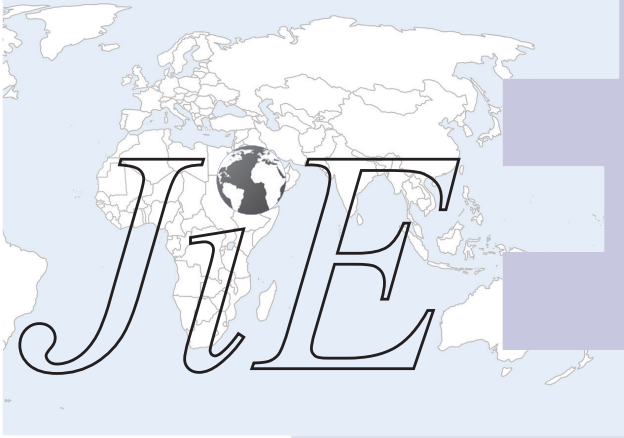

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Contents

From the Editor's Desk...

The year 2021 has bought with it fresh hopes and renewed vigor. Some of the countries, more so, the west European countries are still grappling with the deadly virus. Joe Biden becoming the president is one of the significant developments. It is expected that with Joe Biden taking over the reins, globalization, which under Donald Trump's regime had taken a back seat, will now get a fresh lease of life, which matters immensely to countries world over. Will free trade a get boost under the regime of Biden? How will the relations between US and China pan out? As the days and months pass by we will get answers to these questions. India would watch these developments very closely.

Farmer's agitation in India caught international attention. Justin Trudeau, the Prime Minister of Canada made some adverse comments on it, which was vehemently criticized by the Indian government. Comments made by the climate activist, Greta Thunberg, further made matters worse. Indian Government on its part has made it clear that it is ready to discuss the farm laws clause by clause with farmers. The reforms in the farm sector are long pending. It is still not clear why such a reformative measure, that would free the farmers from the clutches of middle men and give them a chance, to sell the produce anywhere, should receive this kind of response from farmers.

The 'Atmanirbharta' policy, of government, meaning, self-reliance, also is being debated. Critics argue that under the grab of self-reliance India is pushing protectionism. Government defended it by saying that such a policy has been necessitated, to reduce dependence on Chinese supply chains for electronic parts, active pharmaceutical ingredients. Vaccination drive in India has also begun very well. How effective are the vaccines? The judgement is reserved.

The present issue of journal consists of five articles, focusing on issues such as, regional integration, India's current account deficit, stock market volatility in BRICS countries. We would request our readers to continue to contribute articles and reviews of books that focus on issues pertaining to international economics.

Dr Rajesh G

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Analysis of the Sustainability of India's Current Account Deficit#

Ramakrishnan R*
G Raghavender Raju*
Gopakumar K U*

Abstract

Many economies, along their path towards development import more than they export which leads to an increase in Current Account Deficit (CAD). With respect to India, most of the times our current account has remained in deficit which, reflects its developing nature. So, it becomes a more pressing concern for India to find that level of CAD that helps to fund its developments and boost economic growth and at the same time does not pose a threat to the economy. That level of CAD beyond which it has an adverse effect on the economic growth is referred as the threshold level of CAD. This study deals with the issues relating to sustainability of India's CAD for the period 1971-2018. The results conclude that the threshold levels of CAD were 2.1% and 3.4% of GDP, for the pre and post reform periods respectively. After arriving at the threshold level, we determine the probability of crisis due to CAD, using the probit regression for the period 1971-2018. The threshold level of CAD is fixed at 2% for this study as it is the threshold level widely accepted in the academia. The variables chosen for the study include Net External Liabilities to GDP ratio (NELY), Short term liabilities to external liabilities ratio (STLEL) and Import cover (IC). All the variables turned out to be significant and the relationships concur well with the theory. In order to assess the sustainability of CAD, cointegration between exports and imports is carried out using Engle-Granger methodology. Results confirm the existence of cointegration between exports and imports in the long run.

Keywords: Econometric Modelling, India's Current Account Deficit, Sustainability

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Introduction

Rising oil prices, ever increasing imports of gold, inelastic Indian oil imports, depreciating Indian currency, slowdown of the economic growth, rise in inflation, rising Current Account Deficits (CAD) are the developments with regards to India's external sector. A few of economies are defaulting on their payments and plunging into crisis due to the widening of CAD. If deficits are increasing in the economy, then the financing of those shortfalls has to be done by borrowing in huge amounts from the international capital markets which will again put a huge risk on the country's ability to repay. This will further increase the deficit and this will create an additional burden on the functioning of the economy which will escort the economy into a crisis. This makes the CAD a hot topic in the macroeconomic arena and a big headache for the policymakers to keep it under check for the stability of the macro economy and ensuring overall welfare of the economy.

Importance of Sustainability of Current Account Deficits

Current account deficits play a very pivotal role in determining the health status of an economy with respect to its external sector management. These deficits arise due to the prolonged increase in imports and a stagnation in exports be it goods or services. As a country grows, it needs to borrow more in order to fund its developmental activities which will inexorably push a developing economy into current account deficit. Since too much of anything is bad, too much CAD is also very bad. So, in order to strike balance between too much deficit and too low a deficit, we need to find the optimum or threshold level of CAD beyond which it will have an adverse impact on GDP. To ensure that the CAD is sustainable and that the country's solvency condition is met, with regard to its external debt, is a pivotal issue and a daunting task for many an economy.

These issues play a very vital role in determining the soundness of the whole financial and economic system of the country and it takes precedence and priority over various other issues in the policies and formulations which the government or a central bank makes, like policies for strengthening the macroeconomic and financial system, external sector policies etc., CADs in the very short term are transient and ephemeral in nature since these signify and depict the optimum allocation of various resources of capital throughout the world in the places which are most profitable and fruitful. Since these resources are anyway invested in profitable places, such CADs in the short term doesn't scare or intimidate an economy with a possible meltdown. What scares or intimidates more is about the unrelenting and incessant nature of the CADs in various economies. I mean to say, when an economy borrows from the international financial markets it gets encouraged and motivated to borrow more due to high credibility score which they exhibited earlier.

But this continuous spree of borrowing puts a high risk on the repayment and future borrowing capacity of the economy which in turn plunges the economy into a crisis. Most of these crises which occur throughout the globe cannot be imputed to the short run deficits in the current account but must be imputed to the enormous amassment of deficits which continue relentlessly without exercising any caution on the economy's part. Any country with enormous capacity of foreign exchange reserves will not necessarily borrow huge amounts from international capital markets to fund their deficits and garrison their economy from an external sector or exchange rate crisis since the huge amounts of forex reserves portray an economy's capability to withstand any crisis that might possibly intimidate the economy.

The universally accepted principle is that any economy will be able to borrow from the international financial markets as long as its abilities to repay the existing liabilities which it owes to the external world is not questioned by anybody or doesn't become a matter of concern. The risk-averse international investors are unlikely to lend if a country runs large and persistent CADs and, thus, is beset with the syndrome of over-borrowing and the implied likelihood of default on the repayment of its foreign debt. Thus, the magnitude of CAD serves as a constraint on the ability of the borrower to borrow and the willingness of the lender to lend. Numerous crises have been preceded by the large current account deficits – Chile in 1981, Finland in 1991, Mexico in 1994, Thailand in 1997, the United States in 2007, Iceland in 2008, and Greece in 2010."

Statement of the Problem

In case of India, our economy went through a complete overhaul because of the Balance of Payments Crisis in 1991, wherein increasingly unproductive non-developmental expenditures caused the deficit to widen relentlessly and plunge our economy into a crisis. Our position at that time was so precarious that we were not even able to finance 3 weeks' worth of imports. Our Foreign exchange reserves had drained to almost nil. Generally, these enormous and unrelenting CADs and consequentially mammoth amassments of external liabilities will inexorably escort the economy towards:

- Speculative attacks on the external value of domestic currency
- Occurrence of financial calamities and economic upheavals, and
- Intergenerational transfer of international debt burdens."

Thus, the sustainability of these CADs and maintaining solvency position with respect to a country's external debt becomes a very important task for a policy maker to ensure stability of the macro economy and to ensure welfare of the overall economy.

Objective of the Study

The major objectives of this study are:

- To analyse the trends of items in the Current Account of India's Balance of Payments.
- To identify the threshold level of CAD for India.
- To estimate the probability of crisis due to CAD.
- To assess the issues relating to sustainability of CAD in case of India.

Current Account of India's Balance of Payments: Historical Trends

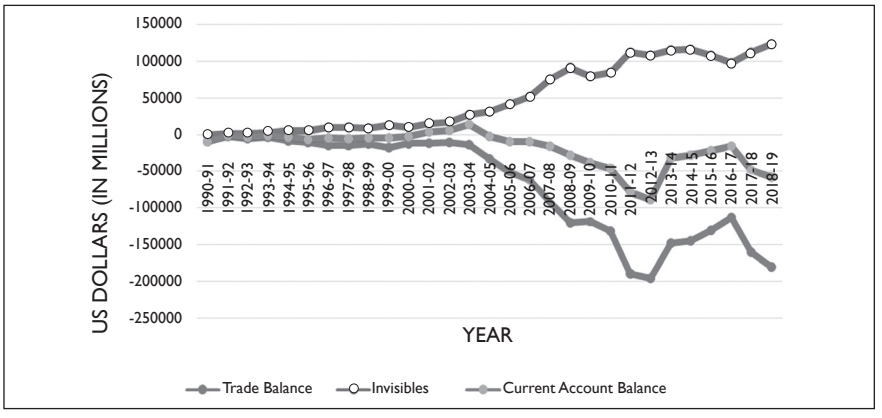
Let us first discuss briefly the developments that have happened in the current account. In the pre-1990 era exports averaged at around 5% of GDP but it has shown an increasing trend after the 1991 reforms which implies that the reforms have brought about a significant impact as the decadal average of the decade 1991-2000 witnessed a mammoth 4% jump from the previous decade to 10.44%. These policies seem to have boosted the exports to a new level. After that there was no looking back for Indian exports as it experienced its bliss point of 24.02% of GDP in the year 2008. The period from 2001-2008 was the bliss period for Indian exports as it averaged at 18.17% boosted because of the IT boom. Even Indian exports experienced the pinch of the Global Financial crisis. For the period of 2011-2013, it was the period of supreme bliss for the Indian exports as it averaged at a mammoth rate of 25.43% of GDP.

Following a sharp decline in the global petroleum prices petroleum exports dipped which caused the decline in overall exports to 19.81% of GDP. A downturn followed for the next 2 years which was followed by an increase in the year 2018 to 19.738% of GDP following a significantly improved performance mainly from the pharma, chemicals and the engineering sectors. Imports averaged at around 6.47% of GDP for the period 1960-1990. For the decade of 1991-2000 imports averaged at 11.35%, an increase of almost 3.5% from the previous decade. Various policies like peak import duties, removal of certain tariff lines etc., have boosted the import growth drastically in the post-1990 era. It touched its peak in the year 2008 as it reached 29.27% of GDP. Trimming of customs duties by the South Asian free trade area accentuated the already expanding imports.

As again the Global oil prices and oil imports ballooned in greater magnitude imports reached its new higher level at 31.25% of GDP in the year 2012. It led to the widening of CAD to its highest level in the Indian history to more than 4.5% of GDP. Sufficient amount of Foreign exchange crisis acted as the cushion for the expanding CAD and prevented it from

falling into unmanageable levels. Following this expansion of CAD to more than 4.5% of GDP the Indian Government acted swiftly to impose several restrictions on Imports such as 10% import duty on gold and tied imports for domestic consumption to exports to discourage the import of that Yellow Metal. These restrictions however saw much fruition as Imports as a % of GDP recorded a steep decline from the year 2012 when it recorded its record high rate of 31.25% of GDP to 20.96% in the year 2016. Indian imports marginally picked up in the next year and reached 23.63% of GDP in the year 2018.

Figure-1: India's Trade, Invisible and Current Account Balances (1990-91 to 2018-19)



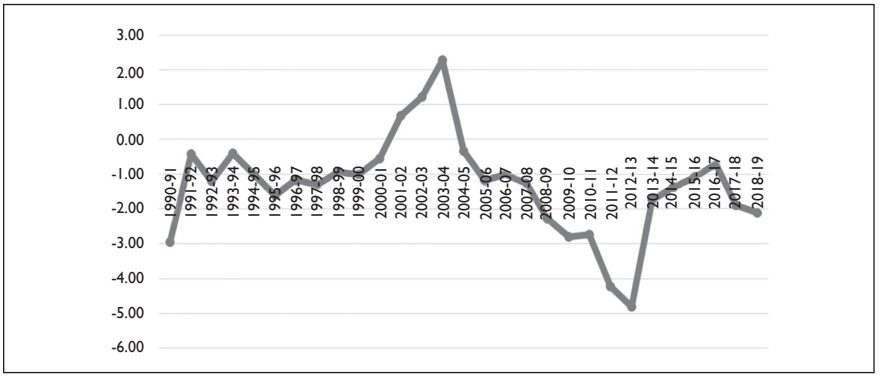
Source: RBI's Handbook of Statistics 2019-20

Widening oil Imports due to fluctuating oil prices, inelastic demand for Indian Oil Imports and ever-expanding desire for the yellow metal has continued to worsen the current account due to which the current account deficit continues to expand. Always invisibles have come to the rescue of CAD when Trade deficit tries to push CAD to unsustainable levels. In the year 2012-13, it came out to bail out the plunging CAD as it offset almost 60% of the trade to GDP. Invisibles' surges can be attributed to the improved inflow in the overseas sales of non-factor services, improvement in the inflow of business services, and the ever-afloat transfers from the private. The improvement in the inflows of business services portrays the improving acumen of the Indian workforce who are becoming more knowledgeable, skillful, virtuous and competent.

Net Invisibles reached its peak in the year 2008-09 when it was at 7.64% of GDP and fell prey to the Global Financial Meltdown in the next year when it stooped to a record low of 4.73% of GDP. In the more recent years i.e., after 2012-13, net invisibles have recorded a constant pace of growth. Invisibles experienced even enormous surfeits for few where it even covered the whole trade deficit and even gave some part of its surfeit to the current account for 3 years 2001-02, 2002-03, 2003-04. The three

years namely 2001-02, 2002-03, 2003-04 witnessed an increasing trend of current account surpluses of 0.7%, 1.2% and 2.7% of GDP due to the enormous surfeit of Net Invisibles. When we see the behaviour of CAD it can be noted that most of the time it remained in deficit, implying the developing nature of our economy.

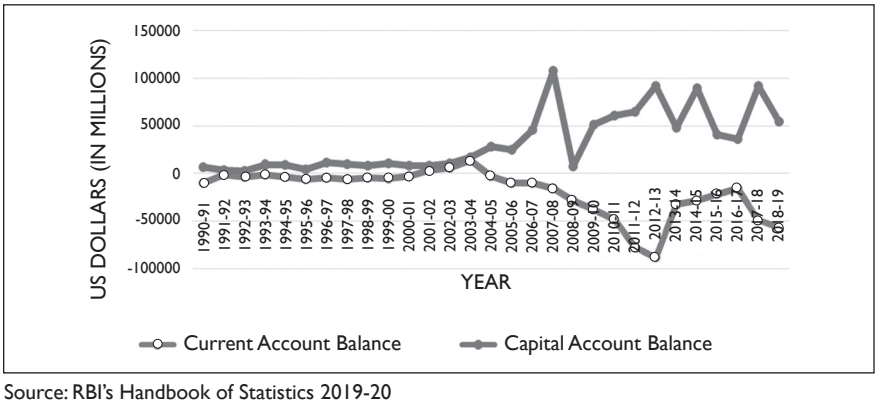
Figure-2: India's Current Account Deficit (As Percent of GDP)



Source: RBI's Handbook of Statistics 2019-20

Though it recorded surpluses for the few years it again fell out of track as before. But it can be easily said that we have come a long way in terms of our components in the current account and the behaviour of CAD whether it is volatile or consistent is fully determined by the behaviour of its components. So, a one-pointed focus should be given to developing its components for a stable CAD. It is always said that the CAD must be kept under 3% to prevent it from becoming unsustainable. But a more pressing concern is our overdependence on capital flows to finance our CAD. Since capital flows have become more volatile the post-2008 crisis era, how far can we rely on this unstable capital flows to finance our current account is a more pressing problem.

Figure-3: India's Current and Capital Account Balances



Source: RBI's Handbook of Statistics 2019-20

Our CAD used to be financed always by capital flows. We have become over dependent on capital flows to finance our CAD. During post 2008 financial crisis capital flows have become extremely volatile which exerts a very dangerous impact on the overdependence on the capital flows. Therefore, we must necessarily reduce the dependence on capital flows to fund our CAD and we must take measures to improve the competitiveness of exports so that sustainability of CAD is not questioned. For e.g., in the year 2012-13 our CAD touched almost US$ 88163 million which was the lowest ever in the history of Indian CADs, our economy did nor plunge into a crisis. Though we experienced some amount of depreciation in the Indian rupee, it did not affect our economy very badly because, we had adequate foreign exchange reserves and the timely intervention of RBI prevented the CAD from falling into unsustainable levels.

Review of Literature

There has been an enormous empirical literature of sustainability of current account deficit. The measurement of sustainability of current account deficit rapidly progressed from elastic approach to absorption approach to the intertemporal approach. In past papers this first two approaches serve to measure the stability of current account but many researchers used intertemporal approach to current account extensively. Obstfeld and Rogoff (1994) view the current account balance as the outcome of forward-looking dynamic saving and investment decision. The paper extensively highlights intertemporal approach to supplant the expanded version of Mundell – Fleming IS-LM model. Using intertemporal approach, it also provides the consistent foundation of open-economy policy analysis. Reisen (1997) using consumption smoothing approach discusses the prominent determinant of recent capital flows to emerging markets and finds the widening of current account deficit if the economy is in boom and by contrast the current account deficit should decline in the face of low world interest rate.

Baharumshah, Lau and Fountas (2005) using panel data approach examine the issue of sustainability of current account imbalance in eight East Asia countries. The empirical result clearly indicate that the current account imbalance was not on the long run steady state in the pre-crisis era and did not move towards external account equilibrium. However, the large currency depreciation and the economic recovery have brought co-movements between exports and imports and brought back on a sustainable path for 8 Asian Economies. A time series perspective in explaining the India current account deficit was done by Behera and Yadav (2019) and found that the widening of current account deficit is due to fall in household savings and corporate investment. It has also been found that the larger part of current account deficit was financed by foreign direct

investment and portfolio investment. Using the cointegration and unit root test, current account deficit of India is found to be sustainable. Furthermore, India current account is driven by fiscal deficit, terms of trade and growth, inflation, real deposit rate, trade openness and relative income and the age dependency factor.

Tim Callen and Paul Cashin (1999) also examines the solvency and sustainability of India external imbalances and analyzes the optimality of its capital flows. The results indicate that India intertemporal budget constraint is satisfied and current account deficit is sustainable if the external borrowing is kept under control. Knight and Scacciavillani (1998) analyze the theoretical approaches movement in current account of the balance of payment from Mundell Fleming paradigm to modern intertemporal approaches. This paper views the current account imbalances as an outcome of intertemporal consumption and investment choices and associated market behavior. Bhaduri (2018) in his paper examines the sustainability of relying on capital flows, remittances and services exports to sustain these persistent and trade and current account deficit. It argues that all the three sources entail fragility because of recent global economic shut down and economic recession in USA and Europe, slow recovery and low growth forecast. Relying on capital inflows also carries risks of financial fragility, with short term flows and external commercial borrowing more prominent in the Indian economy.

Goyal and Sharma (2019) also examine the causality from the capital account to the current account of balance of payments. They found no direct causality between capital account and current account. Of the capital flows component, only FDI affects gross fixed capital formation and thus the latter consistently affects current account. The current account also effects debt portfolio flows and non-resident deposits suggesting that they were used to finance the current account but no causal for gross fixed capital formation. Singh (2015) examines the sustainability of current account deficits and the validity of intertemporal budget constraint in India. The study provides dominant support for the long run relationship between exports and imports and thus vindicate the sustainability of current account deficit and the validity of intertemporal budget constraint.

Following the intertemporal approach, Singh (2017) also estimates the sustainability of current account under IBC for twenty-eight OECD countries. He findings is relevant to the long term long run equilibrium of export and import. The support for the sustainability of CAD suggest that the current account deficit is only short-term phenomena and are balanced by future current account surplus. Applying Domar Debt Sustainability model, Rajan (2012) estimates the sustainable level of current account deficit for India. Probit analysis based on select panel of market economies is used to measure the threshold level of current account sustainability and

concludes that CAD between the range of 2.4 and 2.8 percent of GDP is sustainable over the medium term under the assumption of 6.0 to 8.0 GDP growth rate, 5.0 percent inflation rate and interest rate following the trend of the recent past.

Empirical Analysis

Calculating the Threshold Level of Current Account Deficit

The analysis of the threshold level was carried out for two different periods and the whole period was split into two. The first period was from 1971 to 1990 and the second period was from 1991 to 2018.

Dummy OLS Regression

Let CAB be the Current Account Balance to GDP and CAB* be the threshold level of CAB, ΔGDP be the GDP Growth Rate (Constant Prices), and D(CAB) be the Dummy whose value equals 1 if CAB<=CAB* and otherwise 0. The model to find the threshold level of Current Account Balance to GDP is given as follows in which ΔGDP is modelled as a function of the Dummy and the Current Account Balance to GDP.

$$\Delta GDP = \alpha + \beta 1\ CAB + \beta 2\ (CAB - CAB^*) + \varepsilon;\ \text{if } CAB <= CAB^*$$

$$\Delta GDP = \alpha + \beta 1\ CAB + \varepsilon;\ \text{if } CAB > CAB^*$$

Different values are assigned to the threshold value of CAB and the model is estimated with varying threshold values. This will give rise to different estimates for the parameters and different RMSEs corresponding to each threshold value. We need to find that threshold value which minimises the Root Mean Squared Error and in which the Coefficient of the Dummy is negative. Such value found can be regarded as that threshold value beyond which it will have an adverse impact on GDP. Results are as follows:

Equation I: (1971-1990)

Table-1: Dummy OLS Regression Results for the Period 1971-1990

	Dep variable: ΔGDP						
with CAB and the Dummy	**t= - 0.9**	**t= - 1.2**	**t= - 1.5**	**t= - 2.0**	**t =-2.1**	**t= - 2.2**	**t=-2.4**
A	3.3712	3.5491	3.6379	3.7643	3.7719	3.8019	3.8327
β1	0.331	0.208	0.1004	-0.0971	-0.1115	-0.2018	-0.3155
β2	-2.859	-3.4607	-4.5492	-10.8287	-15.606	-23.893	-595.164
β1+β2 (total impact on GDP)	-2.528	-3.2527	-4.4488	-10.9258	-15.718	-24.094	-595.48
RMSE	3.4091	3.3814	3.3867	3.3697	3.3577	3.3609	3.3745

The various threshold values chosen for the analysis are -0.9, -1.2, -1.5, -2.0, -2.2 and -2.4. At the threshold levels -1.2, -1.5, -2.0, -2.1, -2.2, -2.4 the coefficient of the dummy and the total impact of both the coefficients are negative. From the threshold level of -2.0 even the coefficient of CAB also becomes negative adding to the increase in the value of total impact coefficient which jumps to -10.9258 from -4.4488 in the previous threshold level of -1.5. But, though the dummy and the total impact coefficient shows a negative relationship, structural break happens at that level of threshold where the RMSE is minimum. Based on this condition, the threshold level of CAB was chosen as -2.1 in which RMSE = 3.3577 is the minimum among all the three. This is also corroborated by the strong evidence that the total impact coefficient which was moderately negative at -2.52 when the threshold level was -0.9, jumps to a higher negative value of -15.718 when the threshold level reaches -2.1 taking the total negative impact to a higher level which indicates the adverse effect on GDP.

Beyond the threshold level of -2.1 the value of the dummy coefficient seems to quadruple and reach a whopping -595.164 when the threshold level is -2.4 taking the total impact coefficient to -595.48, indicating the excessively adverse impact on GDP beyond the threshold level. The structural break occurs at the threshold level of -2.1 percent of GDP when the RMSE is minimum and the dummy coefficient is negative.

Equation II: (1991-2018)

Table-2: Dummy OLS Regression Results for the Period 1991-2018

	Dep variable: ΔGDP						
with CAB and the Dummy	**t=-2.0**	**t=-2.4**	**t=-2.5**	**t=-2.6**	**t=-3.0**	**t=-3.4**	**t=-4.0**
A	0.4953	0.5809	0.60191	0.6189	0.6389	0.66701	0.6702
β1	0.1368	0.2836	0.3144	0.3377	0.3613	0.3903	0.3938
β2	0.3827	-0.1007	-0.1281	-0.2354	-0.4529	-0.9061	-1.5086
β1+β2 (total impact on GDP)	0.5195	0.1830	0.1863	0.1023	-0.0916	-0.5157	-1.1148
RMSE	2.4543	2.4599	2.4595	2.4583	2.4557	2.4477	2.4569

The various threshold values chosen for this analysis include -2.0, -2.4, -2.5, -2.6, -3.0, -3.4. We have also included the threshold value found for the pre-1990 era in this analysis also. At this threshold level, the coefficient of the dummy is still positive and the combined coefficient is also positive and RMSE is not the least indicating that this is not the threshold level though this level has a positive effect on GDP. At the threshold levels -2.4, -2.5,

-2.6 the coefficients of the dummy are negative and the combined effects of both the coefficients are positive though the impact is declining with every increase in threshold value up till -2.6. At the -3.0 level of threshold both the dummy coefficient and the total impact coefficient are negative indicating a moderately negative impact on GDP at -0.452 and -0.091 respectively. But, at the threshold level of -3.4 the dummy coefficient is negative at -0.9061 and the RMSE is below than for the previous threshold limit at 2.4477 from 2.4557. Since, RMSE at this threshold level of -3.4 is the global minimum, -3.4 is considered the threshold level of CAB for the post-1990 period, beyond which there is an adverse effect on GDP.

This adverse effect on GDP is indicated in the almost 6x jump in the value of the total impact coefficient to -0.515717 from -0.091557 in the previous threshold level of -3.0. Beyond the threshold level of -3.4 percent of GDP i.e., at the threshold level of -4.0 percent of GDP, RMSE is increasing to 2.4569 and the total impact coefficient more than doubled negatively to -1.1148 signifying an excessively adverse impact on GDP beyond the threshold level.

Equation III: (1971-2018)

Table-3: Dummy OLS Regression Results for the Period 1971-2018

Dep Variable: ΔGDP						
with CAB and the Dummy	**t = - 1.5**	**t = - 2.0**	**t = - 2.4**	**t = - 3.0**	**t = - 3.4**	**t = - 4.0**
A	0.2833	0.2686	0.2779	0.3011	0.3173	0.319
β1	0.1326	0.1082	0.1396	0.1836	0.2081	0.2106
β2	0.0941	0.2328	0.1527	-0.3011	-0.5526	-0.9454
β1+β2 (total impact on GDP)	0.2267	0.341	0.2923	-0.1175	-0.3445	-0.7348
RMSE	3.9605	3.9596	3.9603	3.9605	3.9589	3.9623

For the overall period, the various threshold values considered -1.5, -2.0, -2.4, -3.0, -3.4, -4.0. Till the threshold level of -2.4, the total impact coefficient and the dummy coefficient are still positive indicating that it is not the threshold level. At -3.0, the dummy coefficient turns negative signifying a structural break, but it is not since the RMSE is not minimum. The global minimum RMSE is found at the threshold level of -3.4 and the dummy coefficient is negative indicating that this is the threshold level. 3.4 percent of GDP is considered the threshold level of CAD and any value beyond the threshold level will have an adverse impact on GDP as shown by the total impact coefficient of -0.7348 when the value of CAD reaches 4.0.

Estimating the Probability of Crisis

Having estimated the sustainable threshold level of CAB for both the periods pre-1990 and post-1990 it makes more sense to find out the probability of crisis if the CAB goes beyond this threshold level. Sustainable threshold level is defined as the level which prevents the economy from going into a meltdown. According to this definition it means that if CAB goes beyond that level it might become unsustainable which might increase the probability of meltdown. The validity of this argument is tested by estimating the Probability of Crisis through a Probit Model in which the dependent variable is binary in nature. Since there are only two observations which are beyond the threshold level of -3.4 (it will lead to the problem of zero inflated model), we estimate the model by fixing the threshold level at -2.0, which is the generally accepted level of CAD. We estimate this probit model on the data which has a time space that is constant beginning from 1971 to 2018. Let us look at the variables involved in the study, their relationships with the dependent variable and their explanation.

Dependent Variable

- Crisis (C) – Takes the value of 1 if CAB<=-2.0 and 0 otherwise.

Independent Variables

- Net External Liabilities to GDP ratio (ΔNELY) – It has a positive relationship with the probability of crisis because more the external liabilities it becomes difficult for an economy to repay hence there is a larger possibility of crisis.
- Short term liabilities to external liabilities ratio (STLEL) – If the economy is in the beginning of an oncoming slowdown, more the short term debt to be repaid increases the burden on the already burdened economy which will aggravate the probability of crisis. Hence, a positive relationship.
- Import Cover (IC) in months of reserves – Forex reserves are a very effective solution for making external payments as they are directly regulated and supervised by RBI. If there is more Import Cover, more forex reserves are normalised in terms of overseas purchase of goods and services and there is a lesser possibility of a meltdown. Hence a negative relationship.

The Model

$$P_i = \frac{1}{1+e^{-\beta 0+\beta 1X1+\beta 2X2+\cdots+\beta n\,Xn+\varepsilon}}\,;\ i = 1 \text{ to } n$$

Where P_i is the probability of crisis happening, and β0 is the intercept term and β_i's are the coefficients on the Independent Variables, X_i's are the independent variables.

Table-4: Results of the Probit Regression

Explanatory Variables	Equation 1	Z Score	Equation 2	Z Score
Intercept	-0.9985	-4.14	-1.6656	-0.84
ΔNELY	0.2858	2.28	0.0678	0.28
STLEL			0.6037	2.41
IC			-1.2963	-2.16
Mcfadden Pseudo R2	0.1264		0.7476	
Log Likelihood	-19.8648		-5.7388	

Interpretation of Equation 1

In the first equation the probit model is estimated by using only one independent variable i.e., ΔNELY.

$$P_i^* = \frac{1}{1+e^{-((-0.9985553)+0.2858441*\Delta NELY)}}$$

Calculate the mean of the explanatory variable(s) (ΔNELY). Substituting the mean value of ΔNELY instead of ΔNELY, calculate P_i^*. The value of P_i^* = 0.2748945945. Thus, a 1-unit increase in ΔNELY will increase the probability of crisis that Y_t = 1 by, 0.2858441*0.2748945945 = 0.07857699796. These estimates are called marginal effects.

Interpretation of Equation 2

In the 2nd equation the probit model is estimated using 3 independent variables namely ΔNELY, STLEL and IC.

$$P_i^* = \frac{1}{1+e^{-((-1.665641)+0.067812*\Delta NELY+0.603701*STLEL-1.296323}}$$

Calculate the mean of explanatory variables and substitute them in the equation and find out the value of P_i^*. Value of P_i^* is 0.01197177254. Thus, a 1-unit increase in the value of ΔNELY will increase the probability of crisis by, 0.01197177254*0.067812 = 0.00081183. Thus, a 1-unit increase in the value of STLEL will increase the probability of crisis by, 0.01197177254*0.603701 = 0.007227371. Thus, a 1-unit increase in the value of IC will decrease the probability of crisis by, 0.01197177254*1.296323 = 0.01551928409.

In the first equation relationship of ΔNELY is positive and is according to the theory. It is highly significant as indicated by the z-score which is 2.28. It is proved that a 1 unit increase in ΔNELY will increase the probability of crisis by 7.8 percent

In the 2nd equation when it is estimated with ΔNELY, STLEL and IC the relationships of all the variables are according to the theory. But IC and STLEL turn out to be the most significant variable with z-scores of -2.16 and 2.41 respectively. ΔNELY turns out to be insignificant as it's z-score

of (-0.28) is very low though its relationship is according to the theory. It is proved from the results that a 1 unit change in STLEL and IC will increase and decrease the probability of crisis by 0.722 percent and 1.55 percent respectively.

Assessing the Sustainability of Current Account Deficit

In this section we analyse the sustainability of Current Account Deficit by checking for the long-term association between exports and imports using the Engle-Granger Cointegration Method and by checking the validity of the Intertemporal budget constraint. This method has also been used by (Singh T., Are Current Account Deficits in the OECD Countries Sustainable? Robust Evidence from Time-Series Estimators, 2017) for checking sustainability of CAD for 24 OECD countries and for assessing the sustainability of external imbalances in the European Union. Exports to GDP ratio and Imports to GDP ratio data for the period 1960 to 2018 is used for the purpose of the study. The model is derived as follows:

$$Xt = \alpha + \beta MMt + Et$$

in which Xt represents Exports at time t and MMt represents imports at time t.

First of all, we check for the stationarity of variables using ADF Unit root tests as this cointegration methods demands both the variables to be I (1).

Table-5: Results of the Unit Root Tests for the Variables Under Study

Variables	At First Difference	Critical Value at 1 percent level
Xt	-5.909	-3.570
MMt	-7.614	-3.570

Both the variables are found to be stationary at first difference as the Null hypothesis of a unit root or non-stationarity is rejected at 1 percent level of significance. Now the above model is estimated through OLS Regression and the residuals are then tested for stationarity. If the residuals are stationary at levels, then it proves that there is cointegration between exports and imports which confirms the sustainability of Current Account Deficit and validity of the Intertemporal Budget Constraint. Residuals from this above regression should be integrated of order zero or I (0) in order to reject the null hypothesis of no cointegration between exports and imports. Intertemporal Budget Constraint in simple terms tells that the present value of current and future cash outflows (which is a country's current and future imports) cannot exceed the present value of currently available funds and future cash inflows (which is a country's current and future exports). So, to check for the validity of this Intertemporal Budget Constraint Cointegration between exports and imports can be analysed and

if they are found to be cointegrated then it can be proven that in future exports will finance imports which implies that the Current account is sustainable in the long run. An estimable Intertemporal Model has been formulated by Husted (1992) who has analysed the whether the overseas sales and purchases are associated in the long term to comment on the sustainability of external position in United States.

OLS Regression and Checking for Stationarity of Residuals

$X_t^* = 0.082043 + 0.6257523 * MM_t (10.17)$

P – value = 0.000 R2 = 0.6485 Adj. R2 = 0.6423

RMSE = 0.70645F stat (1,56) = 103.33 Prob (F-stat) = 0.0000

Table-6: Results of the Unit Root Test for the Residuals of the Above OLS Regression

Variable	At Levels I(0)	Critical values at 1 percent level
Residuals	-5.909	-3.570

Residuals implies the residuals of the afore-estimated OLS Regression between Exports and Imports. As it can be concluded from the table the residuals are stationary and integrated at levels which implies the Exports and Imports are cointegrated in the long run. R2 of 0.6423 implies that 64 percent of the changes in exports are explained through imports. Coefficient of import 0.6257523 implies that a 1 unit change in imports will lead to a 62 percent change in the exports. This coefficient is extremely significant as proved by the extremely high t-statistic of 10.17. A statistically significant and Higher value of F- Statistic of 103.33 implies that the overall model is a good fit.

Exports (inflow of resources) is proven to share a long-term association with imports (outflow of resources) which was proven empirically using OLSEG method. Since the variables are found to be cointegrated in the long run, it also validates the fact that the Current Account Deficit is Sustainable in the case of India. Though the variables are found to be cointegrated the validity of the Intertemporal Budget Constraint is very much under question as the value of the coefficient of imports is statistically lower than 1. So, it cannot be confirmed that the Indian economy satisfies its Budget Constraint.

It examines whether India's external sector position is in a steady state (or in other words, it checks whether the growth path projects a sustainable and balanced trend) by checking whether there exists any association between overseas sales and overseas purchases in the long term. As the relationship between overseas sales and overseas purchases is proven to be strong and coexistent in the Indian case, which is reinforced by the results of the afore-mentioned analysis, the growth path of India projects

a sustainable and balanced trend. In any case, our Economy does not seem to satisfy its budget constraint due to the fact that the coefficient value of imports in the OLS regression is statistically lower than 1.

Conclusions

Current account deficit is an important indicator of the country's economic health. As a country grows it needs to borrow more in order to fund its developmental activities which will inexorably push a developing economy into current account deficit. Various policymakers, researchers, economists, and various other communities in the economic academia have been vigorously debating and researching on what is the sustainable level of current account deficit that will prevent an economy from plunging into a crisis etc. The threshold level of CAD in the pre-1990 era was found to be 2.1 percent of GDP and the post-1990 era threshold level was gauged to be at 3.4 percent of GDP. For the overall period from 1971-2018, 3.4 percent was estimated to be the threshold level of CAD. The results from the Probit Analysis show that a 1 unit change in Net external liabilities to GDP ratio increases the probability of crisis by 7.8 percent when taken as a lone independent variable, but turns out insignificant when estimated along with short term liabilities to external liabilities ratio and import cover. Results indicate that a 1 unit change in STLEL and IC will increase and decrease the probability of crisis by 0.722 percent and 1.55 percent respectively. In order to assess the sustainability of CAD, cointegration between exports and imports is carried out using Engle-Granger cointegration methodology. Results confirm the existence of cointegration between exports and imports at I (1) which implies that in the long run imports will be financed by exports.

The most important policy implication is that the level of CAD must be kept under 3.4% for external sector sustainability. For this to happen government must follow the policy of Import substitution and Export promotion. Export promotion and augmentation is the need of the hour as we seek to reduce the dependence on extremely volatile capital flows to finance the CAD. Since the capital flows have become very volatile, it has the capability to make the economy vulnerable which means we must not rely on something unstable rather we must rely on something as stable as export earnings to fund our CAD.

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Dissecting the Economic Integration in South-Asia: Trends and Analysis

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Abstract

South-Asia is the least integrated region in the world with intra-regional trade accounting for only 6.1 percent of its total trade despite institutionalization of South-Asian Free Trade Agreement (SAFTA) in 2006. This paper examines the macroeconomic and trade indicators of South-Asia and its trends over time using indicators like GDP growth rate, trade openness, composition of trade, direction of trade and tariff rates. The paper analyzes the individual trade profiles of all the member countries of the region to study their relative participation and significance in the intra-regional trade of South-Asia. The study also reviews the trends in intra-regional trade and the relative share of all the member countries over the period of last three decades to evaluate the performance of all the countries individually. The results of the study indicate that despite expanding trade volumes individually, the three largest economies of the region India, Pakistan and Bangladesh are the least integrated economies of South-Asia due to which the intra-regional trade remains low.

Keywords: Economic Integration, Intra-regional Trade, Regionalization, South-Asia, SAFTA

Introduction

Trade liberalization and economic cooperation are perceived as the key to economic upliftment. In the wake of this argument bilateral and multilateral arrangements are negotiated between economies for expanding markets for exports and sourcing cheaper imports. The wave of economic integration has led to several preferential / free trade agreements in the world. Growing enthusiasm for regionalism or regional trade arrangements is an extension of this movement.

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Inspired by the achievements of regional cooperation in South-East Asia, the collective economic interests of South-Asian economies motivated the establishment of South Asian Association for Regional Cooperation (SAARC) in 1985 to ensure peace and stability in the region. The SAARC agreement was signed by seven countries namely Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. In 1993, the SAARC countries took the next step towards regional integration and signed the agreement of South Asian Preferential Trade Agreement (SAPTA) which came into effect in 1995. Later in 2004, SAPTA graduated into SAFTA (South Asian Free Trade Agreement) which came into effect in 2006. Under SAFTA, all the countries were bound to reduce their tariff levels in phases to a certain limit different for developing and least developed countries in the region. In 2007 Afghanistan joined SAARC as a new member and SAARC became an association of eight countries.

South-Asian countries share a common history, culture, language, heritage, social and ethnic traditions. Despite that, these countries are plagued with numerous intra-regional disputes and political tensions leading to complicated economic and trade relations. These complexities are deep rooted in historical events which led to never ending conflicts among the countries. These conflicts have raised security concerns which go against the economic and diplomatic pursuits of the region.

Even after establishment of SAARC or signing of SAFTA, South-Asia remains the least integrated region of the world compared with successful regional partnerships of NAFTA, EU, ASEAN or COMESA. The objective of this paper is to assess the level of economic integration in South-Asia and to analyze the relative participation and significance of member countries in intra-regional trade. The review of related literature is presented in Section 2. The macroeconomic overview of South-Asian economies is discussed in Section 3. The analysis of trade indicators of South-Asian economies is given in Section 4. The regional trade profiles of individual member economies of South-Asia are reviewed in Section 5. The synopsis of intra-regional trade in South-Asia is depicted in Section 6 and conclusion is given in Section 7.

Review of Literature

The mechanism of economic integration works as an antidote to intra-regional conflicts and historically it has brought together many disputing countries in Europe and South-East Asia for common economic interests. But in South-Asia, economic integration and peace both have not been realized completely despite many attempts (Bhatta 2004). Baruah (2020) argues that lack of cooperation and trust between key regional players India and Pakistan owing to Kashmir issue severely impedes economic

integration in South-Asia and integration is unlikely in near future until this issue is resolved.

UNESCAP (2018) highlights the potential of South-Asia and states that lost opportunities of economic cooperation in the region has led to loss of export potential of $55.5 billion in 2014. Low intra-regional trade in South-Asia despite the advantages of geographic proximity, common language and falling tariffs is due to high trade costs within the region (Banik and Gilbert, 2008; De, 2009). Newfarmer and Pierola (2007) pointed out that the unrealized potential in intra-regional trade in SAFTA is due to the product exemptions, sensitive lists and restrictive use of rules of origin within the region.

Studies indicate that trade facilitation could benefit regional integration in South-Asia much greater than mere tariff-cuts as main trade barrier hindering the intra-regional trade are non-tariff barriers in South-Asia (Wilson and Otsuki, 2007; Raihan, et al., 2014; Raihan and Razzaque, 2014; Gandhi and Ahmed, 2020). Trade facilitation measures in the domain of transportation, regulatory requirements, customs and other infrastructure could be much helpful.

Being the largest economy in South-Asia, India's role in economic integration in the region is stressed by many studies (Kumar and Singh, 2009; Sharma, 2009; Weerakoon, 2010; Ding and Masha, 2012). It is also stated that India's personal economic advantage in the region is very limited which has been depreciating in recent years. India's objective of regional trade expansion is extending over and above South-Asia towards East-Asia and now the responsibility is on other South-Asian economies to tag along with India which might act as their entry point to larger Asian market (Kawai and Wignaraja, 2007; Agarwal and Mukherjee, 2007; Weerakoon, 2010).

Overview of South-Asian Economies

Eight countries spanning South-Asia are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri-Lanka. Out of these eight countries, four countries namely, Afghanistan, Bangladesh, Bhutan and Nepal are LDCs (least developed countries), whereas, Maldives graduated as a developing country only in 2011 and even the rest of the three countries, i.e. India, Pakistan and Sri Lanka still fall in the category of developing countries by UN. This reflects that South-Asian region is not economically very strong or influential. However, three out of four LDCs in the region, i.e., Bangladesh, Nepal and Bhutan are in the process of graduating soon to the status of a developing country. As reflected in Table-1, India, Pakistan and Bangladesh are the three largest economies of the region in terms of GDP, population size and volume of exports and

imports. These three countries are also the most significant ones to initiate and implement any policy changes and capacity building in the region to improve its economic integration by increasing its intra-regional trade (Das, 2007; Behera, 2008).

Table-1: Macroeconomic Indicators of South-Asian Economies

	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Real GDP (billion US$)	21.13	194.15	2.36	2822.17	4.14	22.97	254.22	85.51
GDP Growth (Annual %)	1.84	7.86	3.03	6.12	6.89	6.70	5.84	3.31
GDP per capita PPP (US$)	2190.24	4441.42	11345.44	6496.81	18508.51	3252.74	4739.77	12864.61
Population (millions)	37.17	161.36	0.75	1352.62	0.52	28.09	212.22	21.67
Population Growth (Annual %)	2.38	1.05	1.18	1.04	3.81	1.65	2.06	1.05
Merchandise Exports (million US$)	0.88	39.25	0.61	324.78	0.34	0.79	23.42	11.89
Merchandise Imports (million US$)	7.41	60.49	1.05	514.47	2.96	12.71	60.08	22.23
Inflation CPI (Annual %)	0.63	5.54	2.72	4.86	0.22	4.06	5.08	2.14
Current A/c Balance (% of GDP)	-20.00	-2.77	-20.34	-2.42	-26.06	-9.51	-6.00	-3.18

Source: World Development Indicators for the year 2018

Despite low level of GDP and GDP per capita in comparison to its developed counterparts, South-Asia is known to be the most rapidly growing region in the World (Kathuria and Mathur, 2018). In the past three decades, the GDP growth rate of almost all South-Asian economies has been around or greater than five percent annually. The GDP growth rate trends presented in the following Table-2 highlight the phenomenal performance of India, Bhutan, Bangladesh and Sri Lanka over the years. In fact, small countries like Bangladesh and Nepal have outperformed India in the recent years in terms of GDP growth rate. Trends in GDP growth rates of Afghanistan and Maldives are rather erratic.

Table-2: Trends in GDP Growth Rate of Member Countries in South-Asia

Country	1990	1995	2000	2005	2010	2015	2018
Afghanistan	-	-	-	11.23	14.36	1.45	1.84
Bangladesh	5.62	5.12	5.29	6.54	5.57	6.55	7.86
Bhutan	10.88	7.07	6.93	7.29	11.95	6.64	3.03
India	5.53	7.57	3.84	7.92	8.50	8.00	6.12
Maldives	-	-	3.85	-13.13	7.27	2.88	6.89
Nepal	4.64	3.47	6.20	3.48	4.82	3.32	6.70
Pakistan	4.46	4.96	4.26	6.52	1.61	4.73	5.84
Sri-Lanka	6.40	5.50	6.00	6.24	8.02	5.01	3.31

Source: World Development Indicators

Trade Indicators of South-Asian Economies

Economic integration can primarily be achieved by greater trade volumes of a country or a region with rest of the world. Trade openness measured as the ratio of trade to GDP of a country is an important indicator of an economy's willingness to integrate with the world. The following Table-3 indicates the trends in trade openness of South-Asian economies in the last three decades. It reflects the significant improvement in trade openness of India and Bangladesh and decline in trade openness of Pakistan over time. Trade openness of the three largest economies of South-Asia namely India, Bangladesh and Pakistan is the lowest in the region. The data also suggests the massive dependence of small economies in the region like Maldives, Bhutan, Nepal and Sri Lanka on International trade.

Table-3: Trends in Trade Openness of Member Countries in South-Asia

Country	1990	1995	2000	2005	2010	2015	2019
Afghanistan	-	-	-	-	52.58	49.63	49.24
Bangladesh	18.97	28.21	29.32	34.40	37.80	42.09	38.24
Bhutan	57.48	80.40	80.35	105.52	115.92	102.19	86.71
India	15.51	22.87	26.90	42.00	49.26	41.92	43.40
Maldives	168.08	-	-	-	142.98	143.92	146.24
Nepal	32.19	59.49	55.71	44.06	45.98	53.10	55.08
Pakistan	35.03	36.13	25.36	32.15	32.87	27.65	29.04
Sri-Lanka	68.24	81.64	88.64	73.60	46.36	49.56	53.23

Source: World Development Indicators

South-Asia spans around 4.01% of total land area of the world and houses around 24.89% of total world's population. It is often seen as a major market for goods and services flowing out of rest of the world. However, South-Asia's share in world trade remains marginal (see Table-4). It has increased from 1.01% in 1990 to 3.09% in 2017 out of which 2.69% originates only out of India which is a modest share for one populous country but insignificant for a region as a whole. India is followed by Pakistan and Bangladesh in terms of share in total world trade. Pakistan's share has been stagnant over the last three decades, whereas Bangladesh has widened its share in world trade from 0.08% to 0.25%. The share of rest of the countries has largely been constant and insignificant over the period of time.

Table-4: Trends in Share (%) of South-Asia and Members Countries in World Trade

Country	1990	1995	2000	2005	2010	2015	2017
Afghanistan	-	-	-	-	0.02	0.03	0.05
Bangladesh	0.08	0.09	0.10	0.11	0.16	0.25	-
Bhutan	0.003	0.002	0.002	0.003	0.004	-	-
India	0.61	0.70	0.74	1.17	1.89	2.03	2.69

Country	1990	1995	2000	2005	2010	2015	2017
Maldives	-	0.003	0.004	0.004	0.004	0.01	0.01
Nepal	-	0.02	0.02	0.01	0.02	0.02	0.03
Pakistan	0.24	0.20	0.16	0.20	0.20	0.20	0.23
Sri-Lanka	0.08	0.08	0.09	0.07	0.07	0.09	0.09
South-Asia	1.01	1.09	1.12	1.56	2.36	2.62	3.09

Source: Own calculations done on UN-COMTRADE data accessed through WITS software

The data on merchandise trade of South-Asia reiterate the huge difference in the size of economies in the region. Four out of eight economies namely, Afghanistan, Bhutan, Maldives and Nepal generate less than 1 million US$ worth of exports which is less than one percent of the total merchandise exports of the region. On the other hand, India alone contributed more than eighty percent of the regions' total exports i.e., USD 325 million and seventy-five percent of total merchandise imports i.e., USD 514 million. Bangladesh and Pakistan follow with less than ten percent share in total merchandise exports and imports.

Table-5: Total Merchandise Trade of South-Asia and Member Countries

Country	Merchandise Exports (million US$)	Merchandise Imports (million US$)	Merchandise Trade (million US$)
Afghanistan	0.885	7.407	8.292
Bangladesh	39.252	60.495	99.747
Bhutan	0.606	1.048	1.654
India	324.778	514.464	839.242
Maldives	0.339	2.960	3.299
Nepal	0.786	12.712	13.498
Pakistan	23.425	60.078	83.503
Sri-Lanka	11.890	22.233	34.123
South Asia	401.961	681.397	1083.358

Source: World Development Indicators for the year 2018

Table-6: Share (%) of Member Countries in Merchandise Trade of South-Asia

Country	Export Share (%)	Import Share (%)
Afghanistan	0.22	1.08
Bangladesh	9.76	8.87
Bhutan	0.15	0.15
India	80.79	75.50
Maldives	0.08	0.43
Nepal	0.19	1.86
Pakistan	5.82	8.81
Sri-Lanka	2.95	3.26

Source: World Development Indicators for the year 2018

Composition of Trade in South-Asia

To understand the trade structure of an economy, it is important to study

the composition of its trade. Trade composition interprets the share of major commodity groups in a country's export and import basket. It also depicts the share of major service categories in a country's total import and export of services. The merchandise trade composition of South-Asian economies illustrate that export baskets of India, Bangladesh, Pakistan, Sri Lanka, Nepal and Bhutan are dominated by manufactured items, whereas, Afghanistan and Maldives are mainly exporters of agricultural products. Bhutan's export basket contains 40.6% of fuel and mining products as well. Like exports, import basket of all the South-Asian economies are dominated by manufactured items followed by fuel and mining products and agricultural products.

Table-7: Trade Composition Profile of South-Asian Economies

		Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Merchandise Trade (MT)									
MT Exports f.o.b. (million USD)		875	39252	620	325562	350	840	23485	11900
MT Imports c.i.f. (million USD)		7407	61500	1020	510665	2970	13465	60472	22535
Share of MT (%) by main commodity groups									
Agricultural Products	**Export**	73.3	3.4	8.1	13.2	54.1	29.9	19.5	28.9
	Import	23.6	30.3	17.9	7.4	23.4	19	15.6	15
Fuel and Mining Products	**Export**	1.1	0.7	40.6	16.2	1.2	1.8	3.1	3.4
	Import	16	10.7	18.9	33.8	13.1	19.1	27.7	16.8
Manufactures	**Export**	6.6	93.3	50.6	69.6	0.2	68.3	77.3	67.7
	Import	24.6	58.8	63.1	52.5	58.3	59.2	56.1	65.7
Others	**Export**	19	2.6	0.6	1	44.5	0	0	0
	Import	35.8	0.2	0.1	6.3	5.2	2.6	0.6	2.4
Commercial Services Trade (CST)									
CST Exports (million USD)		482	2981	183	204475	3218	1780	4004	8378
CST Imports (million USD)		1196	10437	230	175448	1362	2275	9559	6756
Share of CST (%) by main service									
Transportation	**Export**	12.5	25.1	41.3	9.3	7.3	6.4	21.2	30.1
	Import	60.5	65.7	23.2	38	29.2	34.5	38.8	55.3
Travel	**Export**	3.3	11.8	56	14	90.7	45.5	9.7	52.3
	Import	15.2	7.3	32.1	12.1	27.6	48	18.8	24.6
Other Commercial Services	**Export**	84.2	60.2	2.7	76.5	2	48.1	69	17.6
	Import	23.5	26.6	42.3	49.2	43.2	17.5	41.1	20.1
Goods Related Services	**Export**	0	3	0	0.2	0	0	0.1	0
	Import	0.8	0.3	2.5	0.6	0	0	1.4	0

Source: WTO World Trade Profiles, 2019.

Coming to services trade, the data depicts that India, Maldives and Sri Lanka are net exporters of commercial services, while Afghanistan, Bangladesh, Bhutan, Nepal and Pakistan are net importers of commercial services. The data indicates that commercial services export basket of Bhutan, Maldives and Sri Lanka is dominated by travel services followed by transportation services. On the other hand, the commercial services export basket of India, Bangladesh, Pakistan, Afghanistan and Nepal is dominated by other commercial services followed by transportation services for Afghanistan, Bangladesh and Pakistan and Travel services for India and Nepal. The share of goods related services in export and import of services of all the countries is negligible.

Direction of Trade in South-Asia

The other important aspect of trade structure of an economy is the direction of its trade to trace the major trading partners of an economy for exports and imports. The data on direction of trade in South-Asia presented in Table-8 reports that all the countries in South-Asia except Afghanistan engage in trade with developed countries/regions of the world. For exports, most of the countries in the region prefer trade partnership with USA, EU, UAE and China. For imports, the preferred trade partners of South-Asian economies are China, EU, UAE and India. The other important trade partners of South-Asian economies are Japan, Saudi Arabia, Hong Kong and Singapore. The direction of trade data also highlights that regional counterparts are not the major trading partners of most of the economies in South-Asia. Afghanistan trades mostly with its neighboring countries. India is an important trading partner for all the other South-Asian countries except Pakistan.

Table-8: Top Five Trading Partners of South-Asian Economies

Reporter Country		Partner 1	Partner 2	Partner 3	Partner 4	Partner 5
Afghanistan	**Export**	Pakistan (47.5)	India (38.6)	Iran (3.2)	Turkey (2)	Iraq (1.9)
	Import	Iran (19.4)	Pakistan (18.3)	China (16.7)	Kazakhstan (9.5)	Uzbekistan (6.1)
Bangladesh	**Export**	EU (54.5)	USA (19.3)	Canada (3.3)	Japan (3)	China (2.3)
	Import	China (21.5)	India (12.2)	Singapore (9.2)	EU (6.2)	Hong Kong (5.5)
Bhutan	**Export**	India (93.7)	Bangladesh (4.1)	EU (0.9)	Japan (0.4)	Nepal (0.4)
	Import	India (78.8)	EU (4.7)	Korea (3.1)	China (2.5)	Japan (2.4)
India	**Export**	EU (17.8)	USA (16)	UAE (8.9)	China (5.1)	Hong Kong (4.1)
	Import	China (14.6)	EU (10.2)	USA (6.3)	Saudi Arabia (5.6)	UAE (5.2)

Reporter Country		Partner 1	Partner 2	Partner 3	Partner 4	Partner 5
Maldives	**Export**	Thailand (48.6)	EU (30.2)	USA (7)	Sri Lanka (3.8)	Switzerland (2.8)
	Import	UAE (18.6)	Singapore (13.5)	India (12)	China (11.9)	EU (8.6)
Nepal	**Export**	India (56.7)	EU (13.3)	USA (11.2)	Turkey (6.4)	China (3)
	Import	India (65)	China (12.6)	EU (3.4)	UAE (1.7)	Argentina (1.3)
Pakistan	**Export**	EU (33.8)	USA (16.1)	China (7.7)	Afghanistan (5.7)	UAE (4.2)
	Import	China (24.2)	UAE (14.4)	EU (9.1)	Saudi Arabia (5.4)	USA (4.9)
Sri Lanka	**Export**	EU (28.6)	USA (24.9)	India (6.7)	China (3.7)	UAE (2.6)
	Import	India (21.1)	China (19.7)	EU (8)	UAE (7.3)	Singapore (6.1)

Source: WTO World Trade Profiles, 2019.

Tariff Barrier in South-Asia

Tariff is a very significant determinant of trade for any economy or region. The data on tariff profile of South-Asian economies illustrate that South-Asia is a predominantly protected region of the world.

Table-9: Tariff Rates (%) in South-Asian Economies

Country	All Goods	Agricultural Goods	Non-Agricultural Goods
Afghanistan	6.5	9.4	6.0
Bangladesh	14.0	17.5	13.4
Bhutan	22.1	41.9	18.9
India	17.1	38.8	13.6
Maldives	13.0	10.8	13.3
Nepal	12.1	14.2	11.8
Pakistan	12.1	13.5	11.9
Sri-Lanka	9.3	27.2	6.4

Source: WTO World Tariff Profiles, 2019

The lowest tariff rate in the region is imposed by Afghanistan i.e. 6.5% of all goods followed by that of Sri Lanka which is 9.3%. The rest of the economies in South-Asia have double-digit tariff rates with the highest tariff rate imposed by Bhutan i.e. 22.1%. The three largest economies of the region namely, India, Bangladesh and Pakistan are also one of the most highly protected economies with tariff rates 17.1%, 14% and 12.1% respectively. The higher tariff rates in the region prohibit the rest of the world to trade freely with South-Asian economies limiting its trade openness.

Regional Trade Profiles of South-Asian Economies

Afghanistan

Afghanistan is the last country added to South Asian Association for Regional Cooperation (SAARC) in April 2007 during 14th SAARC Summit, one year after South Asian Free Trade Area (SAFTA) came into force in January 2006. Being a non-founder member of SAARC and a landlocked country sharing land border with only Pakistan in the region which means any trade with its regional counterparts has to be done through Pakistan or by air transport, it makes it very difficult for Afghanistan to integrate with the region through trade.

Table-10: Trade in Afghanistan

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Bangladesh	-	-	12.557	0.085
Bhutan	-	-	-	-
India	718.939	40.64	708.564	4.78
Maldives	-	-	-	-
Nepal	-	-	0.004	0.000
Pakistan	758.217	42.86	2173.702	14.67
Sri-Lanka	-	-	0.921	0.006
Rest of the World	291.853	16.50	11917.432	80.45
Total	1769.009	100	14813.181	100

Source: UN-COMTRADE database using WITS software, figures for the year 2018 (latest data available).

It can also be seen in Table-10 that Afghanistan exports to only Pakistan and India within the region and that too more to its neighbor country. The interesting fact here is that only 16.5% of total exports arising out of Afghanistan flow towards rest of the world and more than eighty percent of its total exports flow to two of its regional counterparts, i.e. Pakistan and India. However, in terms of imports, Afghanistan sources more than eighty percent of its imports from outside the region and 14.67% from Pakistan and 4.78% from India. This shows that South-Asia is quite significant for Afghanistan as a market for its exports and not so much for imports.

After the inauguration of Chabahar Port in 2017 in Iran, Afghanistan has now started using it as a vital means to trade with India while bypassing its rival Pakistan by sending its first export shipment to India in February, 2019 and also allows India to expand trade with Central Asia without any cooperation required from Pakistan. This may result in extended integration of Afghanistan with South-Asia in coming years.

Bangladesh

Bangladesh is the third largest country in South-Asia in terms of GDP

and population after India and Pakistan, whereas it is the second largest in the region in terms of total trade as reflected in Table-1 according to latest available data. Despite being an LDC and a smaller country than Pakistan, Bangladesh's trade statistics reflect a glorious picture. The way it has made a mark for itself on world trade map through its textile exports is an exemplary case study for many LDCs. However, Bangladesh is also one of the least integrated economy within the region.

Table-11: Trade in Bangladesh

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	4.712	0.015	0.050	0.0001
Bhutan	2.441	0.008	39.968	0.08
India	517.890	1.632	5882.080	12.24
Maldives	6.142	0.019	0.197	0.0004
Nepal	2.620	0.008	0.051	0.0001
Pakistan	47.742	0.150	777.573	1.62
Sri-Lanka	25.985	0.082	112.572	0.23
Rest of the World	31126.630	98.086	41246.219	85.82
Total	31734.162	100	48058.710	100

Source: UN-COMTRADE database using WITS software, figures for the year 2015 (latest data available).

As observed from Table-11, it derives 85.82% of its total imports from outside the region and also sells more than 98% of its total exports to rest of the world. The marginal trade transaction it executes within the region is with India only, trading negligibly with rest of its regional fellows. The outward orientation of Bangladesh in terms of trade apart from the region creates a huge gap in regional integration and also an opportunity to increase the same.

Bhutan

Bhutan is a small landlocked country sharing border with only India in the region and is in close proximity with Bangladesh and Nepal. Bhutan exports 98.2% of its merchandise within South-Asia out of which 93.69% goes to India only. Similarly, 80.22% of Bhutan's total imports come from the region itself out of which 78.8% come from India only. It trades marginally with neighboring countries Bangladesh and Nepal apart from India. Bhutan is very intensely integrated within the region and quite inward-oriented country of South-Asia.

Table-12: Trade in Bhutan

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	-	-	-	-
Bangladesh	21.910	4.12	5.254	0.53
India	497.716	93.69	781.471	78.80
Maldives	-	-	0.0071	0.001
Nepal	2.008	0.38	8.737	0.88
Pakistan	-	-	0.0018	0.0001
Sri-Lanka	-	-	0.0403	0.004
Rest of the World	9.593	1.80	196.191	19.78
Total	531.227	100	991.702	100

Source: UN-COMTRADE database using WITS software, figures for the year 2012 (latest data available).

India

India being the largest country in the region in terms of area, population, GDP and trade volume is also located at a very advantageous position geographically in the region sharing borders directly with all the regional counterparts apart from Afghanistan. Having produced more than 80% of the region's total merchandise exports and generating more than 75% of total merchandise imports (see Table-6), India trades with a large number of countries outside the region.

Table-13: Trade in India

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	725.934	0.23	513.175	0.08
Bangladesh	8739.349	2.71	1080.153	0.17
Bhutan	652.428	0.20	305.979	0.05
Maldives	220.090	0.07	22.054	0.004
Nepal	7296.706	2.26	484.884	0.08
Pakistan	2344.906	0.73	639.680	0.10
Sri-Lanka	4665.309	1.45	1523.594	0.25
Rest of the World	297646.846	92.35	613376.084	99.26
Total	322291.568	100	617945.603	100

Source: UN-COMTRADE database using WITS software, figures for the year 2018 (latest data available).

The regional trade profile of India presented in Table-13 reflects that 92.35% of its total exports flow outside the region and also 99.26% imports are sourced from rest of the world. Its major trading partners in the region are Bangladesh, Nepal and Sri Lanka. Since Bhutan and Maldives are too small to have a notable trade partnership with India and Pakistan is politically a rival country, India's trade within the region is rather insignificant.

Maldives

Maldives is the smallest country in the region constituted by a group of islands classified by the World Bank as an upper middle income country having the highest per capita GDP and lowest population in the region (see Table-1). Geographically, it is in close proximity of India and Sri Lanka through sea. Looking at its regional trade profile in Table-14, it reflects that Maldives is also quite externally inclined outside the region in terms of exports and imports. Only 6.14% of its total exports are marketed within the region that too only in Sri Lanka, India and Bangladesh. Further, it sources only 15.61% of its total imports from its regional counterparts mainly from India and Sri Lanka.

Table-14: Trade in Maldives

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	-	-	-	-
Bangladesh	2.135	1.17	3.596	0.12
Bhutan	-	-	-	-
India	2.816	1.55	286.674	9.68
Nepal	-	-	0.068	0.002
Pakistan	-	-	6.409	0.22
Sri-Lanka	6.204	3.41	165.352	5.58
Rest of the World	170.556	93.86	2498.928	84.39
Total	181.711	100	2961.027	100

Source: UN-COMTRADE database using WITS software, figures for the year 2018 (latest data available).

Nepal

Nepal is a small landlocked country in South Asia sharing border with only India in the region. Depicting a high growth rate and surpassing India in GDP growth rate as per the 2018 statistics, Nepal is depicting good results for an LDC and is expected to graduate soon as a developing country. Observing its regional trade profile, Nepal portrays intrinsic economic integration to India while trading marginally with all the countries of the region. Nepal generates 64.95% of its total imports from India and sends 56.72% of its total exports to India. There exists a great potential for expanding its exports and imports with other countries of the region.

Table-15: Trade in Nepal

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	0.001	0.0001	0.007	0.0001
Bangladesh	9.776	1.32	38.889	0.39
Bhutan	0.538	0.07	8.258	0.08

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
India	420.179	56.72	6519.702	64.95
Maldives	0.004	0.001	-	-
Pakistan	0.929	0.13	11.771	0.12
Sri-Lanka	0.097	0.01	2.052	0.02
Rest of the World	309.216	41.74	3457.157	34.44
Total	740.742	100	10037.840	100

Source: UN-COMTRADE database using WITS software, figures for the year 2017 (latest data available).

Pakistan

Pakistan is the second largest economy of South-Asia sharing border with Afghanistan and India. Its trade profile given in the following Table-16 indicates that its trade with the small countries of the region namely Bhutan, Maldives and Nepal is almost zero percent. It trades modestly with Afghanistan and Bangladesh and marginally with India and Sri Lanka. Overall, Pakistan is also a very outward inclined economy of the region exporting 87.83% and importing 95.65% of its trade volume outside the region and portray weak trade integration in South-Asia.

Table-16: Trade in Pakistan

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	1347.934	5.70	508.361	0.84
Bangladesh	783.825	3.32	72.283	0.12
Bhutan	0.0002	0.00	0.126	0.0002
India	383.046	1.62	1928.465	3.21
Maldives	5.650	0.02	0.284	0.0005
Nepal	1.731	0.01	0.537	0.001
Sri-Lanka	354.533	1.50	104.963	0.17
Rest of the World	20754.173	87.83	57547.842	95.65
Total	23630.893	100	60162.862	100

Source: UN-COMTRADE database using WITS software, figures for the year 2018 (latest data available).

Sri Lanka

Sri Lanka is an island country located south of India and is one of the three developing countries of the region along with India and Pakistan. Its regional trade profile depicted in Table-17 highlights its weak trading partnership with other countries of the region as it exports 90.49% of its merchandise outside the region while generating 75.28% of its total imports from rest of the world outside South-Asia. India is however one of its major import partner which provides for 21.08% of its total import

requirements and also intakes 6.73% of its total exports. Apart from India, it lacks a significant trading alliance with any of the other countries in the region.

Table-17: Trade in Sri-Lanka

Country	Export (million US$)	Share (%)	Import (million US$)	Share (%)
Afghanistan	0.709	0.01	0.113	0.0005
Bangladesh	125.060	1.07	43.575	0.20
Bhutan	0.305	0.003	0.00013	0.000
India	789.586	6.73	4494.066	21.08
Maldives	117.365	1.00	163.437	0.77
Nepal	3.172	0.03	0.104	0.0005
Pakistan	80.464	0.69	348.903	1.64
Rest of the World	10624.376	90.49	16047.717	75.28
Total	11741.037	100	21316.200	100

Source: UN-COMTRADE database using WITS software, figures for the year 2017 (latest data available).

After analyzing the individual trade trajectories of all the South-Asian countries we look at the holistic view of the member countries' percentage share of trade within the region of their total trade volumes given in Table-18. This data reflects that Bhutan, Afghanistan and Nepal are the most regionally oriented economies of South-Asia. Sri Lanka, Maldives and Pakistan are moderately integrated within the region. India and Bangladesh are the least integrated ones and most regionally outward inclined countries of South-Asia.

Table-18: Members Countries' Share of Trade (%) within South-Asia

Country	Export Share (%)	Import Share (%)
Afghanistan	83.50	19.55
Bangladesh	1.91	14.18
Bhutan	98.20	80.22
India	7.65	0.74
Maldives	6.14	15.61
Nepal	58.26	65.56
Pakistan	12.17	4.35
Sri Lanka	9.51	24.72

Source: Own calculations done on UN-COMTRADE data accessed through WITS software

Intra-Regional Trade in South-Asia

Observing the trends in intra-regional group trade of major regional trade agreements (RTAs) across the world over the last three decades, SAFTA depicts the lowest level of intra-regional trade, making South-Asia the

least integrated region of the world. Apart from that, the growth in the level of intra-regional trade during this time period has also been very sluggish. The regional trade agreement of neighboring South-East Asian nations, i.e. ASEAN has constantly been above 21% and even the RTA comprising of three of the SAFTA members namely Bangladesh, India and Sri Lanka i.e. APTA has shown tremendous growth in intra-regional trade in last three decades.

Table-19: Trends in Intra-Regional Trade (%) of Major RTAs of the World

Country	1995	2000	2005	2010	2015	2018
APEC	71.8	72.7	70.1	68.1	70.1	70.0
APTA	7.4	9.8	15.0	15.6	15.9	15.8
ASEAN	21.5	23.5	24.9	24.5	23.5	22.9
EU	60.5	64.3	64.5	60.8	60.4	60.8
GCC	7.7	8.2	7.9	8.1	10.6	10.7
MERCOSUR	18.4	19.0	14.4	15.9	13.6	14.3
NAFTA	41.5	47.2	43.0	39.9	40.7	39.9
SAFTA	4.8	4.6	5.5	4.6	5.5	6.1

Source: UNCTAD Statistics accessed through unctadstat.unctad.org.

The trade partnership among South-Asian economies has not been outstanding but it is intensifying gradually over the last three decades. As shown in the Table-20 it appears that intra-regional exports share has been always greater than intra-regional imports share. All the three parameters of regional trade integration i.e., intra-regional exports share, imports share and trade share have shown steady growth and the partnership has almost doubled over the years but the magnitude is yet very low especially when compared with other RTAs of the world.

The share of exports within the region has increased by 4.24% since 1990, while, the share of imports within the region has increased by only 2.68 % during the period of twenty-seven years. The share of overall trade of all the economies within the region has increased by just 2.97% in last three decades. These figures indicate the inconsequential pace of growth in regional participation by all the economies of South-Asia combined.

Table-20: Trends in Percentage Share of Intra-Regional Trade in South-Asia's Total Trade

Year	Exports Share (%)	Imports Share (%)	Trade Share (%)
1990	3.62	2.19	2.79
1995	5.32	4.55	4.78
2000	4.52	4.57	4.57
2005	6.60	4.63	5.54
2010	6.01	3.69	4.61
2015	6.88	4.55	5.53
2017	7.86	4.87	5.76

Source: Own calculations done on UN-COMTRADE data accessed through WITS software

The relative significance of various countries in South-Asia concerning intra-regional trade can be assessed from the following data displayed in Table-21, 22 and 23 which depict the share of these countries in intra-regional exports, imports and total trade in South-Asia. The data indicates that Afghanistan has significantly increased its share in intra-regional exports, imports as well as total trade in South-Asia. On the contrary, Bangladesh, Bhutan and Pakistan are the countries whose share in intra-regional exports, imports and hence total trade has gone down significantly. India has shown massive increase in its intra-regional exports share while maintaining its share in intra-regional imports hence increasing its share in overall intra-regional trade over the last three decades. Share of Maldives and Sri Lanka has remained moreover constant over the period of time. Nepal's share in intra-regional exports has diminished slightly while notable growth in its share of intra-regional imports which has resulted in increase in its share of total intra-regional trade.

Table-21: Trends in Percentage Share of Intra-Regional Exports of Countries in South-Asia

Country	1990	1995	2000	2005	2010	2015	2017
Afghanistan	-	-	-	-	1.33	1.83	5.71
Bangladesh	3.82	3.54	2.93	3.14	2.66	2.67	-
Bhutan	6.70	2.87	4.03	2.75	2.22	-	-
India	59.13	75.25	60.21	61.88	68.27	75.97	78.03
Maldives	-	0.49	0.48	0.23	0.10	0.09	0.04
Nepal	-	2.04	11.22	4.03	4.00	1.92	1.67
Pakistan	22.91	12.00	14.61	20.59	17.72	13.23	10.24
Sri-Lanka	7.44	3.82	6.52	7.38	3.70	4.29	4.32

Source: Own calculations done on UN-COMTRADE data accessed through WITS software

Table-22: Trends in Percentage Share of Intra-Regional Imports of Countries in South-Asia

Country	1990	1995	2000	2005	2010	2015	2017
Afghanistan	-	-	-	-	4.53	6.59	14.46
Bangladesh	39.98	36.03	24.05	23.20	26.29	30.31	-
Bhutan	7.87	2.79	4.51	4.44	4.19	-	-
India	13.87	11.05	16.49	20.69	13.13	13.13	13.81
Maldives	-	2.00	2.95	1.94	1.24	1.64	2.23
Nepal	-	19.27	19.35	14.48	20.82	17.98	32.86
Pakistan	15.69	8.00	9.82	11.47	11.63	9.78	11.43
Sri-Lanka	22.60	20.87	22.83	23.77	18.18	20.57	25.21

Source: Own calculations done on UN-COMTRADE data accessed through WITS software

Overall, India dominates the quantum of intra-regional trade flowing within South-Asia with 50% share followed by Bangladesh with 16.42%, Nepal with 15.28%, Sri Lanka with 13.44%, Pakistan with 10.76% and

Afghanistan with 9.53%. Bhutan contributes 3.19% of total intra-regional trade while Maldives stays at 1% share. The constantly and significantly falling of Pakistan's participation in the intra-regional trade is noteworthy fact here.

Table-23: Trends in Percentage Share of Intra-Regional Trade of Countries in South-Asia

Country	1990	1995	2000	2005	2010	2015	2017
Afghanistan	-	-	-	-	2.90	4.20	9.53
Bangladesh	20.26	19.92	13.82	11.83	14.26	16.42	-
Bhutan	7.23	2.83	4.28	3.48	3.19	-	-
India	38.56	42.87	37.67	44.04	41.18	44.72	50.00
Maldives	-	1.25	1.75	0.97	0.66	0.86	1.00
Nepal	-	10.73	15.41	8.56	12.26	9.91	15.28
Pakistan	19.63	9.98	12.14	16.64	14.73	11.51	10.76
Sri-Lanka	14.33	12.42	14.93	14.48	10.81	12.38	13.44

Source: Own calculations done on UN-COMTRADE data accessed through WITS software

Conclusion

South-Asia comprises of eight countries India, Pakistan, Sri Lanka, Maldives, Bangladesh Afghanistan, Nepal and Bhutan out of which four countries are developing countries and four are LDCs. Although the region is emerging as the fastest growing region of the world, yet remains the least integrated region of the world. The smaller countries of the region depict more trade openness than their larger counterparts. Collectively, the region holds only 3.09% share of world's total trade. India alone represents 80.79% of the region's total exports and 75.5% of total imports. The merchandise trade basket of the region is dominated by manufactured products. The services exports are dominated by other commercial services and services imports mainly consist of transportation and travel services. The major trading partners of South-Asian economies are USA, European Union, China, UAE and India. High tariff rates are imposed by all the countries of the region which makes it a highly protected region. All the countries of the region except Afghanistan, Nepal and Bhutan are very outward oriented and their trade shares within the region are dismally low. The intra-regional trade in South-Asia has increased by only 3% in last three decades. The relative share of Bangladesh and Pakistan in intra-regional exports and imports has gone down significantly during this time period while, India's share has largely increased in intra-regional exports. Since, the three largest economies of the region India, Pakistan and Bangladesh are insignificantly involved in intra-regional trade, the overall share of intra-regional trade in South-Asia remains as low as 5.76% only.

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Predicting Stock Market Volatility: A Comparative Performance Study among BRICS Countries

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Abstract

We conduct an empirical study using post financial crisis data of the BRICS economies to examine the predictability performances of the ARIMA and the GARCH models from a risk management viewpoint. Our results show that the ARIMA models perform better against the latter in most of our cases except on the BOVESPA stock market. Secondly, we present the results of the forecasting accuracy estimation of a neural network experiment. Our findings indicate that artificial neural network model performs well and can be used to predict stock market volatility.

Keywords: ARIMA, Artificial Neural Network, BRICS Countries, GARCH, Stock Market Volatility

Introduction

The global financial crisis that hit many economies showed the vulnerabilities of the global financial system. The Basel II accord which emphasizes capital controls and regulatory review appeared to be no longer adequate in providing accurate financial models to be used by banks. As a result, authorised deposit taking institutions and banks increased their capital buffers in the Basel III accord.

Predicting risk volatility is both an interesting and challenging topic because of the complexity of markets which can be nonlinear, dynamic,

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noisy, and nonstationary (Abu-Mostafa, & Atiya, 1996). Research on stock prices volatility using time series data dates back to the seminal work of Engle (1982). Since then various models, Autoregressive Conditional heteroskedasticity (ARCH), Generalized Autoregressive Conditional Heteroskedasticity (GARCH), Autoregressive Integrated Moving Average (ARIMA), grew into a family of mathematical models to forecast volatility of time series data.

Risk managers use different methods regarding the computational accuracy of their financial risk system. The paper seeks to answer this question comparing different models for different financial assets of the BRICS economies.

Several predictive techniques have been used to forecast times series data. Autoregressive integrated moving average (ARIMA) models were first introduced by Box and Jenkins in 1970. They proved to be effective for univariate and multivariate time series data (see Al-Shaib, 2006; Mondal, Shit, & Goswami, S. 2014; Sardosky, 2016).

Other researchers have adopted the Markov-Switching technique to model nonlinearities that arise from different economic regimes (Hamilton, 1989; Ardia, Bluteau, Boudt & Catania, 2018). Forecasting can be achieved using 2 methodologies (statical and artificial intelligence approach). ARIMA model is a robust and efficient tool when dealing with short time series forecasting (Merh, Saxena, & Pardasani, 2010).

The conditional volatility of a financial asset in the GARCH (p,q) model is said to be a linear function of the square q and past p conditional variances. It is expressed as:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \, y^2_{t-i} + \sum_{j=1}^{p} \beta_j h_{t-j} \qquad ...(1)$$

where $\alpha + \beta < 1$, and the parameters $\alpha_i \geq 0$, $\beta_j \geq 0$ with i(0,…,q) and j(1,…p).

The GARCH model is sometimes referred as the GARCH(1,1) model where the first number inside the parentheses corresponds to the number of autoregressive lags that equation (1) includes. The second variable in the parentheses corresponds to the number of moving average lags. Although models with more than one lag are sometimes needed to determine accurate variance forecast, the specification (p, q) = (1,1) has been able to model the volatility dynamics of financial data in many empirical studies. The model uses the maximum likelihood estimation by substituting h_t for σ^2 which is then maximized with respect to the parameters.

Multiple extensions of the GARCH models that take into consideration nonlinearities, asymmetries and other properties observed in financial market are important instruments for risk managers (Ardia et al, 2018). A good risk model must be able to include the properties of stock returns.

Volatility clustering is also an important feature the early family of GARCH model was able to utilize (Engle, 1982). These early models fail to capture the effects (good or bad) of a news on volatility. These shortcomings have led to the development of a more flexible model that allows for different types of shocks (positive or negative) to have different impact on volatility. These new models are the Exponential GARCH (EGARCH) model, the threshold GARCH (TGARCH) model, the Asymmetric GARCH (AGARCH) model, Contemporaneous asymmetry in GARCH model (see Engle & Ng, 1993; Zakoian, 1994; El Babsiri & Zakoian, 2001). In this paper we choose the GARCH (1,1) because it is one of the most robust among the models mentioned earlier. This model is also useful when the analysis concerns the volatility of stocks with a great number of observations (Matei, 2012).

Recently, Nayak & Misra (2018) show that condensed polynomial neural network (CPNN) enhanced the accuracy of stock forecasting indices. Similarly, artificial neural network (ANN) and deep neural network (DNN) reveal to perform better than the traditional model of forecasting (Zhong & Enke, 2019).

A recent research on the portfolio market in the BRIC economies uses three univariate method (GARCH, EGARCH, TARCH) for modelling volatility, the paper finds that capital market in the BRIC's countries is similar to that of selected developed countries (Tabajara, Fabiano, & Luiz, 2014). Other studies have used the constant conditional correlation (CCC), the dynamic conditional correlation (DCC), and the asymmetric dynamic conditional correlation (ADCC) GARCH models to assess portfolio risks when investing in BRICS economies (Bonga-Bonga & Lebogang, 2018). As it can be seen, these studies do not provide a comparison of the accurate model to predict volatility in the BRICS economies. A shortcoming of these studies is that they use the same model with different calibration technique to evaluate the portfolio risks in the BRICS market.

We attempt to address this issue by examining the volatility of stock markets indices in emerging BRICS countries using the ARIMA and the GARCH (1,1) model. The paper compares the forecasting accuracy of both model using different forecasting errors. Our second contribution is that we present the performance of an artificial neural network (ANN) on volatility forecasting.

The paper proceeds as follows. The next section discusses the data and the methods used. Section 3 presents the empirical findings. Section 4 concludes.

Data and Methodology

In accordance with the aim of the study, we investigate the volatility of market prices using the GARCH, the ARIMA, and the ANN methods. We consider the following stock market indices in BRICS countries namely

the Johannesburg Stock Exchange (JSE), the Shangai Stock Exchange Composite (SSEC), the National Stock Exchange of India (SSE), the Brasil Stock Exchange (BOVESPA), the Moscow Exchange (MOEX).

We use the historical monthly stock prices of these indices for the period starting from January 01, 2010 to December 30, 2019. The data comprises 4 components, the closing price, the open price, the high price, and the low price. The study uses the closing price because it reflects all the information related to the stock price within a trading day. The datasets are retrieved from Bloomberg and Investing.com.

Risk Forecasting with ARIMA Model

Building on the ARMA model, Box and Jenkins developed the autoregressive integrated moving average (ARIMA). In contrast to previous methods, the Box-Jenkins model does not use equations but employs the stockatic aspects of time series data with a single approach that allows the data to predict the future (Gujarati, Porter, & Gunasekar, 2009). This is also referred as a univariate time series analysis. The ARIMA (p, d, q) has 3 elements, which are autoregressive element defined by p, integrated element defined by d, moving average element defined by q. It is represented in the following equation:

$$y_t = a + \theta_1 y_{t-1} + \theta_2 y_{t-2} \ldots, \theta_p y_{t-p} + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} \ldots \theta_q y_{t-q} + \epsilon_t \quad \ldots(2)$$

Where y_t represents the closing stock price at a time t, a is the intercept; $\theta i (i = 1,2 \ldots p)$ and $\theta j (j = 1,2 \ldots q)$ are the parameters of the model and ϵ_t is the error term. The model must be specified in an optimal manner in order to minimise the measure of errors. It requires a three step approach, identification, estimation and diagnostic checking.

Risk Forecasting with GARCH Model

A primary goal of financial risk management is modelling the risks factors of the assets held by the financial manager. In this paper, we employ a univariate GARCH(1,1) model, then we estimate the volatility risks associated with each portfolio. The model is specified as:

$$e_t = h_t z_t \quad \ldots(3)$$

$$h_t^2 = w + \alpha e_{t-1}^2 + \beta h_{t-1}^2 \quad \ldots(4)$$

The constants need to be positive, such that $w > 0$, $\alpha > 0$, $\beta > 0$ and $\alpha + \beta < 1$. The weights of the model are given as $(1 - \alpha - \beta, \beta, \alpha)$. The long run average variance which captures volatility is expressed as: $\sqrt{w/(1 - \alpha - \beta)}$. Also, h_t^2 is the variance of e_t, which contains the history of the innovation instrument (z_t) until the period t -1. We use a GARCH t-distribution which assumes that the standardized innovation are not normally distributed but follow a student t-distribution with v degree of freedom (See Bollerslev,

1987). The maximum likelihood estimation requires that v > 2 corresponds to the degree of freedom to be estimated. The log-likelihood function takes the following form:

$$\text{LogL}(\theta) = \sum_{t=1}^{t} log(\Gamma (\frac{v+1}{2}) \Gamma(\frac{v}{2})^{-1} ((v-2)\,\sigma_t^2)^{-1/2} (1 + (v-2)^{-1}\,\sigma_t^{-2}\,\epsilon_t^2) - (v+1)/2) \quad ...(5)$$

The predictor of the unconditional variance (σ^2) is obtained from the equation:

$$\hat{h}_{t+s}^2 = w\,(s-1) + h_{t+1}^2 \quad ...(6)$$

Where 's' is the forecast horizon to be predicted.

Risk Forecasting with Artificial Neural Network (ANN)

Neural network are flexible estimators with the ability to model a wide range of nonlinear data. The assumptions under the model do not require much economic economic theory which enable them to predict different types of functions correctly. The generalization technique employed by artificial neural network have been applied successfully in financial markets (see Zhang, 2003; Mallikarjuna & Prabhakara, 2019). The implementation of the model requires the use of the input and the output layers of nodes corresponding to the number of variables observed and the forecasting period, respectively. These layers are also separated by what is referred as the hidden layers. The mathematical representation of the model between the output y_t and the input $(y_{t-1,} y_{t-2\ldots,} y_{t-p})$ is:

$$y_t = \beta_o + \sum_{q=1}^{j} \beta_j.g\,(\alpha_o j + \sum_{i=1}^{p} \alpha_i j.y_{t-i}) + \epsilon_t \quad ...(7)$$

with $\beta_j\,(j = 0,1,2,\ldots,q)$ and $\alpha_i j\,(i = 0,1,2,\ldots,p;\ j = 1,2,\ldots,q)$

β_j and $\alpha_i j$ are the parameters of the model, where p and q are the numbers of input nodes and hidden notes, respectively. The hidden layer function of the model is expressed as:

$$\phi\,(z) = \frac{1}{1 + \exp(-z)} \quad ...(8)$$

We must note that the artificial neural network in equation (7) runs a nonlinear functional mapping using past observations of $(y_{t-1,} y_{t-2\ldots,} y_{t-p})$ to the future value of y_t such that:

$$y_t = f(y_{t-1,} y_{t-2\ldots,} y_{t-p}, w) + \epsilon_t \quad ...(9)$$

The network structure and the model parameters determines the function f. This shows that the neural network works similarly as a nonlinear autoregressive model. The modelling process requires the selection of the number of lagged variables (p) and (q). However, there is no systematic

rule for the selection of the lagged variables. Neural network is an extensive process which uses a forward propagation, a loss function and a backward propagation.

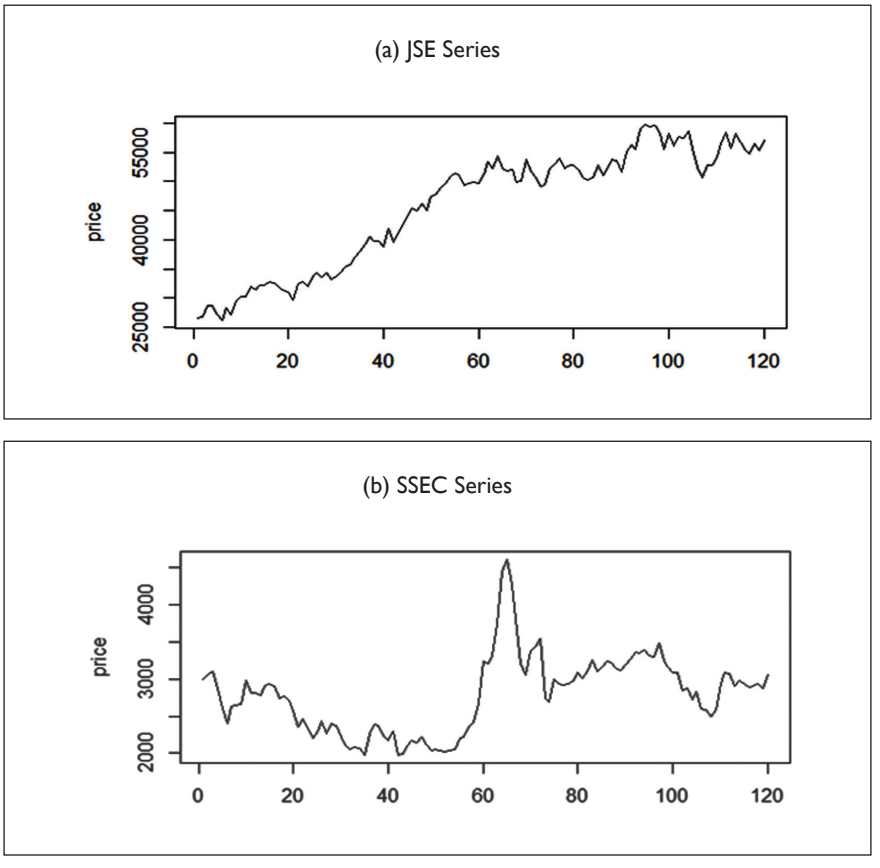
Empirical Results

The Datasets

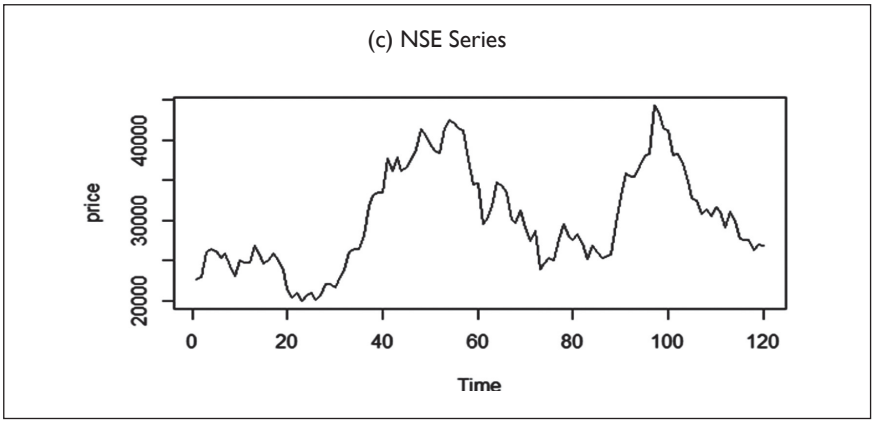
We examine the performance of the ARIMA, the GARCH, and the ANN model using different well known stock exchange in the BRICS countries. The analysis of time series data have been widely investigated in the literature. However, there is little research on the accuracy of linear and nonlinear models to time series data applied in these markets.

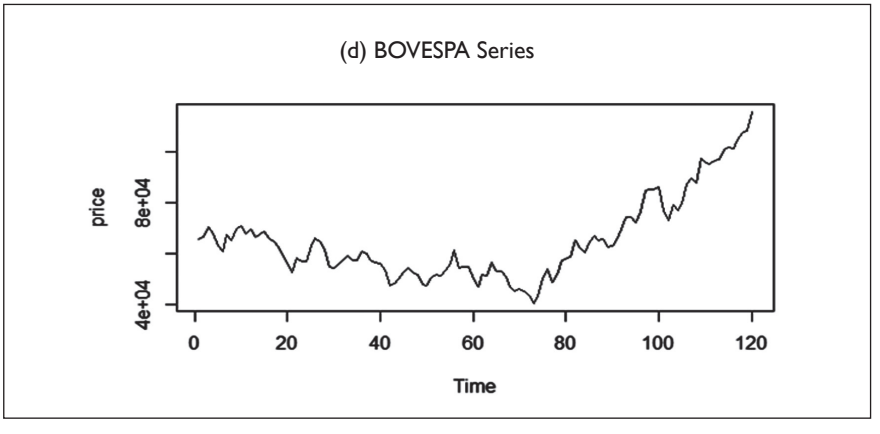
The data we uses contain 120 observations for each market from the period of January 01, 2010 to December 30, 2019. Thus, there is a total number of 600 observations. The plot of the data shows that there is a cyclical pattern in the each of the series observed. The JSE is represented below (see Figure-1).

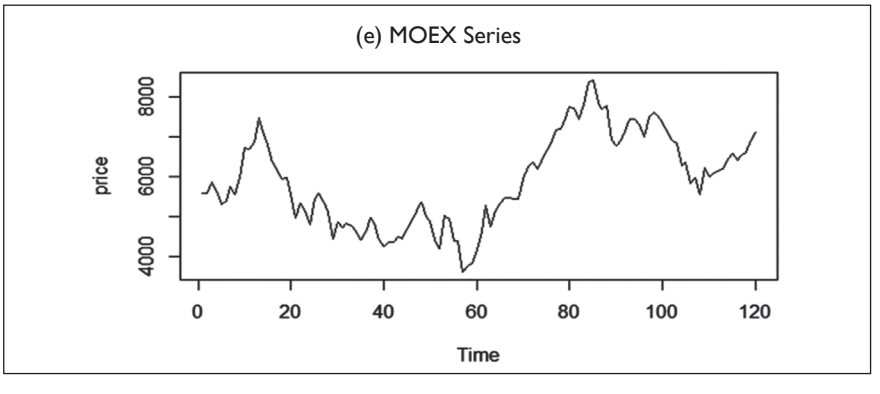
Figure-1: Time plots of a) JSE series, b) SSEC series, c) NSE series, d) BOVESPA series, e) MOEX series



Further, the SSEC series (b) shows a trend in the data which needs to be removed for efficient analysis. The rest of the series, NSE, BOVESPA AND MOEX also display irregularities and patterns in (c), (d), and (e), respectively.







Following the work of Zhang (2003), we employ the natural logarithmic transformed data to model and forecast the series. To assess the predicting

performance of different models, each data is then divided into two samples, training and testing (Adhikari & Agrawal, 2014). The steps for each model are presented in the next section. We compute the accuracy of each method for all the series using the mean error (ME), root mean squared error (RMSE), mean absolute error (MAE), mean percentage error (MPE), and the mean absolute percentage error (MAPE).

Results and Discussion

In this paper, we compare the results of the ARIMA and the GARCH model for each of the series observed. Several forecasting accuracy measures are used to reduce the potential bias in selecting one indicator over the other. All experimental work in this study are implemented via the R system. Table-1 reports the summary statistics of the monthly data for all the series examined. We report the mean, the standard deviation (Std), the skewness (Skew), the kurtosis (Kurt), the Jarque-Bera statistics (JB) evaluated for all the series as well as the value added risk (VaR) at 1% and 5%, respectively.

We observe a higher volatility in the JSE and BOVESPA market compared to the other stock market. Also, JSE and MOEX are the only stock indices to exhibit negative skewness. This shows the asymmetric distribution of the data. Positive skewness is displayed in the other stock and appears to be more pronounced in BOVESPA.

Table-1: Descriptive Statistics of the Stock Market Indices

Stock Market Indices	Mean	Std	Skew	Kurt	JB	1% VaR	5% VaR
JSE	4.648	0.106	-0.687	-1.007	14.436 (0.000)	-4.426	-4.456
SSEC	3.437	0.079	0.066	-0.371	0.626 (0.731)	-3.297	-3.309
NSE	4.471	0.089	0.084	-1.003	4.847 (0.088)	-4.304	-4.320
BOVESPA	4.800	0.100	0.665	2.856	8.952 (0.011)	-4.632	-4.668
MOEX	3.763	0.084	-0.183	2.130	4.454 (0.107)	-3.576	-3.638

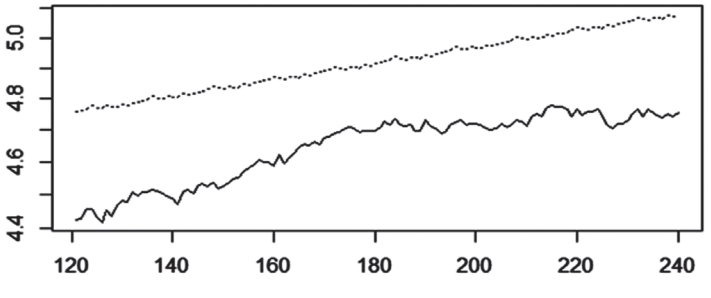
Further, we observe a significant and positive curtosis for BOVESPA and MOEX indicating a leptokurtic distribution. Light tails are however present in the JSE, SSEC, and NSE stock indices. The Jarque-Bera test signals that the series have a non-normal distribution. From Table-1 the VaR shows that SSEC is the least risky portfolio.

Risk managers do not only care about the VaR but also about the accuracy of the predictive model. Hence, in this paper, we attempt to assess the

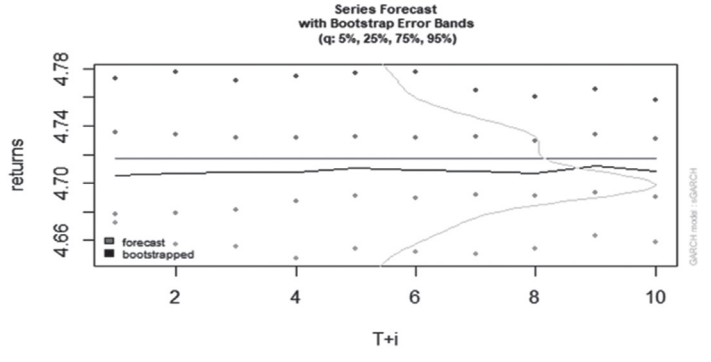
performance of the GARCH and the ARIMA model for yielding accurate forecasting. Figure-2 presents the actual versus the forecast value of each model on all the series examined.

Figure-2 : (a,b) ARIMA and GARCH prediction of JSE, (c,d) ARIMA and GARCH prediction of SSEC, (e,f) ARIMA and GARCH prediction of NSE, (g,h) ARIMA and GARCH prediction of BOVESPA, (i,j) ARIMA and GARCH prediction of MOEX

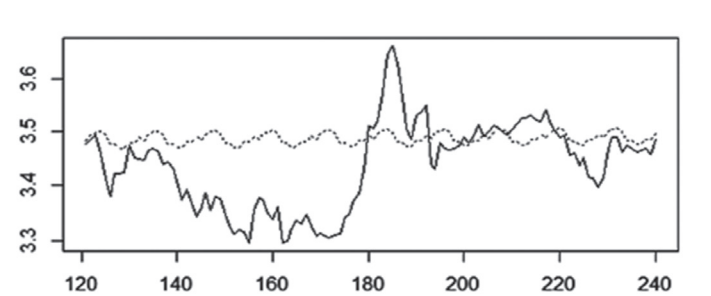
(a) ARIMA prediction of JSE



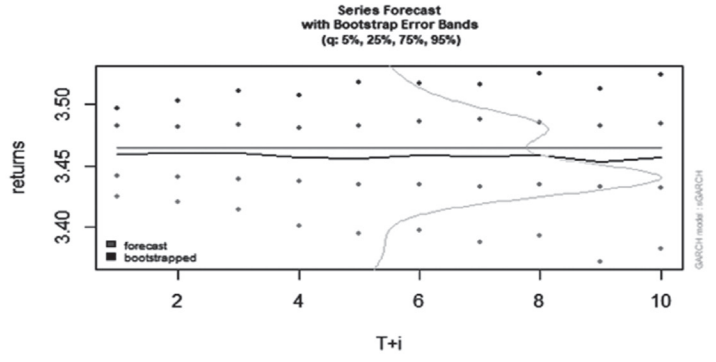
(b) GARCH prediction of JSE



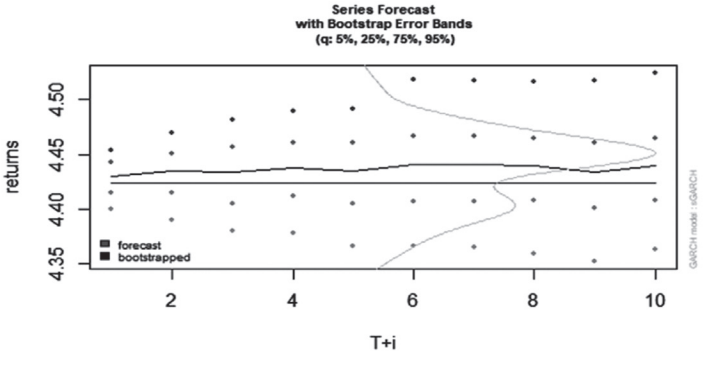
(c) ARIMA prediction of SSEC



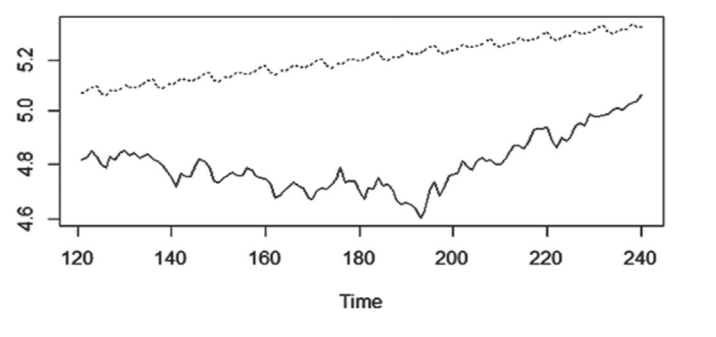
(d) GARCH prediction of SSEC



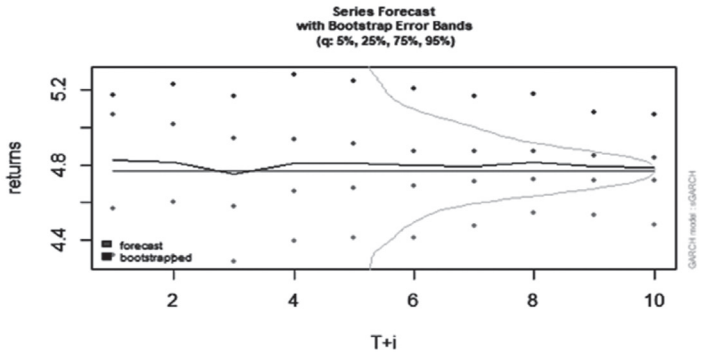
(f) GARCH prediction of NSE



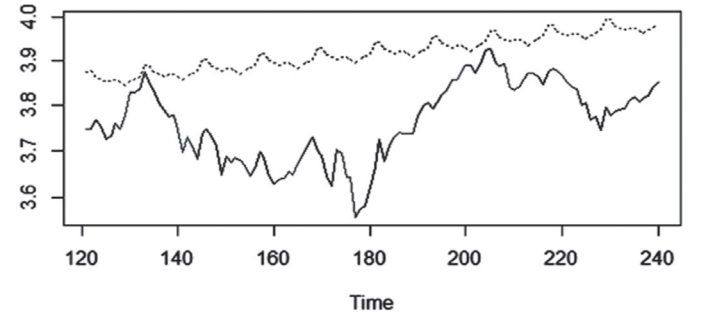
(g) ARIMA prediction of BOVESPA



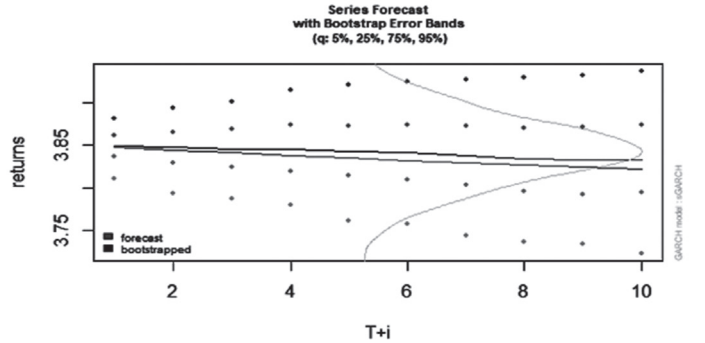
(h) GARCH prediction of BOVESPA



(i) ARIMA prediction of MOEX



(j) GARCH prediction of MOEX



actual ……. **predicted**

The data are differenced to remove non-stationarity and trending as displayed in (Figure-1). An autoregressive integrated model (1,1,0) has been identified to be the most effective among all ARIMA models examined using the model with the lowest information criteria. Using the GARCH(1,1) model, it allows the random residuals to have a nonGaussian distribution. Table-2 provides the forecasting results for the JSE series. Arima model clearly outperforms the Garch model as displayed in Table-2.

Table-2: Forecasting Performance for JSE Data

Statistics Error	ARIMA	GARCH (1,1)
ME	3.390045	0.002776554
RMSE	0.01416787	0.01485831
MAE	0.01186813	0.01219265
MPE	0.001124772	0.05998343
MAPE	0.2558408	0.2628162
ACF1	-0.004088683	-0.2247363

Table-3 provides the forecasting comparisons for the SSEC series. Several tests using the autocorrelation function (ACF) and the partial autocorrelation function (PACF) are performed to ensure that the residuals follow a random walk. We find that an autoregressive model (0,1,0) to be the best model among all ARIMA models. The ARIMA model outperforms the GARCH model.

Table-3: Forecasting Performance for SSEC Data

Statistics Error	ARIMA	GARCH (1,1)
ME	0.0001020787	7.373046
RMSE	0.02715447	0.02726647
MAE	0.01940887	0.01954277
MPE	-0.0001496649	-0.0009912583
MAPE	0.5636283	0.5675243
ACF1	0.1560434	0.1557153

Table-4 displays the accuracy forecast for the NSE series. The autoregressive model (0,1,0) is the most parsimonious among all class of ARIMA. Similar to the previous results, the findings suggest that ARIMA performs better than the GARCH model.

Table-4: Forecasting Performance for NSE Data

Statistics Error	ARIMA	GARCH (1,1)
ME	0.0006597978	0.0006287542
RMSE	0.02461297	0.02471295
MAE	0.01883392	0.0189556
MPE	0.01351797	0.01279123
MAPE	0.4213035	0.4240035
ACF1	0.1089144	0.1085865

Table-5 highlights the performance accuracy for the BOVESPA series. The autoregressive model (2,1,2) has been identified to be the best model among ARIMA models. In contrast to the previous findings, the results displayed show evidence that the GARCH model outperforms the ARIMA model.

Table-5: Forecasting Performance for BOVESPA Data

Statistics Error	ARIMA	GARCH (1,1)
ME	0.002102984	0.002080189
RMSE	0.02433643\	0.02443449
MAE	0.01917032	0.01929095
MPE	0.04130731	0.0408141
MAPE	0.4006537	0.4031802
ACF1	0.05260159	0.05239774

Table-6 shows the accuracy forecast for the MOEX. An autoregressive model (0,1,0) has been identified to be the most parsimonious among all class of ARIMA models. The results show that the ARIMA model outperforms the GARCH model.

Table-6: Forecasting Performance for MOEX Data

Statistics Error	ARIMA	GARCH (1,1)
ME	0.0008965176	0.0008725625
RMSE	0.02560681	0.02571188
MAE	0.01972764	0.01986193
MPE	0.021241	0.02057916
MAPE	0.5272513	0.5308416
ACF1	0.01148911	0.01153333

Further, we present the results of forecasting the stock market for JSE, SSEC, and BOVESPA using artificial neural network (ANN). We selected ANN because it is one of the most successfull machine learning in predicting method (Adhikari & Agrawal, 2014). ANN models are used for non-linear time series data, hence we do not compare these models to the traditional models used earlier.

Also, we do not include the NSE and MOEX in the analysis because of the unavailability of the historical volume traded data for those series. The intrisic relationship in data built by the ANN is displayed below (see Figure-3). The open price, low price, high price, and volume are used to predict the closing price of each stock. We show the performance of ANN method using the RMSE statistics. The results are shown in Table-7.

Figure-3: Architecture of an ANN Model

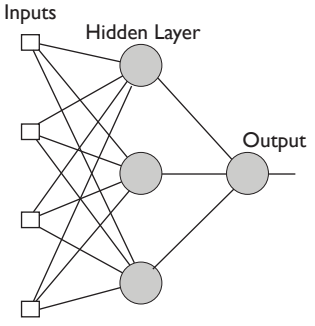


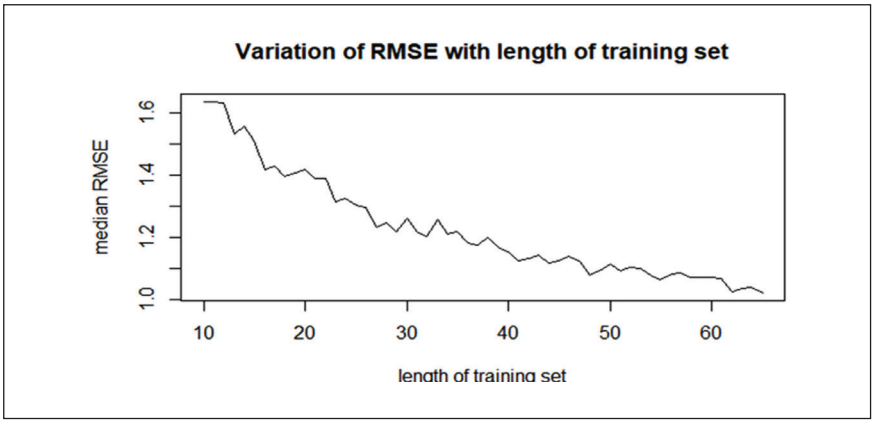
Table-7: Forecasting Results using ANN

Stock Market	JSE	SSEC	BOVESPA
RMSE	0.8615390072	0.07241645	2.140041169

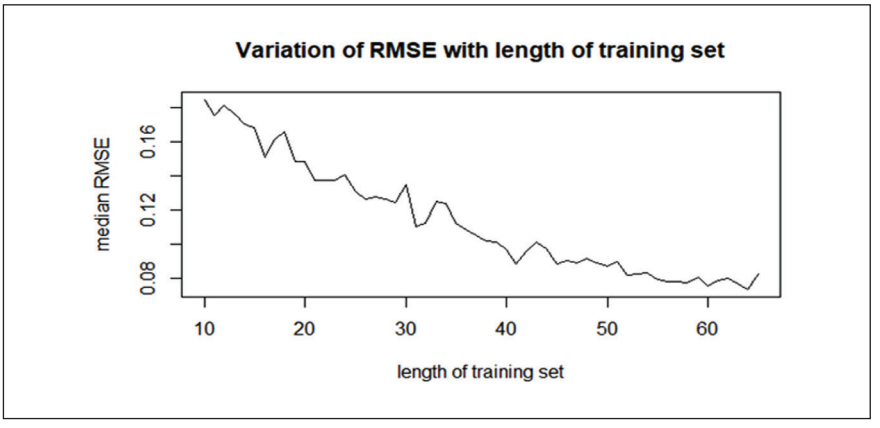
The residuals error of our ANN estimations are low, indicating that artificial neural network performs reasonably well. We then perform a robustness test of our ANN method to ensure the accuracy of our model estimations. We use a k-fold cross-validation tool which requires separating the data into training and test set. The data are then divided into approximately equal size set and each set is used as a test set while the remaining set is used as a training set. This method ensures that the findings are free of sample bias. In Figure-4 we show the variation of the RMSE for each test.

Figure-4: Variation of RMSE using ANN model for (a) JSE series, (b) SSEC series, and (c) BOVESPA series

(a) JSE



(b) SSEC Series



(c) BOVESPA

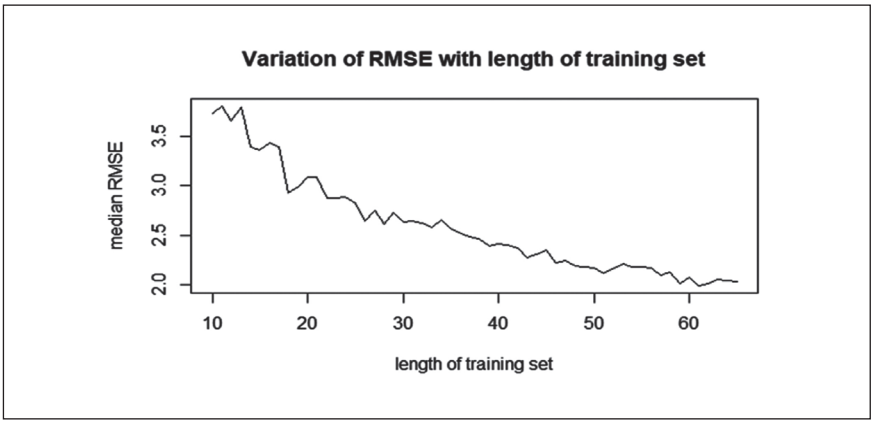


Figure-4 shows that as the training set increases the forecast accuracy for each series rises. This confirms and validates the findings that neural network can be used to predict time series data in stock market.

Conclusion

The analysis of time series data is an important topic for academics and practitioners. Financial managers always look for ways to improve the forecasting accuracy of their management portfolios. In that regards, this paper compares the performance of two important forecasting methods such as the ARIMA and GARCH model in the BRICS stock market. After identifying and implementing the right model for each stock series, the study finds that the ARIMA model outperforms the GARCH model in

almost all the series observed except on the BOVESPA. As an extension the paper also presents the forecasting performance of an ANN model. The results show that ANN model performs well and can be used to predict stock market data.

The study recommends that financial managers should make use of the ARIMA model for stock market predictions. Another useful continuation of this research is to evaluate the performance of ARIMA and GARCH model using time series data for companies operating in different sectors of the economy. This would help to generalize the results and strengthen the findings on the accuracy of forecasting models.

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The Traditional Phillips Curve – Evidence from Developed and Least Developed Countries

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Abstract

The present study examines the validity of the traditional Phillips curve both in developed and least developed countries. The linear correlation and regression models are used to estimate the interrelationship between inflation and unemployment rates in these countries. Time series data have been collected for the period 1975-2019 for Canada and Belgium. In the case of Laos and Liberia, the observations are taken for the period 1991-2019. The results of the study suggest that inflation and unemployment rates are not conversely correlated in these economies. On the other hand, in developed countries such as Canada and Belgium, the Phillips curve has flattened, and in least developed countries like Laos and Liberia, it shows a positive relationship between these two macro variables. The study has also observed free trade, nominal wage rigidities, anchoring inflation expectations, weak bargaining power of workers and stagflation as some of the factors that have weakened the traditional Phillips curve model in these economies.

Keywords: Belgium, Canada, Inflation, Laos and Liberia, Phillips Curve, Unemployment

Introduction

The Phillips curve is a very significant economic model developed by the economist A.W Phillips in 1958. The curve represents an inverse relationship between unemployment rates and inflation. Phillips observed the trends in UK's annual money wage growth and unemployment rates for the period 1860 – 1957 and displayed his observations on a scatter graph, which showed that money wage rates tend to be high when unemployment

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is low and vice versa. Thus, the statistical evidence demonstrated a converse correlation between unemployment rates and wage inflation. (Phillips, 1958). Later economists adapted it to show the short- term link between price inflation and unemployment in an economy.

Theoretical Framework

The Phillips curve model fundamentally explains how demand side shocks can influence unemployment rates and inflation in an economy. When the economy operates at full potential, a rise in aggregate demand (AD) can result in a fall in unemployment as firms recruit more workers to increase production at the expense of inflation due to a rise in wages and higher unit labour costs. On the other hand, if there is a decrease in AD at full employment level of output, demand for workers will fall, unemployment increases and therefore, wage pressures in the labour market are likely to be low owing to spare capacity and inflation falls. Thus, changes in AD cause expansion or contraction along the Phillips curve and explains the negative correlation between inflation and unemployment in the short run. The Phillips curve was widely accepted during the 1960s as it accurately delineated real world macroeconomics and offered a menu of policy options for central banks and the government to choose appropriate demand side policies targeting either inflation or unemployment.

However, in the 1970s some developed countries, including the UK and the USA, experienced stagflation due to negative supply side shocks (Olson, 1982). At that time, American economists and monetarists Milton Friedman and Edmund Phelps questioned the theoretical underpinnings of this model as it could not illustrate the concurrent increase in inflation and unemployment caused by stagnant growth and high unemployment. Consequently, Friedman reformulated the Phillips curve by introducing the idea of the natural rate of unemployment and the theory of adaptive expectations (Friedman, 1968). It is worth noting that even when there is full employment in an economy, the natural rate of unemployment prevails. According to the adaptive expectations hypothesis, people adjust their presumptions in the future, based on recent past incidents. Thus, the Phillips curve was updated by incorporating expected inflation as a determinant of current inflation into the model as individuals started showing evidence of adaptive expectations when inflation persisted for a long time in the 1970s (Friedman, 1968) and this came to be known as the expectations - augmented Phillips curve.

Monetarists argued that rational employers, workers and individuals pay more attention to wages adjusted for inflation and thus, nominal wages are agreed on the basis of anticipated inflation. This being the case, if the government tries to reduce unemployment below the natural rate using expansionary policies, increase in income and output will encourage firms

to hire more workers to produce and absorb excess demand by paying slightly higher nominal wages. As workers suffer from money illusion in the short term, they falsely perceive an increase in money wages as an increase in real wages, and will be willing to supply more labour, which results in a decrease in unemployment and an increase in inflation. However, in due course, workers will realise that their real purchasing power hasn't increased and therefore, revise their inflation expectations, and bid for even higher money wages in order to retain their real income. When workers demand higher wages, firms' costs increase, profits decrease and hence, they cut down the number of workers and unemployment will return to its natural rate, although inflation stays high and the Phillips curve shifts upwards.

Eventually, Franco Modigliani and Lucas Papademos discovered another important concept called Non Accelerating Inflation Rate of unemployment (NAIRU) in 1975. They expanded on the natural rate of unemployment hypothesis put forward by Milton Friedman. According to the NAIRU theory, if the NAIRU is greater than the actual unemployment rate, then inflationary expectations rise and inflation tends to accelerate, and if the actual unemployment rate is greater than the NAIRU, then inflationary expectations fall and inflation tends to decelerate. The shifts in the short run Phillips curve are caused by these short term deviations. If the NAIRU and the actual unemployment rate are coequal, then it results in non-accelerating and stable inflation, and the natural rate of unemployment is maintained. Thus, according to Friedman, unemployment is traded not with actual inflation but expected inflation. He argues that once inflation expectations are fully adjusted and real wage is reinstated, unemployment falls back to its natural rate at the current rate of inflation. In other words, inflation may rise or fall based on the size of AD in the economy, nonetheless, the unemployment rate will be always at the natural rate. Therefore, monetarists argue that in the long run, the Phillips curve is a vertical line as the natural rate of unemployment will always be maintained irrespective of changes in inflation.

Related Literature and the Relevance of the Study

Several studies have been carried out to examine the relevance of the Phillips curve since it was developed in 1958. The Phillips curve model has been extensively revised and adapted in the past sixty years incorporating more macro variables and adopting sophisticated methodologies. Some of those studies that have observed a convex correlation between inflation and rates of unemployment are Akerlof et al. (1996), Clark et al. (1996), Clark and Laxton (1997), Debelle and Laxton (1997), Laxton et al. (1999), Tambakis (1999), Turner (1995), Filardo (1998), Schaling (2004), Barnes

and Olivei (2003), Huh et al. (2009), and Fuhrer et al. (2012). On the other hand, a few other eminent studies by Gordon (1997), Dupasquier and Ricketts (1998), Eliasson (2001), Tambakis (2009), Ball and Mazumder (2011). Eisner (1997) and Stiglitz (1997) observed a concave Phillips curve.

In this context, it is worth reviewing a couple of recent studies that are similar to the present work. Muchdie (2016) carried out an investigation to analyse the Phillips curve using simple Linear regression model and concludes that the Phillips curve exists in Asian , African and European Economies. However, it was based on the cross-section data, which is unable to trace the trends in macro variables over a time period.

Connor (2017) conducted a study to explore the Phillips curve in developed countries such as the USA and Japan and developing countries like Colombia. Nonetheless, the Phillips curve analysis was developed by adding more variables such as GDP and industrial productivity and used the multiple regression model.

In the present study, the Phillips curve analysis has been conducted using the data from four countries across the globe. Canada and Belgium are developed countries representing two different continents. Nevertheless, they have similar economic and political systems. Besides, the main goal of the central banks in both countries is to ensure price stability and their monetary policy is mainly aimed at maintaining the two percent target rate of inflation, which is one of the crucial macro indicators used in the present work. Moreover, only limited studies have been carried out to analyse the relevance of the Phillips curve in these two countries. Therefore, Canada and Belgium have been chosen for the analysis of the Phillips curve model. In contrast, Laos and Liberia are the two least developed countries that are located in Southeast Asia and West Africa respectively and they experience similar economic and political challenges. Furthermore, no attempt has been made to investigate the existence of the Phillips curve in these two least developed countries. Hence, Laos and Liberia have been selected to explore the significance of the Phillips curve model in these two poor countries. More importantly, two developed and two least developed countries have been chosen to examine whether there is any difference in the nature and relevance of the traditional Phillips curve among developed and least developed countries.

Although, quite a lot of research has been conducted in estimating and exploring the relevance of the Phillips curve across the world, only limited studies have been conducted to estimate the traditional Phillips curve using the original statistical model. Therefore, the purpose of this study is to explore the plausibility of the traditional Phillips curve using the simple linear regression model providing evidence from both developed and least developed countries and fill the research gap in this field.

Methodology

We have used scatter plots as well as the simple OLS regression model to examine the nature and the relevance of the traditional Phillips curve in Canada, Belgium, Laos and Liberia.

The regression equation is:

$y^{\blacktriangle}=b_0+b_1x+ \acute{\varepsilon}$

$y^{\blacktriangle}$ is inflation in the current year(dependent variable)

b_0 is the intercept

b_1 is the regression co-efficient

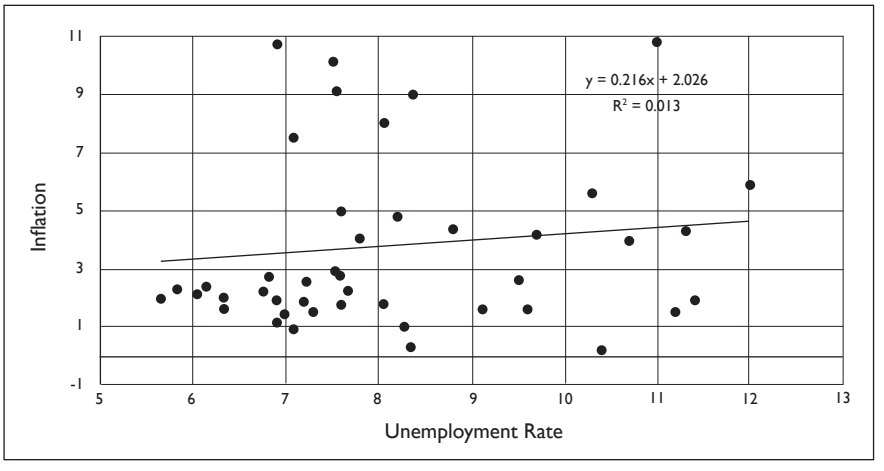
x is the unemployment rate(independent variable)

$\acute{\varepsilon}$ is the error term

The Traditional Phillips Curve in Canada

The data for inflation (consumer price index) and unemployment rates (unemployed workers as a percentage of the total labour force) were collected from the OECD and the scatter diagram that shows the relationship between these two macro variables is given in Figure-1.

Figure-1: The Phillips Curve in Canada (1975-2019)



Source: Author's estimation

We have also used the linear regression model to estimate the relationship between inflation and unemployment rates in Canada for the period 1975-2019.

Empirical Analysis	
Correlation	0.114359561
R^2	0.013078109
Adjusted R^2	-0.009873563
S E	3.149433604
Observations	45

	Coefficients	Standard Error	t Stat	P-value
Intercept	2.026415509	2.380998233	0.851078	0.399441
Unemployment rate	0.216459562	0.286755303	0.754858	0.454449

In our estimate, the correlation coefficient(R) is only 11 percent, which indicates that there is a weak positive linear relationship between inflation and the unemployment rate for the period 1975-2019 in Canada.

The coefficient of determination (R^2) shows that only 1 percent of the variability in Y(inflation) is explained by the independent variable, the unemployment rate.

The total number of observations is 45, which is the number of years under consideration.

The regression equation shows a one percent increase in the unemployment rate will increase inflation by 22 percent.

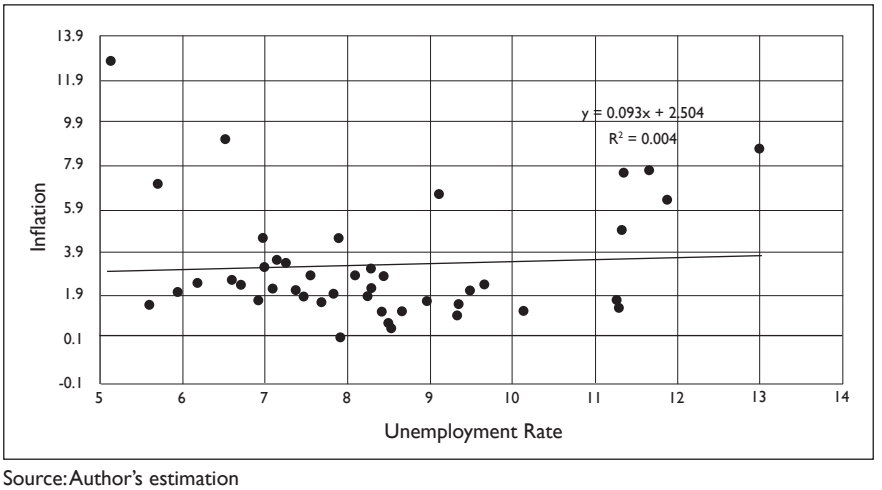
Moreover, the p-values for b_0 and the unemployment rate are not statistically significant at 95% confidence level as they are greater than .05.

Hence, it can be inferred that the scatter diagram as well as the regression estimate show that for the last 45 years, there has been a weak positive relationship between inflation and unemployment rates in Canada and the evidence shows that the traditional Phillips curve is not alive in this country.

The Traditional Phillips Curve in Belgium

The data for inflation (consumer price index) was collected from the OECD and the unemployment data (unemployed workers as a percentage of the total labour force) was gathered from the World Bank. The scatter graph that displays the correlation between these two macro variables is given in Figure-2.

Figure-2: The Phillips Curve in Belgium (1975-2019)



Source: Author's estimation

We have also used the OLS regression equation to examine the traditional Phillips curve in Belgium for the period 1975-2019.

Empirical Analysis	
Correlation	0.063718522
R Square	0.00406005
Adjusted R Square	-0.019101344
Standard Error	2.718308992
Observations	45

	Coefficients	Standard Error	t Stat	P-value
Intercept	2.50450247	1.893454671	1.322716	0.192921712
Unemployment rate	0.093062862	0.22227625	0.418681	0.67753315

It can be seen that the R is positive and is 6 percent, which indicates that there is a very weak positive linear relationship between inflation and the unemployment rate for the period 1975-2019 in Belgium.

R^2 is almost zero percent and implies that inflation is not all influenced by changes in unemployment rates.

The total number of observations is 45, which is the number of years considered for analysis.

The regression coefficient shows a one percent increase in the unemployment rate will increase inflation by 9 percent.

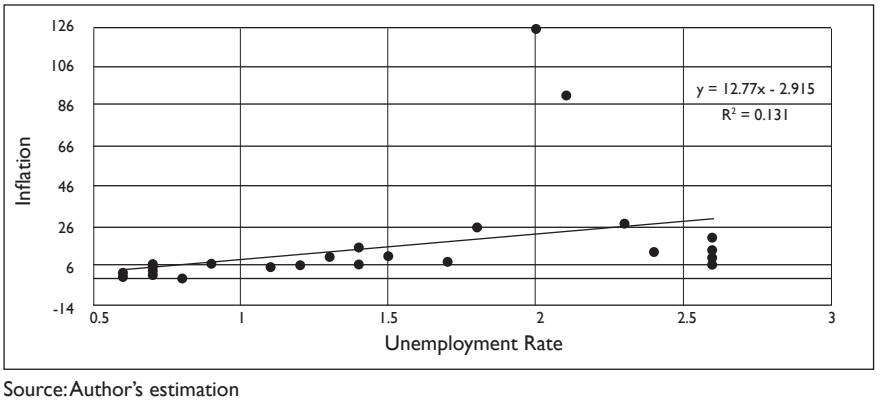
Furthermore, the p-values for b_0 and the unemployment rate are not statistically significant at 5 percent level as they are greater than .05.

Thus, the scatter graph and the regression analysis demonstrate that in the last 45 years, the traditional Phillips curve has flattened in Belgium.

The Traditional Phillips Curve in Laos

The data for inflation (consumer price index) and unemployment rates (unemployed workers as a percentage of the total labour force) were collected from the World Bank and the scatter diagram that shows the correlation between these two macro variables is given in Figure-3.

Figure-3: The Phillips Curve in Laos (1991-2019)



Source: Author's estimation

We have also used the linear regression model to estimate the correlation between unemployment rates and inflation in Laos for the period 1991-2019.

Empirical Analysis	
Correlation	0.362444849
R^2	0.131366269
Adjusted R^2	0.099194649
SE	25.56086356
Observations	29

	Coefficients	Standard Error	t Stat	P-value
Intercept	-2.915302161	10.21779022	-0.285316306	0.777579147
Unemployment rate	12.77695814	6.322982832	2.020716879	0.053328881

It is quite clear that the correlation coefficient (R) is 36 percent and positive, which means that there is a moderate positive linear relationship between inflation and unemployment rates for the period 1991-2019 in Laos.

R^2 shows that 13 percent of the changes in Y (inflation) is explained by the independent variable, the unemployment rate.

The total number of observations is 29, which is the number of years considered for the study.

The regression equation shows a one percent increase in the unemployment rate will increase inflation by 13 percent.

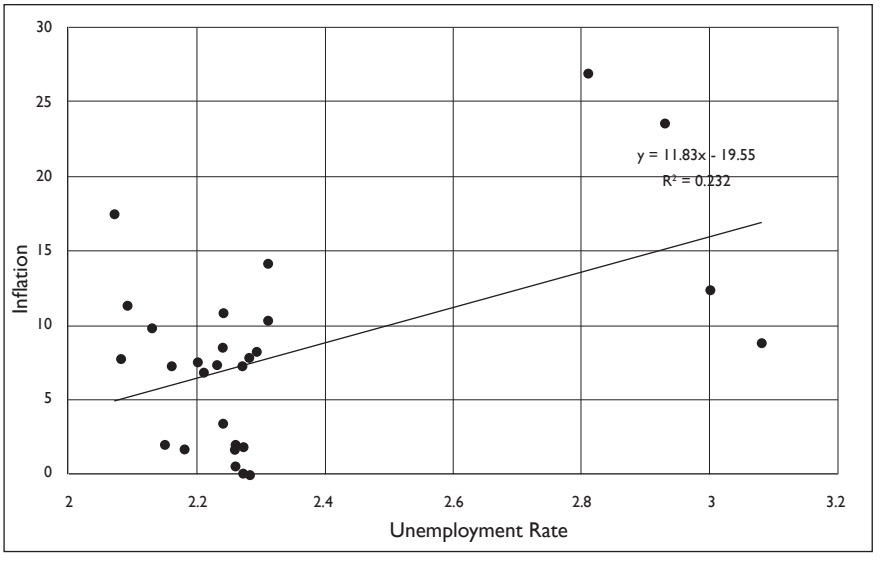
Although the p-value for b_0 is not statistically significant at 95% confidence level, the p-value for the unemployment rate is significant as it is equal to .05.

Therefore, it can be deduced that the scatter chart as well as the regression model show moderate positive association between inflation and unemployment rates in Laos and over the last 29 years, the conventional Phillips curve has disappeared in this country.

The Traditional Phillips Curve in Liberia

The data for inflation (consumer price index) and unemployment (unemployed workers as a percentage of the total labour force) were collected from the World Bank and the scatter diagram that shows the relationship between these two macro variables is given in Figure-4.

Figure-4 : The Phillips Curve in Liberia (1991-2019)



Source: Author's estimation

We have also used the linear regression model to estimate the relationship between inflation and unemployment rates in Laos for the period 1991-2019.

Empirical Analysis	
Correlation	0.482589131
R Square	0.232892269
Adjusted R Square	0.204480872
Standard Error	5.866284746
Observations	29

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	-19.55743656	9.660271164	-2.024522524	0.052911476
Unemployment rate	11.83143795	4.132437479	2.863065203	0.00801524

It can be seen that the correlation coefficient (R) is 48 percent and positive, which suggests that inflation and unemployment rates in Liberia are moderately correlated during the period 1991-2019.

R^2 shows that 23 percent of the variability in Y (inflation) is explained by the independent variable, the unemployment rate.

The total number of observations is 29, which is the number of years under consideration.

The regression coefficient shows a one percent increase in the unemployment rate will increase inflation by approximately 12 percent.

It is worth noting that the p-values for b_0 as well as the unemployment rate are statistically significant at 95% confidence level as they are equal to and less than .05 respectively.

Hence, it can be inferred that the scatter graph as well as the regression analysis indicate that inflation and unemployment rates are positively related in Liberia and the evidence suggests that the traditional Phillips curve doesn't exist in this country.

Conclusion

To sum up, this study demonstrates that there is no converse correlation between inflation and unemployment rates in Canada and Belgium for the period 1975-2019 as well as in Laos and Liberia during the period 1991-2019. On the other hand, the results show that there is a positive correlation between these two macro variables and it is more evident in least developed countries such as Laos and Liberia.

The regression statistics show that the coefficients for unemployment rates are not statistically significant for Canada and Belgium as the p values are greater than .05. However, it is significant for Laos and Liberia as it is less than .05.

To be more specific, the Phillips curve has flattened for developed countries like Canada and Belgium. This implies that inflation is less responsive to fluctuations in output and unemployment in these countries. Free trade, nominal wage rigidity and anchoring inflation expectations are some of the factors that have led to a flatter Phillips curve in these two countries.

In Canada**,** the globalisation of trade intensified competition and led to an advancement in technology and productivity, which eventually helped to curb the rise in prices for some goods and services. In addition, wage growth has been fairly sluggish in recent years, despite strong job growth and the drop in unemployment rates. Furthermore, the Bank of Canada has started targeting inflation since 1991 and inflation expectations are quite well anchored in Canada through prudent monetary policies targeting low and stable inflation. (Desjardins, 2018). However, during the period 1975-1983, both unemployment and inflation rates were high and it might have contributed towards the positive weak correlation between these two variables.

In Belgium, free trade and the reduction in the bilateral trade costs among the Eurozone nations have pushed down trade prices via a pro-competitive effect (Baldwin, 2008). Besides, according to the national bank of Belgium, the wage growth has remained particularly weak in this country, even though unemployment rate has fallen continuously since 2014. Moreover, after the adoption of the euro in 1999, price stability has been the main objective of the central bank (ECB) in the euro zone and targeting inflation has helped to anchor inflation expectations, weakening the sensitivity of inflation to tight labour market.

Jorgensen(2019) stated that "the anchoring agents' inflation expectations would make reduced-form versions of the Phillips curve appear flatter. If inflation expectations become insensitive to changes in economic activity, then inflation itself will become insensitive to economic activity". It can mute both inflationary as well as disinflationary pressures.

In Laos, the unemployment rate averaged 1.43 percent from 1991 until 2019 (author's estimation), which is extremely low and doesn't truly reflect the real economic situation. According to the World Bank, 62.4 percent of the workers are employed in the agriculture sector and it has one of the highest poverty rates in Southeast Asia. During 1997-1998, the Lao National Statistics Bureau reported that Lao's currency depreciated by 70 percent against the US dollar and it resulted in hyperinflation of 125 percent in 1999. Since then, the inflation rate has started showing a decreasing trend in this country. The average inflation rate in the last 19 years has been around 6.5 percent (author's estimation) and between 2013 and 2018, both unemployment and inflation rates have showed decreasing trends, and this could be one of the reasons for the weak positive correlation between inflation and unemployment in this country.

Furthermore, since 1999, the unemployment rate has always been below 2 percent and theoretically, implies a tight labour market. However, it didn't accelerate inflation, as Laos has a relatively weak collective bargaining system with little influence on wage increases in general, and wage negotiation is neither coordinated industry wide nor powerful enough to influence wage increases nationwide (Ahn, 2015). This could be the reason why tightening the labour market didn't result in wage growth and wage inflation in Laos.

In Liberia, according to the World Bank, about 54 percent of the population live below the poverty line, which is less than 2 $ US a day and it is one of the poorest countries in the world. The Ebola crisis plunged the economy into recession between 2014 and 2016 and the depreciation of the currency put the country at risk between 2015-2019 (African Development Bank, 2019) increasing food prices and triggering off cost-push inflation. These problems led to stagflation and an increase in both unemployment and inflation since 2015, which might have contributed towards a direct relationship between these two macro variables in this country.

To conclude, the study has found that the long-established negative correlation between unemployment and inflation doesn't exist and the traditional Phillips curve is dead in Canada, Belgium, Laos and Liberia. Trade liberalisation, technological advancement, nominal wage rigidities, anchoring inflation expectations, weak bargaining power of workers and stagflation are some of the factors that have influenced the reduced responsiveness of inflation to changes in output and employment.

The Phillips curve is one of the most important statistical models in macroeconomics that explains the trade-off between inflation and unemployment and it has been very popular among policy makers over the past several decades. Nonetheless, in recent years, the conventional version of the Phillips curve is unable to capture the complexities of the new global economy such as increased economic interdependence, shifts in monetary and fiscal policies, currency crisis, COVID-19 pandemic as well as aggregate supply side shocks. This has clearly diminished the usefulness and the validity of the traditional Phillips curve model in the modern world.

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Regional Integration, Growth and Convergence: The Case of COMESA Regional Bloc

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Abstract

The present paper is an attempt to verify whether regional integration has an impact on convergence and economic growth among COMESA member countries. Data are collected from World Bank for the period from 1980 to 2016. Fixed effect panel model is applied to estimate convergence among COMESA member States. The results indicate no evidence of unconditional as well as conditional convergence in growth among COMESA member States. Thus, the growth experience of COMESA member countries is explained by divergence rather than convergence theories. The study also examined the effect of regional integration on per capita income growth of COMESA trading bloc. We find that integration had a positive and significant effect on growth of the trading bloc. Thus, the formation of common market / trading bloc had a positive impact on per capita growth of the member countries. Based on these findings some policy initiatives are suggested. Accordingly, the member countries should look beyond trade agreement or custom union such as harmonizing policies and transform their economies.

Keywords: COMESA, Convergence, Growth, Panel Models, Regional Integration

Introduction

Regional economic integration among developing countries is rationalized on the basis of prospective gains that can be derived from the dynamic effects of such integration. These gains are industrialization, increased bargaining power in international trade, large scale economies in production and efficiency (Balassa, 1966). Of course there are static gains

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from integration which are frequently listed to justify the desirability of trade integration. Viner (1950) is the first author in modeling integration and recognizes that the trade induced by a preferential trading agreement has both trade creation and diversion effects. In general, regionalism is viewed as a mechanism to promote economic development and political independence. However, most often, the benefits from forming regional trade bloc may not necessary distributed fairly among members of the regional trading bloc. Therefore, it becomes imperative to understand whether regional integration is a driving means of growth divergence or convergence while having initial differences between member countries. Knowledge of the impact of integration on convergence is important to understand the distributional impact. Moreover, the knowledge about whether countries in a regional trading bloc converge in economic growth at some point is critical to understand the sustainability and desirability of such an arrangement.

The appeal of regionalism for many policy makers in Africa is more geographically intuitive. Colonialism had created extremely fragmented state functioning system combined with economic and political marginality that encouraged the formation of many inter-state organizations and institutions (Gibb, 2009). Economic integration without accompanied by political integration can lead to less innovation and slower growth since firms respond to increased competition in the economic market by focusing more on rent seeking activity (Brou and Ruta, 2007). Accordingly, economic integration by itself is not sufficient to promote competition and enhance productivity in the short run. The re-allocation of resources to encourage domestic firms possibly undermined the realization of long run efficiency gains from economic integration. Therefore, possibly economic integration might not be the driving force for convergence in economic growth.

Several researchers attempted to estimate the growth model of convergence for groups of countries and regions. Venables (1999) has argued that free trade agreement between low income countries may lead to divergence among member countries while agreement between high income countries may lead to convergence. Therefore, the characteristics of member states are more important than the agreement itself. On the other hand, empirical evidences are mixed about the effect of integration on convergence. For instance, integration leads to convergence in some of the African regional economic communities and could not in some other countries (Carmignani, 2006; Homles, 2005). There is no consensus on whether the poor countries can catch up the rich ones at least in the long run. This study inspired by these empirical evidences examines whether forming regional trading bloc lead to convergence in per capita growth in the less developing economies using Common Market for East and South Africa (hereafter, COMESA) regional trading bloc as a case. We attempted to provide an evidence for

whether economic integration is a means to attain the convergence in economic growth in the long run. We also looked at conditioning factors in convergence of economic growth using a long period dataset of COMESA member States. This study contributes additional evidence to the existing empirical studies on developing countries particularly on COMESA. The paper is organized in to five sections. The next Section briefly presents the review of theoretical and empirical literature followed by methodology in Section three. In Section 4 data analysis and findings are presented. The summary and conclusion are presented in the final Section.

Theoretical and Empirical Evidences

Regional Integration, Growth and Convergence

The literature on regional integration goes back to a seminal work of Viner (1950), a pioneer in identifying the possible effects of economic integration. According to Viner (1950) economic integration can have production (trade creation or trade diversion), consumption and terms of trade effects. Corden (1972) incorporated economies of scale into the concept and highlighted its impact on cost-reduction and trade-suppression. Rodrik (2018) argues that the impact of Regional Trade Agreements (henceforth RTAs) would be more than trade creation and trade diversion effects. There is a debate whether RTAs promote liberalization (Maggi, 2014) or an obstacle to the process of global liberalisation (Bhagwati, 1995). However, broadly speaking, there would be two types of effects of integration on a member country economies, viz., static and dynamic effects.

On the other side, the concept of convergence surfaced in literature in the 1980s mainly focus on two notions; the β-*convergence* and the σ-*convergence*. The β-*convergence* or absolute convergence is defined as a catch-up process where poor countries tend to grow faster than rich ones (Barro and Sala-i-Martin, 1991). On the other hand, σ-*convergence* measures the dispersion in growth among a group of countries. If there is σ-*convergence* then the inequality among member trading bloc tends to decrease. The distribution of benefit is evaluated using standard deviation of the per capita income or the logarithm of the per capita income (Barro and Sala-i-Martin, 1995).

Dynamic Effects of (RTAs)

In the long run, RTAs could have an impact on development of a member country via competition and scale (te Velde, 2011). The most important aspect of RTAs is its dynamic effects. Hence, RTAs intensify competition and exert huge pressure on less efficient firms. As a result, in the long run more efficient firms are expected to flourish. Of course, the underlying hypothesis is, RTAs have played same role as like that of liberalization. As per new trade theory, trade has positive effect on productivity of firms in the long run (Grossman and Helpman, 1991), and an improvement

in productivity of trading partner can spillover through importing and exporting to the other trading partners (Coe and Helpman, 1995; Coe, Helpman and Hoffmeister, 1997). However, the realization of these dynamic as well as static gains of integration depends on specific conditions of the member countries. Blomstrom and Kokko (1997) argue that the impact of RTAs on efficiency depends on the change that is brought by the regional investment agreements. The locational advantage of the country, the competitiveness of local firms in the integrating region, and the motives of foreign direct investment in and by the country also matter in the overall impact of integration on single country economies. However, on average, less developed countries will have less benefit from RTAs (Feenstra, 1996).

Regional Integration and Convergence

There is well documented empirical evidence on whether regional integration is a driving force of divergence or convergence. Venables (1999) found that free trade agreements between low-income countries tend to lead to divergence among member countries, while the agreement between high-income countries tends to lead to convergence. Hammouda et al. (2007) have studied the rate of convergence of SADC, COMESA, ECOWAS, CEMAC, and UEMOA trading blocs and found that there is convergence among members of RTAs, but the rate of convergence is slow. This is due to slow growth of productivity, and low accumulation of production factors. Moreover, low levels of intra-regional trade and limited inflow of FDI among regional trading blocs are also mentioned as reasons for the low level of convergence in Africa. On the other hand, Ghura and Hadjimichael (1996) found that the per capita income convergence growing by 2% in 29 Sub-Saharan African countries belonging to a regional trading bloc.

Several other studies have found contradictory evidence. To mention few, Holmes, (2005) finds convergence in SADC over the period of 1960-2000 and non-convergence in ECOWAS for the period 1960-2000. On the other hand, Jones (2002) has finds convergence in ECOWAS over the period 1960-1990. Similarly, Mutate and Kihangiri, (2006) have found convergence in COMESA regional trading bloc for the period 1995-2004. Carmignani (2006) finds non-convergence in COMESA for the period 1980- 2002. Furthermore, Aziz (2004) finds convergence across UEMOA trading bloc for the period 1965-2002 Hence, the empirical evidences from Africa are mixed, and need more investigation.

A comprehensive study conducted by Gohou and Soumaré (2013) for ten regional economic communities in Africa found that SADC, CEMAC, EAC, and WAEMU experience β-convergence, while only WAEMU and SACU experience σ-convergence. The authors have concluded that the poor member countries can catch up the rich ones, and income inequality

tends to decline over time. Table-1 presents summary of findings of most of the previous empirical studies.

Table-1: Previous Empirical Studies and Findings

Region	Period of Coverage	Convergence	Author (Year)
U.S. State level	1880-1988	Yes	Barro and Sala-i-Martin (1992) and Sala-i-Martin (1996)
MENA Countries and EU	1960-2004	No	Péridy and Bagoulla (2012)
Sub-Saharan African Countries belonging to regional integration schemes	1981-1992	Yes but Low	Ghura and Hadjimichael (1996)
ECOWAS	1960-1990	Yes	Jones (2002)
WAEMU	1965-2002	Yes	Aziz (2004)
SADC	1960-2000	Yes	Holmes (2005)
ECOWAS	1960-1990	No	Holmes (2005)
COMESA	1980 - 2002	No	Carmignani (2006)
COMESA	1995 - 2004	Yes	Mutoti and Kihangiri (2006)
46 African Countries (SADC, COMESA, ECOWAS, CEMAC, WAEMU)	1980-2003	Yes but low	Hammouda et al (2007)
European Union 25	1980 - 2005	Yes	Marelli **(2007)**
U.S. county-level	1970-1998	β-convergence: Yes σ-convergence: Ambiguous	Young et al. 2008
100 developing countries	1970-2004	No	te Velde (2011)
Czech 14 regions	1995-2009	No	Mazurek (2013)
Regional economic integrations of Africa including; AMU, ECCAS, ECOWAS, IGAD, SADC, CEMAC, EAC, SACU, WAEMU, and WAMZ	1960- 2012	SADC, CEMAC, EAC, WAEMU- β convergence SACU, WAEMU, σ- convergence	Gohou and Soumaré(2013)

Source: Compiled by authors

Methodology

The history of COMESA has begun in December 1994. COMESA is formed to replace the former Preferential Trade Area (PTA) which established in 1981. COMESA is established as an organization of free independent sovereign States which have agreed to co-operate in development of their natural and human resources for the good of all their people. It has wide-ranging objectives that include promotion of peace and security in the region. COMESA has now 19 member States namely, Burundi,

Comoros, D.R. Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Uganda, Zambia, and Zimbabwe. In addition, several institutions have been establishing to promote regional cooperation and development. These institutions includes, the COMESA Trade and Development Bank in Nairobi, the COMESA Clearing House in Harare, the COMESA Association of Commercial Banks in Harare, the COMESA Leather Institute in Addis Ababa, and COMESA Re-Insurance Company (ZEP-RE) in Nairobi.

In the year 2015, the overall growth of COMESA trading bloc has dropped to 6.0% from 6.5% in 2014 because of weaker global demand and lower commodity prices. Intra-COMESA total export is declined by 8% in 2015 from US$ 9.2 billion in 2014 to US$ 7.6 billion in 2015 (COMESA 2016). Furthermore, the report shows that gross savings rate of most COMESA member States is below 20% of the Gross Domestic Product (GDP).

Data Sources

This study is mainly designed to analyze the growth and convergence among the common market for Eastern and Southern Africa (COMESA) member States for the period from 1980 to 2016. The study confined only to the economic impact of forming a trade bloc. It does not include the political aspects of integration. The data for the study collected from the World Bank database for 37 years starting from 1980 to 2016. The economic data series of per capita growth, per capita income in USD, share of trade to GDP, and the ratio gross saving to GDP are used for this study to verify whether there is unconditional or conditional convergence among member states of COMESA. The share of gross saving and trade to GDP are selected and included in the empirical model of conditional convergence specification. Because a report of COMESA (2016) reveals that private consumption and investment are the main drivers of economic growth among member states.

However, this study has a few limitations: First, the sample confines to only COMESA member countries and non-member countries are not included. Since most of the regional economic community policies are designed to support its members, excluding non-member countries from the sample may create a bias. To avoid this, we should have included some non-member countries also. Second, the data collected from World Bank (WB) has incomplete information for some important variables (gross saving) for some years and for some countries. As a result, we could not get sufficient number of observations for some countries. We have not used other data sources of information to fill the gaps for consistency purposes and also not attempted filling the missing data using statistical procedures. However, it is well known that there exist discrepancies between World Bank data and individual government owned data sources particularly

in the African context. We have used panel data analysis keeping these limitations in view.

Econometric Models

The data is analyzed using appropriate econometric models. We have estimated panel models after verifying unit roots in the variables and testing for long-run panel cointegration. First, we estimated unconditional beta convergence model specification which suggests overtime countries with different levels of initial GDP per capita will converge in growth in the long run. We adopt standard growth model. The unconditional β convergence is estimated by the following empirical model.

$$g_{it} = \alpha + \beta Y_0 + \epsilon_{it} \quad \ldots(1)$$

Where, g_{it} is the first difference of real per-capita GDP. It is therefore the growth rate, and $Y0$ is the logarithm of the initial level of real GDP per-capita. The subscripts i and t represent country and time respectively. The null hypothesis of convergence is accepted if β is negative so that countries with lower initial values of GDP per capita should have higher growth rates. Second, we run the following regression to check the whether there is conditional β convergence. Accordingly we estimated the following empirical model specification.

$$g_{it} = \alpha + \beta Y_0 + \delta X_{it} + \epsilon_{it} \quad \ldots(2)$$

Where; X denote vector of explanatory variables. In this case we have two variables; the share of trade and gross saving to GDP while the remaining variables denotation stated in equation (1). The null hypothesis stating conditional convergence is accepted if β is negative and significant.

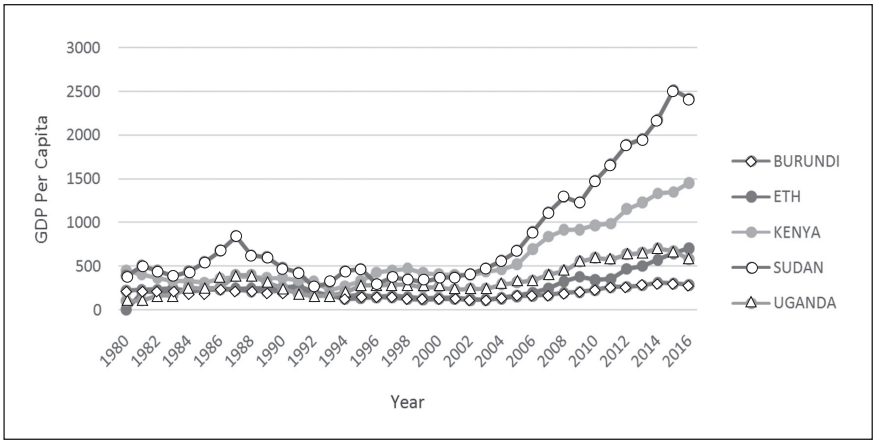
Data Analysis and Findings

We categorized COMESA member counties into three groups based on their proximity and geographic location. In the first category, Burundi, Ethiopia, Kenya, Sudan and Uganda are included based on their geographical proximity. And the performance of these countries is expected to have similar trends. In the second category based on geographic location, Zimbabwe, Zambia, Malawi, Egypt and Democratic Republic of Congo, representing the nomenclature of south, while Egypt is included based on the level of per capita income. The remaining five island States are included in the third group. It is interesting to look at the experience of these countries as the economic integration is becoming deeper and barriers are eased between these countries due to the change in level of agreements, i.e., from preferential to common market.

When we look at the performance of the horn of African countries economies in terms of GDP per capita, between the year 1980 and 2004,

there was no significant rise in per capita income of the. Exceptionally however Sudan has been registering relatively better performance between the year 1984 and 1987. After 2004, the Sudan and Kenya have performed better than the remaining three countries while Ethiopia and Uganda showed improvement after 2006. In the year 1980, almost all countries had similar level of GDP per capita income, but after 2004 growth disparity between these countries became more visible. On the other hand, the pace of economic growth dramatically changed for Sudan and Kenya while other countries were still lagging behind. It seems true that countries with same level of initial conditions, such as factors of production and per capita income, their economies performance might differ in the long run due to fundamental factors (Acemunglu et al., 2002). In contrast, the per capita income of Burundi sharply declined between 1987 and 2003 mainly because of the higher population growth with almost stagnant economic growth. However after 2004, there is a sharp rise in its per capita income which coincided with the period that COMESA sub-region has managed to expand their intra-trade (HESPI 2013).

Figure-1: The Performance of horn of African countries



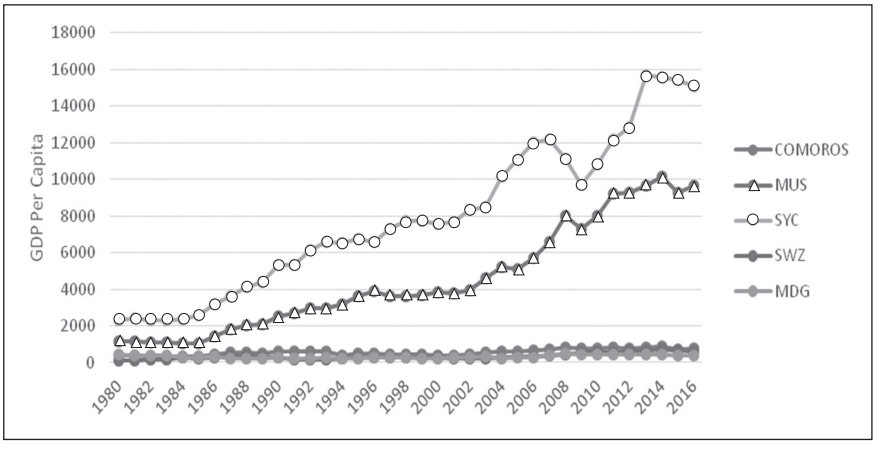
Source: World Bank, 2017

GDP Per Capita of COMESA (Island States)

In the figure presented below, the GDP per capita of Comoros, Swaziland and Madagascar shows almost similar trend and level. As Solow (1956) and Swan (1956) forecasted these island States might be at steady state because at steady state the growth of per capita income is zero. A puzzle that emerges from the trend is that whether these countries achieved steady state before 1980s? This we have not inquired as it is beyond the scope of our enquiry. On the other hand, Seychelles and Mauritius rose steadily from 1985 to 2008, but in 2009 there was a sharp decline in per capita income in both

the countries possibly due to financial crisis in Europe during in 2008/09. The 2008/09 financial crisis possibly could affect their GDP due to their dependence on tourism. However, on average these countries' economies grew steadily till 2016. It is interesting to note that these countries had similar trends in GDP per capita growth. These countries' economies are dependent on one sector and the factors that affect this sector are either beyond the control each government or had similar institutions and processes. Unfortunately, for Mauritius trade constitutes more than 100 percent of GDP starting from 1980s. Similarly, trade contributes more than 80 percent of GDP for Seychelles. Therefore, both countries are highly vulnerable to external demand shocks.

Figure-2: GDP Per Capita of COMESA

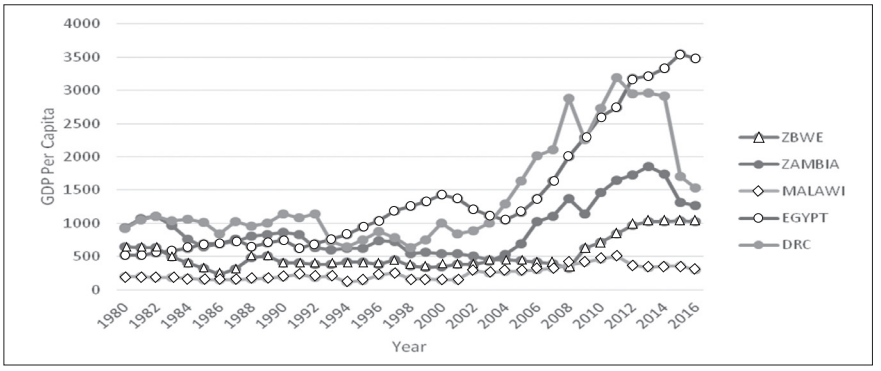


Source: World Bank, 2017

Trends in GDP Per Capita of COMESA (Southern States)

Per capita incomes of DRC and Zimbabwe, Zambia and Egypt are almost similar to start with. But over the period, the gap has started increasing. This gives a clue about the possibility of whether there is an unconditional convergence among COMESA member states. The economic performance of Democratic Republic of Congo is unstable, and there is a sharp rise and decline of per capita income during 2007 to 2016 indicating how the fragility of the economy. When we compare the trends between Egypt and Zambia, Egypt performed well between the period 1992 and 2000, and 2004 and 2016 Zambia's per capita income showed a significant rise between 2004 and 2014. Therefore, the period between 2004 and 2014 was quite good period for both the countries. However, during these 37 years, Malawi's per capita income has never exceeded 500 USD. Thus, the COMESA member countries had dissimilar economic performance and the possibility of achieving convergence was very marginal.

Figure-3: Trends in GDP Per Capita of COMESA



Source: World Bank, 2017

Unconditional Beta Convergence

The present study verified whether COMESA member countries economic growth has converged in the long run as per the predictions of Solow's (1956) model of growth. Alternatively, we have attempted to verify whether it is natural that the per capita growth of countries converges to same steady state in the long run, using COMESA regional trading bloc as a case study. The question is that irrespective of the initial stage of countries and other determinants of economic growth, do the countries converge in growth in the long run? To address this question we followed the beta convergence theory of economic growth. As Barro and Sala-i-Martin (1991) suggested poor countries grow faster than rich countries. As a result, in the long run the rate of growth for rich and poor is the same. Accordingly, we estimated the usual standard growth model with per capita growth as the left hand side variable and per capita income as the right hand side variable. Both variables are tested for presence of unit root using Im, Pesaran and Shin W-t bar test. Since, the per capita and the log of GDP are found stationary at I (1) level (see Table-2). We have tested for cointegration between these variables using Westerlund (2005) panel coinegration test. The test results indicate a panel cointegration with and without verifying for cross-sectional heterogeneity. These results are presented in the following tables 3 and 4.

Table-2: Im, Pesaran and Shin W-t bar Unit Root Test

Variable	Statistics	Prob	Cross sections	Observations
per capita gdp	4.5863	1.0000	16	567
per capita gdp growth	-12.9964	0.0000	16	567
Loggdp	1.8421	0.9673	16	553
Dlogdp	-15.5781	0.0000	16	553

Source: Estimated

As can be seen the results of Table-3 we reject the null hypothesis that there is no cointegration between per capita growth and logarithm of GDP.

We have used Westerlund (2005) cointegration test that uses a model in which the AR parameter is panel specific and for which the alternative hypothesis is that the series in some of the panels are cointegrated. Specifying the all panels' option produces the results for a test in which the alternative hypothesis is that the series in all the panels are cointegrated.

Table-3: Westerlund Test for Cointegration

	Statistic	**p-value**
Variance ratio	-3.8940	0.0000

Source: Estimated

Table-4: Westerlund Test for Cointegration

	Statistic	**p-value**
Variance ratio	-3.7513	0.0001

Source: Estimated

The above tables presented the results for cointegration between the per capita growth and per capita GDP. The results indicate the presence of cointegration between these variable. These tests have been attempted after verifying cross sectional homogeneity. In addition, Westerlund test presents the evidence for all panels being cointegrated.

To choose an appropriate panel estimation model i.e., either fixed or random effect estimation methods, we applied Hausman test. The null hypothesis is rejected at 5 percent significance level indicating fixed effect estimator is appropriate for the dataset. Therefore, the intercept in the model is time invariant. Intuitively, initial level of per capita of a country is independent to the time trend. For the presence of an unconditional Beta convergence among member states, the coefficient of Beta should be negative and significant. Thus, countries having a higher level of per capita income expected to be low per capita income growth as compared to lower level per capita income of countries. Hence, a poor country is expected to catch up a rich country (Sala-i-Martin, 1996). However, the results presented in in Table-5 indicate the opposite, i.e., the coefficient of GDP per capita income is positive and statistically significant. Thus, there is no evidence for an unconditional convergence among COMESA member countries for the study period. This finding is consistent with the previous findings (see, Carmignani, 2006) and confirms the assertion of Venables (1999).

Table-5: Unconditional Beta Convergence

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.9323	0.1950	4.7721	0.0000
Dloggdp	15.1779	1.2702	11.9444	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.2643	Durbin-Watson stat	1.708	

Source: Estimated

Conditional Beta Convergence

This is an alternative to unconditional convergence in growth theory which assumes that there are a multiple points (pre-conditions) for convergence unlike to that of the natural or unconditional convergence. In other words, the speed and length of time needs to converge depend on other factors that have impact on growth of a country. The basic postulate of the theory is there is a limit to growth and that limit is steady state where there is zero economic growth. To verify whether there is conditional convergence among COMESA member countries, we introduce two important variables in the model viz., the share trade and gross saving to GDP. In the process of doing this estimation, we excluded six-member countries from the estimation, namely, Djibouti, Eritrea, Ethiopia, Libya, Rwanda and Zambia due to data constraint for the specified time period for the new variables included in the model.

We have selected fixed effect estimator using Hausman test. The Table-6 below indicates that fixed effects model is appropriate in estimating unconditional convergence. Thus, we use fixed effects model to estimate the empirical specification. Since the null hypothesis rejected, we retain the fixed effects model. We verified whether there is conditional Beta convergence (Table-7) while adding dummy and other explanatory variables in the model that might be relevant to understand the implications of integration for convergence.

Table-6: Hausman Test

Variable	(b) (Fixed effect)	(B) (Random effect)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Loggdp	1.866	1.1399	0.7266	0.3369
	chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)			4.65
		Prob>chi2		0.03

Note: B = inconsistent under Ha, efficient under Ho
b = consistent under Ho and Ha
Test: Ho: difference in coefficients not systematic
Source: Estimated

As we have presented in the above, the per capita income growth is stationary at I (0) and logarithm of GDP are stationary at first difference. Since, we introduce two more variables in to the model, trade (as % GDP) and gross saving (as % GDP) the presence of unit root in these variables need to be tested. The test results reveal that both the share of trade and saving to GDP are stationary at first difference level i.e. is I (1), therefore, we have used ARDL cointegration test. The cointegration test result also indicates that there is long run relationship between the four variables included in the model.

Table-7: Conditional Beta Convergence

Variable	Coefficient	Std.Error	t-Statistic	Prob.
per capita growth(-1)	0.2774	0.0444	6.2456	0.0000
gdp per capita	0.0017	0.0004	4.0690	0.0001
gdp per capita(-1)	-0.0016	0.0004	-3.6330	0.0003
gross saving to gdp	0.0857	0.0322	2.6514	0.0083
gross saving to gdp(-1)	-0.0494	0.0321	-1.5399	0.1243
trade to gdp	-0.0010	0.0052	-0.1907	0.8488
Time	0.7545	0.3894	1.9376	0.0534
R-squared	0.1871	Durbin-Watson Stat		2.0646

Source: Estimated

The results indicate that the coefficient of beta is positive and significant, which is the coefficient of logarithm of per capita income. Hence, there is no convergence in economic growth among member countries of COMESA. These results somehow are contrary to the expectations of theory of growth convergence and steady state. Rather, the results provide support for divergence theories in explaining the growth experience of COMESA member countries. It also indicates that the better performing economies perform better than the low performing ones. The share of trade in GDP has not significantly impacted the per capita income growth, but its coefficient is positive, which is consistent with the theories of trade. It clearly reveals that the static and dynamic gains of integration are not materialized in COMESA member countries.

The impact of integration is captured by the time dummy variable. The period between 1980 and 2016 is categorized into two sub-periods; 1980-2004 and 2005-2016. The period before 2004 is considered as the period of low level of integration. However after 2004, there is a sharp rise in per capita income which coincides with the period that COMESA sub-region has managed to expand their intra- trade (HESPI 2013). A COMESA member states have agreed to reduce tariff rates significantly in the year 2000 and, then after period is considered as the period of better integration. The results show that the time dummy variable has positively and significantly affected the per capita income growth. After the year 2004, the COMESA member countries per capita income grew by more than 1 percent. Therefore, the formation of common market/trading bloc had a positive impact on per capita growth member of COMESA trading bloc. Furthermore, the constant parameter, which is the initial per capita, has significantly varied from one country to the other. The variable gross saving as a percentage of GDP has positively and significantly affected the per capita growth, which is consistent with theories of growth such as (Solow, 1956; Domar, 1946; Harrod, 1939).

Conclusion and Policy Suggestions

This paper examined whether there exists convergence in economic growth among COMESA member States and the impact of regional integration on convergence and growth of COMESA member States. We find no unconditional as well as conditional convergence among the COMESA member States using standard growth model for 16-member States over a period of 37 years starting from 1980. This is similar to the findings of an earlier study of Carmignani (2006). .The evidence suggests that there is little or no hope for poor countries such as Malawi to catch up the relatively richer countries such as Egypt. However, regional integration had an impact on the growth performance of member countries' economies as there is an increase in the growth of most member countries after integration.The earlier studies revealed that some of COMESA member States have been benefited at the cost other member States due to integration. Therefore, being a member of Regional Economic Community (REC) may not be enough to experience the growth convergence. Thus, the main policy implication of this study is that the member States should look beyond trade agreement or customs union, such as harmonization of member States policies. Because the evidence suggests that the trading agreement could not lead to the convergence among member countries. The common market as an instrument of trade diversion could not yield expected results. The economic characteristics of the member States such as sources of growth make the possibility of convergence is elusive without transforming the economic structure of some of the member States. Governing body of COMESA should strive more to substantially reduce trade barriers in order to increase intra- member state trade and member State should committed to implement the free movement of factors of production among member countries.

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