 1, $I(1)$. Although, ARDL method cannot be used if the variables are in integrated of order 2, $I(2)$. To check the existence of integrated of order 2, this paper tends to run the unit root tests – Augmented Dickey-Fuller test (ADF) and Phillips Perron (PP) unit root test.

ADF test and PP test is conducted for all the cyclical components in the model such that cyclical component of unemployment rate from HP and BK – U^c (HP) & U_c (BK), and the cyclical component of the real GDP - Y^c (HP) & Y_c (BK). Unit root test is done for the level model as well as the first difference model. The table 2 below shows the results of the ADF test and the PP unit test on the cyclical components of the dependent and the independent variables.

<i>ADF</i>	<i>PP</i>
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Country	$U^e(HP)$	$U_e(BK)$	$Y^e(HP)$	$Y_e(BK)$	$U^e(HP)$	$U_e(BK)$	$Y^e(HP)$	$Y_e(BK)$
Levels								
Bangladesh	-4.33	-5.27	-3.17	-4.01	-4.30	-5.61	-3.20	-3.95
Bhutan	-3.33	-6.18	-4.42	-4.75	-3.39	-6.39	-4.38	-5.05
India	-2.54	-4.29	-5.18	-5.65	-2.67	-4.25	-5.20	-6.41
Maldives	-2.80	-2.76	-6.93	-6.52	-2.87	-2.52	-8.48	-8.91
Nepal	-2.62	-4.67	-6.47	-5.62	-2.77	-4.67	-7.21	-6.04
Pakistan	-1.99	-3.43	-4.02	-5.37	-2.38	-3.39	-4.01	-5.82
Sri Lanka	-4.18	-7.23	-6.21	-6.27	-4.21	-8.38	-6.28	-8.33
First Differences								
Bangladesh	-6.74	-6.61	-4.61	-4.01	-7.27	-8.02	-4.60	-3.95
Bhutan	-7.99	-8.89	-5.69	-5.42	-7.94	-11.35	-6.24	-6.37
India	-4.96	-6.19	-7.32	-6.69	-4.96	-7.04	-8.54	-9.20
Maldives	-4.91	-4.62	-8.27	-7.38	-4.919	-4.64	-12.09	-11.57
Nepal	-5.22	-6.91	-6.47	-7.41	-5.22	-7.76	-7.21	-9.04
Pakistan	-3.51	-5.26	-7.16	-6.32	-3.51	-5.60	-7.42	-7.93
Sri Lanka	-8.29	-9.53	-8.99	-6.91	-8.98	-15.46	-11.27	-12.41

Table: 2 Augmented Dickey-Fuller (ADF) test and Phillip Perron (PP) unit root test for levels and first difference for the cyclical components of the dependent and independent variables. $U^e(HP)$ and $Y^e(HP)$ shows the cyclical component for unemployment rate and the real GDP, respectively, extracted by Hodrick-Prescott filter. $U_e(BK)$ and $Y_e(BK)$ shows the cyclical component for unemployment rate and real GDP, respectively, obtained from applying Baxter-King band pass filter. The lag order is zero and the level of significance is 5%.

The unit root results shows that the cyclical components for Unemployment rate and real GDP of Bangladesh, Bhutan and Sri Lanka are stationary both in levels model and first difference model when ADF unit root test and PP unit root test are conducted. In case of India, Maldives, Nepal and Pakistan – when PP unit root test is conducted, the cyclical components of unemployment is non-stationary in the levels model. Other than that, all the cyclical components of unemployment rate and real GDP for all seven nations in the first difference model are stationary. Therefore, it can be said that not the series is in integrated order of two, $I(2)$. In the following chapter, results and findings are stated explained.

Findings

This chapter includes the estimations using the formula in equation 8 which shows the short-run dynamics and equation 7 which shows the long-run dynamics for the series of each individual nations the two filters used in this paper- Hodrick-Prescott filter and Baxter-King band pass filter. The lag lengths for each country is determined using the Akaike info criterion and Schwarz Criterion, i.e. the value of the parameters x and y . The estimations shows the validity of the law

in these countries and later the stability of these okun's coefficient is attained using CUSUM test for each country. Table 3 contains the results of the regression of long-run and short-run ARDL coefficients of each country using the two filters used in the paper and to see if there is serial correlation, Durbin-Watson statistics are provided for each nation using both the filters.

The findings demonstrates that Okun's law is valid in four countries in the short-run using both HP filter and BK filter and they are Bangladesh, Bhutan, India and Maldives. Therefore, the cyclical component of unemployment rate depends on the cyclical component of the real GDP and job creation is related to the output in the country for these four nations in the short-run. The result is contradicting to the study of Lal, Muhammad, Jalil and Hussaid (2010) where the author stated that Okun's law is invalid in these countries, probably because of the data used in those study are of different timeframe. Whereas, in Pakistan Okun's law is valid in the short-run when the cyclical component of HP filter is used in the model. Okun's law is invalid in Nepal and Sri Lanka for both HP filter and Bk filter but in Pakistan, Okun's law is valid for only for gap model using HP filter.

Country	Model	(x,y)	ω	β_1	β_2	β_3	β_4	μ_1	μ_2	μ_3	μ_4	φ	R^2	DW	N
Bangladesh	GAP(hp)	(4,1)	-0.000	-0.125	-0.149	-0.182	0.126	-0.177				-0.320	0.55	1.96	23
	GAP(bk)	(4,1)	0.014	-0.913	-0.837	-0.644	-0.222	-0.281				-0.532	0.64	2.17	19
Bhutan	GAP(hp)	(4,1)	0.008	0.204	0.560	0.313	0.310	-0.065				0.013	0.53	2.22	23
	GAP(bk)	(4,1)	0.013	0.765	0.649	0.554	0.641	-0.021				-0.031	0.77	2.21	19
India	GAP(hp)	(3,4)	0.006	0.185	0.145	0.358		-0.027	-0.024	-0.023	-0.014	0.008	0.69	2.65	23
	GAP(bk)	(3,2)	-0.001	0.521	0.249	0.264		-0.017	-0.007			0.009	0.55	2.04	20
Maldives	GAP(hp)	(3,1)	-0.005	0.619	0.011	0.715		-0.001				-0.001	0.51	2.09	24
	GAP(bk)	(4,1)	-0.001	0.841	0.001	0.425	-0.087	-0.002				0.001	0.54	2.15	19
Nepal	GAP(hp)	(4,3)	-0.041	0.614	0.492	0.417	0.127	0.158	0.093	0.085		-0.071	0.52	1.88	23
	GAP(bk)	(4,1)	-0.038	0.776	0.444	0.282	-0.019	0.074				-0.044	0.58	2.20	19
Pakistan	GAP(hp)	(4,4)	-0.002	0.613	0.428	0.485	0.485	-0.029	-0.041	-0.033	-0.018	0.024	0.58	1.90	23
	GAP(bk)	(4,1)	-0.007	0.975	0.643	0.564	0.612	0.005				-0.003	0.66	1.70	19
Sri Lanka	GAP(hp)	(4,4)	-0.033	0.411	0.740	1.174	1.103	0.030	0.017	0.020	-0.002	-0.010	0.73	2.04	23
	GAP(bk)	(4,2)	-0.067	1.095	0.791	0.806	1.320	0.015	0.006			-0.009	0.83	2.24	19

Table: 3 findings of regression of long-run and short-run ARDL, where x,y are the lag values, ω is the intercept, β_1 is the coefficient of cyclical real GDP with 1year lag, β_2 is the coefficient of cyclical real GDP with 2year lag, β_3 the coefficient of cyclical real GDP with 3year lag, β_4 the coefficient of cyclical real GDP with 4year lag, μ_1 the coefficient of cyclical unemployment with 1year lag, μ_2 the coefficient of cyclical unemployment with 2year lag, μ_3 the coefficient of cyclical unemployment with 3year lag, μ_4 the coefficient of cyclical unemployment with 4year lag, φ is the coefficient of cyclical unemployment in the long-run gap model, DW is the Durbin-Watson coefficient and N is the number of observations after adjustments, R^2 shows the coefficient of determination in the short-run.

In the long-run, Okun's law is valid in Bangladesh, Nepal and Sri Lanka for both HP filter and BK filter, which means in the long-run job creation in these nations relates to the output of the nations. For Bhutan and Pakistan, Okun's Law is valid on in the gap model using BK filter. Okun's law is valid in Maldives in long-run for the gap model using HP filter. And lastly, in the long-run, Okun's law is invalid in India.

Even though Okun's law is valid in the above mentioned nations, but the Okun's coefficients are not very strong, which gives a frail estimations for the models chosen in this study. lastly, to test the stability of the valid Okun's coefficient CUSUM test is done for the gap models using HP filter and BK filter. Figure 1 and 2 in the Appendix shows the results of CUSUM test which demonstrates that the coefficients are stable over the time in short-run for Bangladesh, Bhutan, India and Maldives for both HP filter and BK filter and for Pakistan, okun's coefficient is stable in the short-run for HP filter at 5% level of significance.

Conclusion

This paper intends to estimate the Okun's coefficient for the seven SAARC countries- Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Even though the statistics in table 1 shows an average level of unemployment rate in the nations compared to other regions of the world, this paper intends to see that if job creation in these nations is related to the output of these nations- which means if job is created due to the increase in output in the nation. Therefore, to say in a few words, this paper investigates if Okun's law is valid in these nations individually. This paper used secondary data from World Bank and IMF with the time frame 1991-2018 annual data. Hodrick-Prescott filter and Baxter-king band pass filter is used to detrend the components and form gap model. ARDL method to estimate the coefficients for each nations individually. This also shows if the okun's coefficients are weak or strong for the estimations.

As many studies stated that because of the political instability and asymmetry, Okun's law is invalid in these regions, this study demonstrates that Okun's law is valid in four counties in the short-run – Bangladesh, Bhutan, India and Maldives- using all the models considered in the paper. Okun's law is Pakistan but not for all the estimating models in the paper. As for the long-run, okun's law is valid in Bangladesh, Nepal and Sri Lanka. CUSUM test shows that in short-run, Okun's coefficients for all four nations is stable and therefore job creation is related to the

output of the nation in the short-run even though the coefficients are not strong enough, therefore the effect of real GDP on unemployment is frail.

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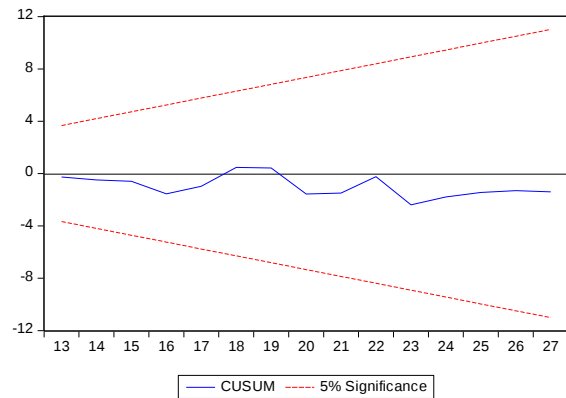
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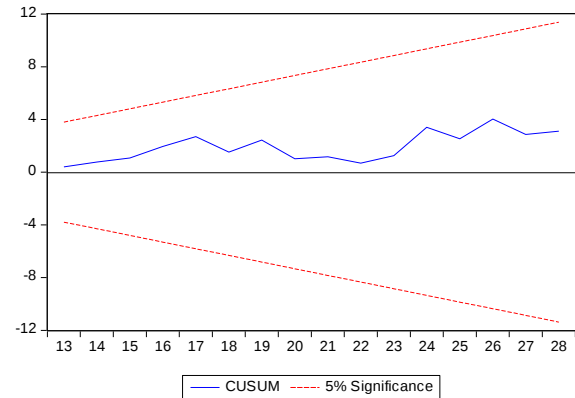
Appendix

Figure 1: CUSUM test results on the nations (Gap model using Hodrick-Prescott Filter)

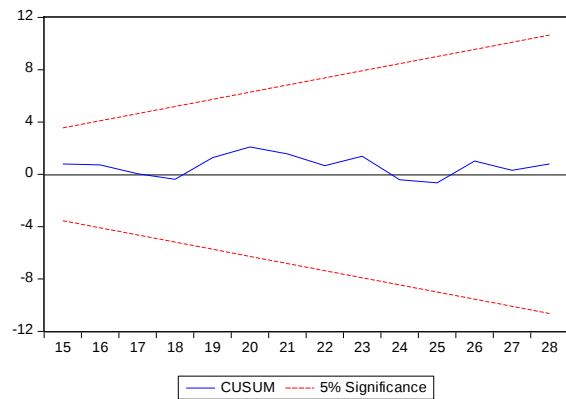
Bangladesh



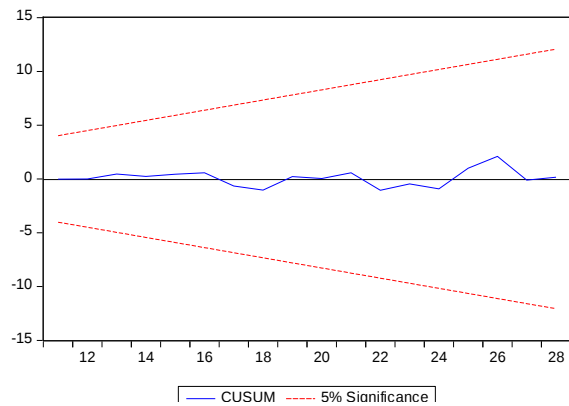
Bhutan



India



Maldives



Pakistan

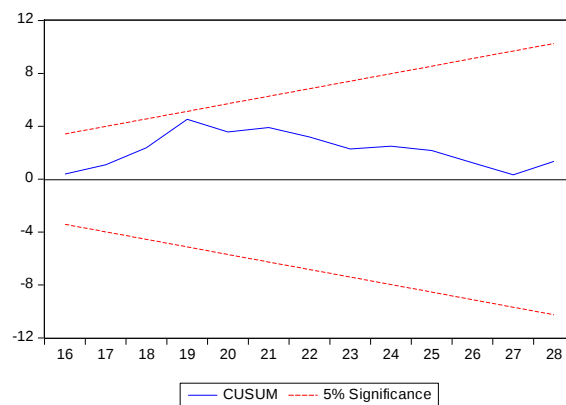
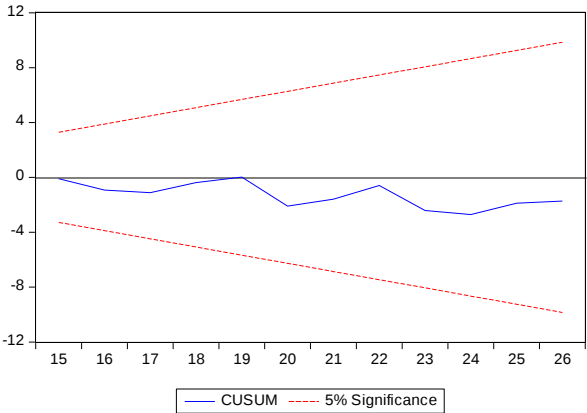
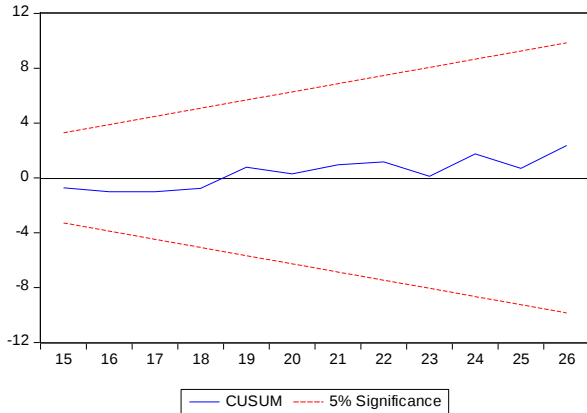


Figure 2: CUSUM test results on the nations (Gap model using Baxter-King Filter)

Bangladesh



Bhutan



India
Maldives

