Palacký University Olomouc

University of Clermont Auvergne

University of Pavia

MASTER THESIS

DEBT SUSTAINABILITY: A CASE STUDY OF BHUTAN

Gaki Dem

Supervisor: Vaggi Giovanni

GLODEP 2019

DEBT SUSTAINABILITY: A CASE STUDY OF BHUTAN

Gaki Dem

Supervisor: Vaggi Giovanni

Declaration

This thesis has been submitted to the GLODEP consortium as a partial requirement for fulfilment of the master's degree in international development studies. I hereby declare that to the best of my knowledge; the content of the thesis is my own work and all the sources used have been correctly referenced and acknowledged.

Signature:

(Gaki Dem)

Date: 28/05/2019

Acknowledgment

I would like to sincerely express my heartfelt gratitude to my thesis supervisor Professor Gianni Vaggi, University of Pavia for his continuous support, motivation and guidance. This work would not have been possible without his encouragement, extensive knowledge and rich experience in this field.

Besides my advisor, I would like to thank my colleagues and friends who have helped me in one way or other to complete this thesis successfully. Without your valuable suggestions and feedback, this work would have never been completed.

UNIVERZITA PALACKÉHO V OLOMOUCI

Přírodovědecká fakulta

Akademický rok: 2018/2019

ZADÁNÍ DIPLOMOVÉ PRÁCE

(projektu, uměleckého díla, uměleckého výkonu)

Jméno a příjmení:	**Gaki DEM**
Osobní číslo:	**R170504**
Studijní program:	**N1301 Geography**
Studijní obor:	**International Development Studies**
Téma práce:	**Debt Sustainability:Issues and Implications- A case study of Bhutan**
Zadávající katedra:	**Katedra rozvojových a environmentálních studií**

Zásady pro vypracování

This study intends to explore issues related to Bhutan's debt sustainability and the implications of high level of debt on the macroeconomic situation of the country, both in the short and the long run. This study strives to address these concerns pertaining to the current trade practices prevailing in the country and aims to investigate the causes of external debt, the consequences of the growing debt burden and the policy recommendations needed to attain sustainable levels of foreign debt.

Rozsah pracovní zprávy:	**15000 slov**
Rozsah grafických prací:	**Podle potřeb zadání**
Forma zpracování diplomové práce:	**tištěná/elektronická**

Seznam doporučené literatury:

1.Mustapha, S., & Prizzon, A. (2015). Debt Sustainability and Debt Management in Developing Countries. PEAKS Topic Guide, July. London: Overseas Development Institute 2.Vaggi, G., & Prizzon, A. (2013). On the sustainability of external debt: is debt relief enough?. Cambridge journal of economics, 38(5), 1155-1169. 3.Yang, J., & Nyberg, D. (2009). External debt sustainability in HIPC completion point countries: an update (No. 9-128). International Monetary Fund. 4.Ferrarini, B. and Ramayandi, A., 2016. Public Debt Sustainability Assessments for Developing Asia. In Public Debt Management (pp. 131-192). Springer, New Delhi. 5.Loser, C. M. (2004). External debt sustainability: guidelines for low-and middle-income countries (Vol. 25). UN. 6.Panizza, Ugo. „Domestic and external public debt in developing countries." (2008). 7.Gligorov, V. (2004). Debt Sustainability and Growth in Croatia(No. 306). The Vienna Institute for International Economic Studies, wiiw. 8.Llorca, M. (2017). External debt sustainability and vulnerabilities: Evidence from a panel of 24 Asian countries and prospective analysis (No. 692). ADBI Working Paper Series. 9.Sopek, P. (2011). Testing the sustainability of the Croatian public debt with dynamic models. Financial Theory and practice, 35(4), 413-442. 10.Vaggi, G. (2002). Trade and sustainable finance for development (No. 2002/64). WIDER Discussion Papers//World Institute for Development Economics (UNU-WIDER). 11.Blanchard, O., & Das, M. (2017). A New Index of External Debt Sustainability. 12.Karadam, D. Y. (2018). An investigation of nonlinear effects of debt on growth. The Journal of Economic Asymmetries, e00097. 13.International Monetary Fund.2016.Bhutan:Staff Report for the 2016 Article IV Consultation-Debt Sustainability Analysis. IMF.

Vedoucí diplomové práce:	**prof. Gianni Vaggi** University of Pavia
Datum zadání diplomové práce:	**31. ledna 2019**
Termín odevzdání diplomové práce:	**31. května 2019**

V Olomouci dne 31. ledna 2019

L.S.

doc. RNDr. Martin Kubala, Ph.D.
děkan

doc. RNDr. Pavel Nováček, CSc.
vedoucí katedry

Abstract

This study empirically investigated the debt sustainability of Bhutan by adopting Geometry of Debt Sustainability. The study is carried out by separating the total external debt into hydropower-related debt and non-hydropower debt. The results revealed that the hydropower debt which accounts for 77% of total external debt is found unsustainable while, the non-hydropower debt appears sustainable based on this analysis. The high level of current account deficit (21% of GDP) accompanied by the non-concessional interest rate on hydropower loans are the main factors contributing to the non-sustainability of hydropower debt. The study further estimated the governments' reaction towards an increasing level of government debt through estimation of fiscal reaction function for the period 1985-2017. Unit root and cointegration techniques, and Vector Error Correction Model (VECM) are used to determine the behaviour of the government. The findings showed that the government is taking corrective measures to the increasing level of debt to ensure fiscal sustainability.

Keywords*:* Debt-Sustainability, VECM, Geometry of Debt Sustainability

TABLE OF CONTENTS

List of Figures

List of Tables

List of abbreviations

ADB	Asian Development Bank
ARDL	Autoregressive Distributed Lagged
DSA	Debt Sustainability Analysis
GDP	Gross Domestic Product
GDS	Geometry of Debt Sustainability
GoA	Government of Austria
GoI	Government of India
IDA	International Development Assistance
IMF	International Monetary Fun
MoF	Ministry of Finance
NICA	Non-interest current account
nica	Non-interest current account/Gross Domestic Product
NSB	National Statistical Bureau
OECD	Organization for Economic Cooperation and Development
VECM	Vector Error Correction Model

1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

To achieve Sustainable Development Goals the lag between revenues and expenditures can be covered by long term borrowings. Such borrowing has the capacity to ameliorate the short-term imbalances between revenue and expenditure and reduce pressure on the government. Developing countries can borrow from abroad or from private entities within the country and can smooth their economic activity needed for enhancing welfare. However, excess borrowings could lead to a problem of an unsustainable public debt as developing countries are unable to service them (Inter-Agency Task Force on Financing for Development, 2016; Solomon et al., 1977). Moreover, debt-servicing redirects spending from social sectors such as education and health and therefore reduces the wellbeing of a country's population (Fosu, 2007).

The increase in debt servicing cost remains an immediate concern for developing countries as the external debt payments grew by 85% as a proportion of their revenue between 2008-2018 (Jubilee Debt Campaign, 2019). External debt burden remains one of the key barriers to economic and social progress due to huge debt servicing. Moreover, the debt sustainability of developing countries is affected not merely by the accumulation of debt stock over time and debt servicing burdens, but also due to the change in the composition of external debt structure (Jubilee Debt Campaign, 2019). In order to implement the 2030 agenda, the estimated financing requirement for developing countries is estimated to be between 1.6 and 7 trillion per year over the next 15 years (United Nations General Assembly, 2016). The accessibility to new sources of financing can help the countries achieve their development goals, if debts are managed well. However, accumulation of debt beyond a sustainable level could jeopardize the country's development outcomes. Moreover, the change in the debt composition towards more expensive and risker source of financing leads to increased debt servicing cost, and refinancing risk (IDA, 2018).

In 2018 the public debt of developing countries has increased from 36 percent of Gross Domestic Product (GDP) to 51 percent and the external loans have increased from $191 billion in 2008 to $ 424 billion in 2017 (Elliot, 2019). In 2018 more than 40 percent of developing countries are categorized as "debt-stressed" (IDA, 2018). The number of countries who fall under this category has almost doubled since 2013 (IDA, 2018). Moreover, the safety margins for these countries have shrunk considerably making them vulnerable to both internal and external shocks.

As compared to other less developed regions of the world, South Asia has shown a contraction in the total level of external debt with reductions by almost 2 percent in 2016 (Das, 2017). However, this is largely due to India which is going through a structural transformation and Afghanistan recovering from a war of almost three decades. Other economies like Pakistan, Maldives, Sri Lanka, and Bhutan have registered a substantial increase in external debt (Das, 2017).

The public debt of Bhutan has rapidly increased over the past few years and in 2017 it recorded a debt to GDP ratio of 106 percent (MoF, 2017). Bhutan is among the top 15 countries in the world with the highest debt of 39% as a share of its revenue in 2018 (Jubilee Debt Campaign, 2019). Among the external debt, the hydropower debt constitutes for almost 77 percent of the GDP while the non-hydropower debt constitutes around 22 percent of the GDP (MoF, 2017). Therefore, debt sustainability is closely related to the sustainability of hydropower debt. More than 90 percent of the hydropower debt is financed by the Government of India, with an interest rate of 9 to 10 percent and the repayment period of up to 10 to 12 years (World Bank, 2017). According to the estimates of both the World Bank and the IMF, the country's debt dynamics have a moderate level of risk pertaining to a debt crisis given that most of the hydro-related debt is self-liquidating (World Bank, 2019; IMF, 2018). This, on the other hand, is based on a strong assumption that the power projects would be implemented on time and would generate ample revenues through which the debt could be serviced (IMF, 2018).

However, several emerging issues arising from accelerated hydropower development due to significant delays in the ongoing mega intergovernmental projects and huge cost escalations (Haidar, 2017). This is reflected in the economic growth rates as well where it is estimated to stagnate around 5.7 percent for the period of 2018-2020 mainly due to delay in commissioning of two mega-hydropower projects (IDA,2018).

The government of India has funded almost all of Bhutan's hydropower projects and transmission system through a mix of grant and debt financing. Nevertheless, over the years the grant component has been lessening and debt component has increased. The interest rates have also been on an upward trend putting higher debt servicing risks (Rinzin, 2015). Furthermore, the share of contribution of the electricity sector to GDP declined from 22 percent in 2007 to 19 Percent in 2013 (NSB, 2013), and the share of electricity to the national revenue steadily decreased from 44 percent in 2001 to 20 percent in 2013 (NSB, 2013). Currently, most of the electricity produced by the hydropower projects are sold to one buyer i.e. India. The Government of India is not only the key financier of these projects but also the key buyer. However, this puts a small country like Bhutan located between two massive economic powers of India and China in an extremely vulnerable position. In case of any external shock to the

Bhutan-India trade relationship, the ramifications would be profound both on the economy and the population. Hence, it is crucial that the sustainability of both the external and public debt is revisited, and the current debt situation is analyzed through debt sustainability analysis. Different approach to assessing debt sustainability has been adopted by different authors. IMF and World Bank have formally developed the Debt Sustainability Analysis (DSA) framework to assess the debt situation of the low- and middle-income countries. They determine the debt sustainability based on the critic levels of some ratios or indicators. A more comprehensive approach to debt sustainability has been proposed by Bohn (1998) where he determines the debt sustainability based on whether the government satisfies the intertemporal budget constraint or not. Another approach to debt sustainability is the economic-based sustainability which looks at channels through which debt can affect economic growth. Krugman (1988) and Sachs (1989) formulated and tested the hypothesis of debt overhang.

Currently, there have been limited studies on the debt sustainability of Bhutan. The IMF and World Bank investigated debt sustainability using DSA and find debt situation as a moderate risk of distress. There are some panel studies carried out by Sheikh.et al. (2014) and Asian Development Bank (2017) by employing unit root and cointegration techniques which generated mixed results. Thus, it is important to study the debt sustainability specific to the country and by adopting different approaches/methods. This study attempts to fill the gap by adopting different framework (i.e. Geometry of Debt Sustainability) to assess the sustainability of external debt. This framework asses debt sustainability and the debt ratio trajectories based on given parameters for interest rates, economic growth and the trade deficit (for this analysis NICA i.e. non-interest current account is used). This study also explores the government reaction towards its debt burden through fiscal reaction function estimation. The different view related to debt burden and an adverse consequence due to an increase in borrowings will have on economic growth calls for an action to maintain the debt at a sustainable level. Thus, it is vital to analyze the sustainability of public debt to draw relevant policy measures.

This study is organized as follows: Chapter 2 reviews the theoretical and empirical review on debt sustainability, Chapter 3 discuss the data and methodology employed for the study, chapter 4 presents the empirical results and discussion, chapter 5 offers the conclusion and policy recommendations based on the study.

1.2 BHUTAN'S ECONOMY OUTLOOK

Bhutan is a small landlocked country in South Asia and is one of the smallest, Nonetheless, it is one of the fast-growing economies in the world. The average annual GDP growth rate was 6.7 Percent from 1990 until 2017. However, the GDP dropped to 4.63 percent in 2017. The highest growth rate

was 17.90 percent in 2007 against the lowest of -0.40. in 1991 (World Bank, 2018). Bhutan has a population of 735,553 as of 30th May 2017 and the median age for the population is 26.9 years. The population growth rate between 2005 and 2017 was 1.3 per annum with an average fertility rate of 1.7 children per women. The total dependency ratio stood at 47.0 and the unemployment is recorded at 2.4 percent for the country while youth unemployment stands at 10.6 percent (Population and Housing Census,2017).

The small economy of Bhutan is largely based on Hydropower, Agriculture, and Forestry providing the livelihood for more than half of the population. The GDP per capita in 2017 has increased from $ 3,055 to $ 3438, an increase from 4.91 in 2016 to 9.33 Percent. The change in price (inflation) as measured by the consumer price index stands at 4.96 Percent in 2017. The average inflation rate was 5.06 percent from 2001 until 2018. Gross national saving was noted at Nu. 45,527.51 million in 2017 against Nu. 48,656.07 million in 2016, out of which Nu. 34,609 were private saving. The investment recorded a drop of -0.12 percent in 2017 against the growth of 11.97 percent in 2016. The investment-saving ratio was noted at 0.54 in 2017 against 0.59 in 2016. The gross national saving as a percentage of GDP was recorded at 27.65 in 2017 against 32.62 in 2016 (NSB, 2018). In 2017, the trade deficit in current price was recorded at Nu. 33,685.24 million and accounted for 20.46 percent of GDP, and 5.86 percent growth in the deficit was recorded against 16.02 percent in 2016.

General government gross debt (in % of GDP) was recorded at 106.31 percent and current account (in % of GDP) stands at -22.8 Percent (IMF, 2018). The export to GDP ratio was recorded at 26.00 as per the World Trade Organization. The country has recorded an external debt stock of 2505.40 million USD in 2017 and debt service ratio (% of Export G&S) is estimated at 33.3 percent for the FY2016/17 (IMF, 2018). The development activities in Bhutan are carried out through the five-year development plan which started in 1961. Ministry of Finance is responsible for the overall financial management as per the mandate of the Public Finance Act 2007 through effective and efficient use of public resources. Fiscal deficit was recorded at 3.3 % in Financial Year 2017 against 1.1% in FY2016. The increase in fiscal deficit is mainly driven by the substantial expansion of capital expenditure while the tax revenue decline partly due to the weaker revenues related to hydropower. However, the deficit is estimated at 1 % of GDP for the FY2018 with improvements driven by higher hydropower revenue and excise duty refunds from India. The overall balance surplus is expected to swing to 2.2 % of GDP due to the huge decrease in capital expenditure from 17% of GDP to 5.5% of GDP for FY2019 (IMF, 2018).

1.3 RESEARCH OBJECTIVES

The main objective of this study is to evaluate the sustainability of Bhutan's public debt based on the geometry of debt sustainability framework and to ascertain the nexus between primary balance and public debt through the estimation of fiscal reaction function. The specific objectives are:

1. To investigate the sustainability of external debt at the current level of indebtedness.
2. To ascertain whether the nexus between public debt and primary balance satisfies the intertemporal budget constraints or not.
3. To explore the extent to which the government reacts towards its debt burden through estimation of the fiscal policy reaction function
4. To propose policy recommendations needed to maintain the public debt on the path of sustainability.

1.4 OVERVIEW OF THE EXTERNAL DEBT SITUATION

In Bhutan, public debt had played a vital role in the socio-economic development of the country. Over the period of 20 years, in terms of utilization of the debt, the major portion was allocated to the investment made in the construction of hydro projects. Bhutan relies heavily on concessional foreign loan from multilateral agencies namely IDA- World Bank, Asian Development Bank, and IFAD for both budgetary and corporate on-lending loans. Bhutan also depends intensely on bilateral loan from the Government of India (GoI) and Government of Austria (GoA) for hydro projects and other developmental projects. As on 30th June 2017, the outstanding total public debt was Nu. 170,256.76 million which is about 106.6% of GDP. Of the total debt, domestic debt accounted for Nu. 10,057.344 million and the external debt was Nu. 160.199.41 million. (US$ 2478.14 million) The total external debt accounts for 106.1% of GDP. The increase in debt stock is mainly contributed by the disbursement for on-going hydro projects from GoI and outstanding T-Bills.

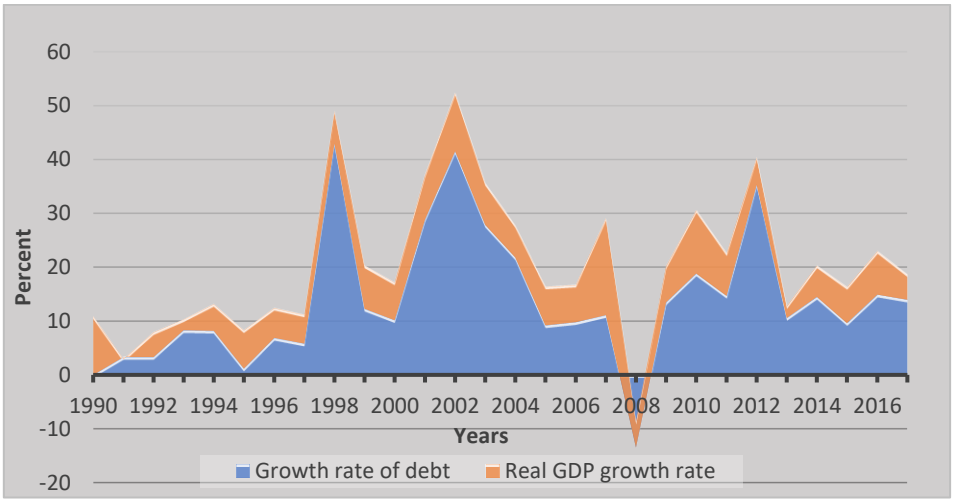
The external debt accounted for 94.1% of the total debt and out of the total external debt 26.6% was convertible currency debt and the rest 74% was Rupee-denominated debt. The hydropower debt accounted for 77.3% of the total external debt and the non-hydro debt accounted for 22.7 of the GDP, against the target of 35% of GDP set by Public Debt Policy 2016. The share of the domestic debt is insignificant since it accounts for only 5.9% of the total debt. During the fiscal year 2016/17. The total principal repayment of the loan was recorded at Nu. 2,703.34 million (MoF, 2017). The composition of the external debt is shown in Table 1. The grow rate of debt and GDP is presented in figure 1 and the size and magnitude of the external debt from 1990 to 2017 is presented in Appendix A.

Table 1: Structure of External Debt

Borrowers/Purposes	Hydropower (in Billion)	Non-hydro power (in Billion)	Total (in Billion)
Government	0 (%)	22(14%)	22 (14%)
State Enterprises	124 (77%)	6 (0%)	130 (81%)
RMA	0 (0%)	7 (4%)	7 (4%)
TOTAL	**124 (77%)**	**37 (18%)**	**159 (99%)**

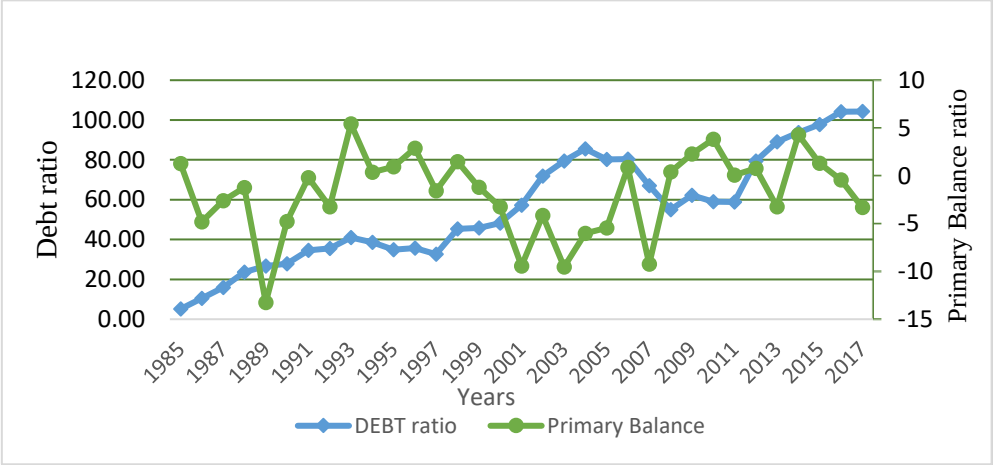
Source: World Bank, 2017

Figure 1: Trend of GDP and Debt Growth Rate



Data Source: World Bank

Figure 2: Trend of Primary Balance and Debt Ratio



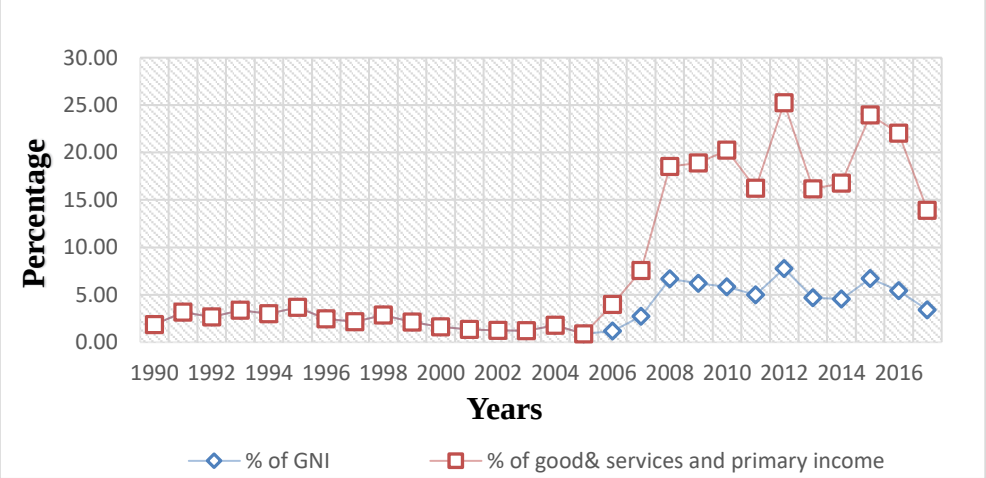
Data Source: Statistical Yearbook, Ministry of Finance

As evident from Figure 2, The debt ratio has an increasing trend while the primary balance is very volatile. However, after 2014 it has a decreasing trend when the debt ratio is still increasing.

1.4.1 Debt service

The debt service is defined as *"The total of interest and principal payments made on the debt during the financial year".* The total debt service made during the financial year 2016/17 was recorded at Nu. 4,531.05 million. Of the total debt service, hydropower debt service accounted for Nu. 2,586.31 million. (MoF, 2017). According to the Interim budget financial year 2018/19, the estimated debt service to be Nu. 7,758.38 million. Debt service of Nu. 4,909.08 million out of the total debt service was repaid through the budget and the balance debt service was recovered from SoEs and repaid to the principle lenders during the financial year 2017/18. The debt service ratio is estimated to be 14.7% of GDP. Figure 3 shows the share of debt service made as a share of Gross National Income and exports of goods & services and primary income for the period 1990-2017.

Figure 3: Debt Service

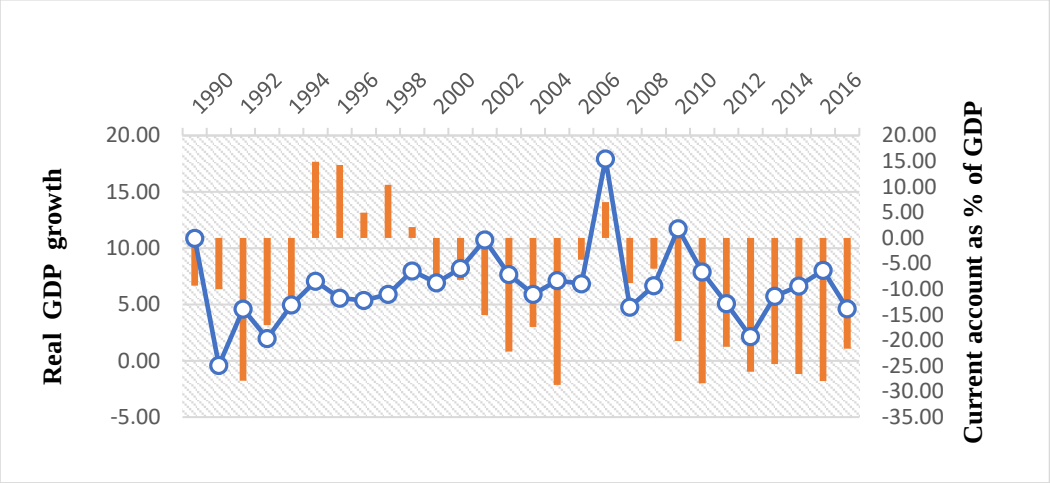


Data Source: World Bank, International Debt Statistics

1.4.2 Trade balance and current account balance

In 2017, Bhutan recorded a trade deficit of Nu.29,699 million and the country's trade deficit increase to Nu.30, 227 million in 2018, and trade balance with India alone accounts for Nu. Nu.27,937 million (NSB, 2018).For the FY 2015-16 country's current account deficit was 29.8% of GDP however, the current account deficit improved to 22.7% of GDP in FY 2016-2017 and it is further estimated to improve at 21.7% of GDP for the FY 2017-18 (MoF,2017). The following Figure 4 displays the trend of current account balance as a share of GDP. Bhutan has a sustained current account deficit starting from 2000 till 2017 except for the year 2007.

Figure 4: GDP Growth and Current Account



Source: International Monetary Fund

2 LITERATURE REVIEW

The issue of debt sustainability has gained importance in developing countries as well as among the political leaders, an academic economist, and researchers. The issue has gained high attention from the government since it requires the adoption of responsible policies to ensure the stability at the macroeconomic level. Moreover, debt sustainability is a blazing topic of debate as a result of several worldwide financial/debt crises. Subsequently, the extensive theoretical and empirical literature has emerged on this topic since the 1990s. This section reviews the studies related to debt sustainability and its different aspects.

2.1 THEORETICAL REVIEW

International Monetary Fund (1997) defined the country's debt situation as sustainable if they can meet the current and future debt obligations without any requirement for debt relief or accumulating any arrears, and without jeopardizing the economic growth of the country. Likewise, Blanchard (1990) defines a fiscal policy as sustainable if it ensures the convergence of debt to GDP ratio to its initial level, and similar definition is provided by Buiter (1985) who describes the fiscal policy as sustainable if the government's net assets to GDP is sustained at its current level. However, Krejdl (2006) argued that these definitions are arbitrary in nature and there are no theoretical explanations on why the ratio of debt to GDP should return to its initial level and not to any other levels. Moreover, it is easy to design a policy in which the debt ratio increases initially to a level considered as excessive by market participants and later only the debt ratio starts to fall and return to its initial level. There are two conceptual approaches to assess the sustainability of debt: (i) accounting approach, and (ii) present value constraint approach (PVC). The debt to GDP ratio is mostly used in accounting approach. According to Pasinett (1998) and Goldstein (2003), fiscal policy would be sustainable if a stable debt ratio can be sustained over time. Cuddington (1999), expressed that a constant ratio of primary deficit (or surplus) to GDP and debt to GDP should be generated for a debt to be sustainable. The level of primary surplus (or deficit) which can stabilize the debt-to-GDP ratio -*b*- is given by:

$$SURP_t = \frac{r_t - g_t}{1 + g_t}\, b$$

Where ***r*** is the real interest rate and ***g*** is the GDP growth rate. Provided that the economy grows at a rate higher than the interest rate **(*g* > *r*),** a sustainable primary deficit can be maintained. According to PVC approach, a country's debt is considered sustainable if the present value of future primary

surpluses is equal to the current level of public debt which is derived from the intertemporal budget constraint (Arone, Bandiera, and Presbitero, 2005). This condition is specified as given below:

$$B_0 = \sum_{t=1}^{\infty} \frac{SURP_t}{(1+r)_t}$$

Where B is the initial stock of debt, *r* is the real interest rate and SURP are the future surpluses. The real debt growth rate should be less than the real interest and if the growth rate of debt is between the real interest rate and the GDP growth rate, the condition of PVC is satisfied. Nevertheless, the debt/GDP ratio can still grow over time.

World Bank's International Development Assistance and IMF have developed formal debt sustainability Analysis (DSA and they have precisely developed two different frameworks; one for low-income countries and another for middle-income countries. To determine a sustainable level of external debt, there are various indicators and these indicators are primarily in the form of ratios, and they support policymakers in the management of external debt. These indicators measure the creditworthiness of the country as they consider the stock of debt at a certain time to in relation to the capacity of the country to pay back their unpaid debt through resource generations (IMF, 2000). Some examples of such indicators include debt-GDP ratio, foreign debt-Export ratios, government debt to current fiscal revenue ratio, a share of foreign debt to total debt and short-term debt to total debt.

Additionally, the IMF put forward the second category of indicators which focus on a country to meet the short-term liquidity requirements with respect to its debt service obligations. The example of such indicators is the debt service to GDP ratio, external debt service to exports ratio, and government debt service to current fiscal revenue ratio. Current account balances can also be employed to measure the external debt sustainability since financing a persistent current account deficit by allotting debt leads to an increasing debt burden. Different thresholds of external debt sustainability have been computed and under the HIPC initiative, the ratio of NPV of debt-to-exports is 150%, while debt to fiscal revenue ratio (fiscal indicator) was pegged to 250%. However, Sachs (2002) reasoned that the existing definition of debt sustainability is arbitrary in the enhanced HIPC initiative. He claimed that the ratios of 150% and 250% respectively cannot judge truly whether one is sustainable or not except in the context of a country's need which needs to be spelled out by themselves. There is always a possibility that debt can be sustainable, and a significant debt servicing is made but at the cost of human development.

The DSA used in the HIPC initiative is based on stock indicators only, while the flow indicators are simply descriptive. HIPC initiative has faced strong criticism for mainly relying on the debt/export ratio for measuring the sustainability of external debt. The argument provided was that the generation of export revenue is not necessarily associated with economic growth and reduction of poverty. Moreover, the fiscal revenue, and does not apprehend the possible country variations (Caliari, 2006). Additionally, for instance, Gunter (2003); Cohen (2000) argued that the choice of thresholds and accounting framework have been subjected to many criticisms. In the long run, the HIPC initiative was meant to exit the countries permanently form debt rescheduling in the future as a result of achieving debt sustainability. However, after achieving certain NPV of debt to export does not necessary to ensure that it will be upheld in the long run in a simple accounting framework. Furthermore, the framework assumes borrowing at very high concessional terms by HIPCs continuously, and the domestic debt is been ignored from the analysis.

Fiscal sustainability is defined as the ability of the government to be able to pay its debt at some point of time in future by maintaining public finance. Thus, primary balance is the main determinants of government debt dynamics (OECD, 2013). Hence, sustainability indicates the fulfilment of the intertemporal budget constraint. According to Intertemporal budget constraint of debt sustainability, if a country meets the condition of No Ponzi game (NPG) which states the current level of debt in the economy should be equal to the present discounted value of future trade surpluses, a country's fiscal situation can be considered sustainable. A further test on fiscal sustainability is proposed by Bohn (1995,1998) which states a given public debt policy can be shown sustainable if there is a positive response of primary surplus to debt ratio. This suggests if a government, run into debt today, counteractive action should be taken in the future by increasing the primary surplus.

The economic sustainability-based approach looks at the channels through which the debt burden blights the economic growth of the country. This approach basically analyses the interlinkages between fiscal deficits, interest rates, economic growths, inflation, exchange rates, investment and balance of payment to solve the endogeneity problem of these variables. Krugman (1988) and Sachs (1989) has first formulated and tested the debt overhang (country's level of debt is high and its ability to attract new investors is lost) hypothesis. The current level of public debt places an obstacle on the investment by daunting future investment leading to huge deadweight loss. A negative relationship tends to exist between high debt and economic growth according to this theory. Debt Laffer curve was first introduced in the context of debt overhang argument that relates to the level of debt to GDP growth. The curve demonstrates a situation in which a country who borrows too much and suppress certain endogenous debt thresholds could result in efficiency loss. It shows the inverted U-shaped

relationship between debt and economic growth and "reflects that there is a specific threshold level beyond which the debt will not only cap the growth process but also give a reverse gear to the economic growth of the country" (Sheikh, Nauman, Iqbal and Masood, 2014). Another competing theory regarding the effect of debt on the growth is the concept of liquidity constraint, which captures the 'crowding out effect' of servicing debt will have on the funds available for investment and growth. Cohen (1993), suggested that the negative effect of debt on growth is not only through the debt stock impact but also via the flows of debt service payments, which are likely to crow out public investment. Therefore, the current reduction in debt service payments should lead to an increase in current investment regardless of any level of future indebtedness of the country. The other channels via which debt servicing can affect the economic performance according to Claessens et al. (1996) are the lack of access to international markets and the general level of uncertainty in the economy due to the accumulation of huge debt stocks.

2.2 EMPIRICAL REVIEW

A panel of 24 Asian emerging and developing Countries external debt sustainability was evaluated by adopting the present-value approach to identify whether the country satisfies its intertemporal external constraints for the period of 1993-2014 by Asian Development Bank (2017). The samples are divided into four sub-panels and they studied the panel stationary of the variables (external debt, current account, imports, and exports) by panel unit root and cointegration test. The study used both first-generation and second-generation unit root test due to the presence of cross-sectional interdependence in one region (the Pacific). The study concluded that the external debt in this region has been sustainable over the last two decades based on the unit root and cointegration test. However, the study will not be able to conclude the fiscal situation of the country without the estimation of the nexus between primary balance and debt ratio to draw relevant policy measures. The study also analyzed the vulnerabilities, factors, and risk affiliated with external debt by employing four debt criteria namely debt currency composition, the share of short-term external debt, the debt servicing and the total reserves to assess the risk. The result concluded that the external debt position in emerging and developing Asian countries is not distressing. Having said that it is always important to be cautious and monitor the external situation.

Likewise, Sheikh.et al. (2014), also conducted external debt sustainability analysis for eight SAARC economies (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) using three main techniques univariate unit root test, panel unit root test and panel cointegration test to check the status of countries external debt. The study applied three tests (Augmented Dickey-Fuller, PP and DF-GLS) for univariate unit root and based on the results, all the series are found non-stationary.

Based on the time series based stationary test of sustainability the study concluded that the current level of debt for all the countries are found high with respect to their capacity of repayment. Consequently, they declared the external debt as unsustainable which can negatively affect economic growth. However, Bohn (1998,2007) claimed that determining the sustainability based on time series stationary is invalid since any order of integration of debt will be consistent with transversality condition in an infinite sample. Thus, the intertemporal budget constraint will be satisfied even if the series is not stationary. Furthermore, Adam et al. (2010) argued that time series-based sustainability does not necessarily recognize the fiscal policy reactions and thus does not clarify any policy that might provide sustainability. The study also applied three-panel unit root tests; Levin Lin and Chu test, Fisher ADF test and the Im Pesaran & Shin test on the external debt sustainability indicators to assess the external debt status of SAARC countries and found that the overall external debt of SAARC is sustainable. This result was incompatible with the result of the previous test. The residual based cointegration test and the likelihood-based test were applied which generated a similar result and declared their external debt as unsustainable except for Bangladesh, Pakistan, and Srilanka.

Mehmood et al. (2014) analyzed the sustainability of public and external debt for four major South Asian economies i.e. Pakistan, Bangladesh, Sri Lanka, and Bangladesh. Using traditional debt ratio's and comparing them across various threshold levels the study reveals that all the four countries have a high and an unsustainable debt burden due to large current and fiscal account imbalances. It concludes that debt would continue to be an issue for all these countries unless corrective policy measures are not applied to account for inherent structural imbalances.

Afonso and Jalles (2017) analyze the fiscal reaction function for a panel of 173 countries across the time period of 1970 to 2014. In order to access the existence of non-Ricardian regimes as established by the Fiscal Theory of the Price Level (FTLP), the authors conclude that on average governments have increased the primary balance as a response to higher levels of prior government indebtedness. Moreover, the Ricardian results are more pronounced for higher income countries, particularly the European countries as compared to other less developed countries. The Ricardian fiscal regime emerged after the 1995 and 2008 Global Financial Crises and an increase in primary balances necessarily supports the presence of an average Ricardian fiscal regime.

Shastri, Giri, and Mohpatara (2017), examined the sustainability of public finance in five major South Asian countries (India, Pakistan, Bangladesh, Nepal, and Sri Lanka) for the period 1985-2014. The study employed two alternative approaches; firstly, they assess the existence of long-run relationship between government revenue and expenditure using Gregory and Hansen (1996) and Carrion-i-

Silvestre, and Sanso (2006) test, and secondly they investigated whether the fiscal rule that relates to the primary surplus and debt holds for these countries with ARDL estimation. The findings confirmed the presence of a long-run association between government revenue and expenditure for all countries, and ARDL estimation of fiscal reaction disclosed a positive long-run response of primary balance to rising public debt for four countries (India, Pakistan, Bangladesh, and Sri Lanka). Thus, the empirical findings demonstrate the coherence with intertemporal budget constraint. However, due to the presence of significantly less than one cointegrating slope parameter except for Bangladesh, fiscal sustainability exists only in a weak form.

A study to address the impact of public debt on economic growth using regression threshold model estimations was carried out by Caner, Grennes, and Koehler-Geib (2011) for a sample of 101 developing and developed countries for the period 1980-2008. The study showed that there was a well-defined level of public debt, beyond which debt starts to have adverse effects on the growth of the economy. The critical level for the full sample was 77 Percent of Gross Domestic Product (GDP) while, 64 percent of GDP was the level for developing countries included in the sample, which indicates the effect is more definite in emerging markets. If the debt exceeds this level an additional percentage points in the ratio of public debt to GDP costs the economy 0.0174 percentage points in average annual real growth. Below this threshold, additional debt has a positive effect on growth. However, Hansen (2017) claimed that the presence of the threshold effect is inconclusive. Using regression kink model with an unknown threshold on U.S time series data, the point estimate was found consistent with the hypothesis of debt slowing down economic growth when exceeding the threshold of Reinhart and Rogoff (2010). Nevertheless, the confidence intervals for the regression function are adequately extensive that the uncovering of the effect on debt was difficult. Since the estimation is carried out only on one single country time series data, it would be valuable to cover the study on the panel data.

Reinhart and Rogoff (2012) examined the relationship between high-level public debts, growth, and inflation in 44 emerging and developing economies. The study found that there is a link between growth and debt which appears relatively weak at normal debt levels. The median growth rate for countries with debt level over 90 percent of the GDP is about one percent lower than the countries with their debt level below 90 percent. The study also found that the relationship between debt and growth is similar across all the emerging markets and advanced economies. However, the study has not found a systematic relationship between high-level debts and inflation for advanced economies with the exception in the case for the United States. In contrast, in emerging markets, high-level public debts are associated with inflation. The non-linear effect of debt on growth is alike of ‘debt

intolerance' (Reinhart, Rogoff and Miguel A. Savastano, 2003) and it is supposedly related to the nonlinear response of market interest rates as the public debt reaches its tolerance limit by the countries. As a result of the sharp rise in interest rates, will lead to painful fiscal adjustment through tax hikes and reduced public spending, and some cases in the form of unmitigated default. There are some vulnerabilities associated with build-up debts, notably if the debt servicing cost is mitigated through the restructuring of the debt. Countries that fully rely on financing their debt via short term borrowings are more vulnerable to crisis and can stimulate sudden and unexpected financial crises.

Fosu A.K. (2007), explored the impact of binding debt service constraint on the sectoral composition of government expenditure in African economies. The author applied Seeming Unrelated Regression (SUR) to five-year panel data for 35 countries. The paper finds that debt servicing constraint would shift away from the public expenditure from social sectors such as education and health, and as well the public investment. The partial elasticity of the expenditure share on health and education with respect to debt servicing constraint is estimated at 1.5. One-Standard-Deviation increases in debt burden result in a reduction by one-third of the share of budget allocation to these sectors. Similar results have been obtained in a study of external debt sustainability of Bangladesh (Islam and Faisal, 2012) where more allocations of their budget were made for external payments (debt servicing) than any other important sector such as health, education. Fosu, also observed that the external aid exhibit positive impact on expenditure share of the social and public investment sectors, and this positive effect of aid may reflect donors' favorable preferences to these sectors. Yet, due to relatively small responsiveness of expenditure to ODA from these sectors may indicate fungibility of aid.

Islam and Faisal (2012) explored the external debt sustainability and future concerns of Bangladesh using the Low-Income Country Debt Sustainability Framework of IMF and World Bank and OLS regression. DSA framework provides indicative levels of debt burden beyond which the country's debt distress reaches an unacceptable level. The author ran the regression on debt service with relevant variables to see the most contributing sources to external debt service. Base on the results obtained Bangladesh's debt burden is far from being alarming. Yet, there is no ground for ease for the government since every year in the budget plan, more allocations were made for external payments (debt servicing) than any other important sector such as health, education, etc. Meanwhile, most of the debt is payable to multilateral agencies, Bangladesh has not yet faced any debt problem. Nevertheless, owing to increasing external debt together with the expiry of grace periods and unfavourable exchange movements has led to an upsurge in debt service. Bangladesh has been servicing its debt through its export earnings, remittances, and foreign reserve. In this context, the authors suggest debt management as a policy priority. The authors also provided the argument that

the DSA framework does not reflect the true nature of the debt burden on government rather it puts too much emphasis on exports. Thus. They concluded that for a poor country like Bangladesh, it would be unrealistic to calculate debt sustainability without looking into the allocation of money on schools, infrastructure, government agencies, health care, clean water and sanitation essential to combat poverty.

International Development Assistance and International Monetary Fund (2018) assessed the external risk of Bhutan through Debt Sustainability Analysis (DSA) framework and the current assessment remained broadly the same as the DSA assessment made in 2014 and 2016. The result of the assessment concluded Bhutan's debt at moderate risk of debt distress. The DSA methodology focused on five key ratios namely present value of PPG external debt to GDP, the present value of PPG external debt to exports, debt service to exports, the present value of PPG external debt to revenue and debt service to revenue. Under the DSA framework, the magnitude of each ratio is compared with respective indicative thresholds defined and in turn the thresholds depend on the classification of the country as strong, medium and weak policy institution. The investigation was carried out based on the three case scenarios: (1) considering all PPG debt, (2) excluding loans from GoI for the intergovernmental projects, (3) excluding loans for both intergovernmental projects and the joint-venture projects.

The results under scenario 1 showed the breach of all external debt thresholds and the cause for such breach is due to the accumulation of debt on hydro projects in the long run. However, debt burden indicators remained much below the indicative thresholds for all ratio under the case scenarios 2 and 3 except for minor breaches, and this observation was considered under moderate risk rating. Even though under the baseline scenario all indicators breached its threshold, the debt situation is considered at moderate risk of distress due to the unique mitigating factors. The mitigating factors are explicit guarantees from India that cover financial and construction risk; strong track record of project implementation; rapid growth in energy demand from India; committed donor support; and high level of international reserve. More than 70 Percent of Bhutan's external PPG debt is related to hydropower and these projects are constructed under the intergovernmental agreements between the Government of India (GoI) and Royal Government of Bhutan. Additionally, GoI buys the surplus electricity at cost plus 15 percent net return, thus the solid validation for categorizing Bhutan's debt as a moderate risk of distress is that the hydropower debts are self-sustaining or liquidating. Nevertheless, it would be insightful to investigate the debt sustainability using different approaches such as fiscal and current account sustainability, and the impact of increasing level of external debt on the economic growth to draw relevant policy actions.

Burger et al. (2011) estimated the fiscal sustainability and fiscal reaction for South Africa using various methods such as OLS, VAR, TAR, GMM, State spacing model and VECM. The study investigated how the government of South Africa responded to the public debt position historically. They considered the possibility of stationary data, non-linear data, and non-stationary data by employing different techniques mentioned earlier. They found that the South Africa government during the sample period indeed has stiffened its fiscal policies when dealing with shocks to the debt-to-GDP position. This result obtained from various methods remained unchanged making the findings more robust.

In a similarly way, Doi, Hoshi, and Okimoto (2011) analyzed the fiscal sustainability of Japan for the period 1980-2010 by incorporating quadratic term for debt, output gap and government expenditure using simple linear OLS, and non-linear Markov-Switching models. Their findings showed that government revenue/GDP must permanently rise at 40-47 percent from the current 33 percent for the debt ratio to stabilize. Moreover, the response of the primary surplus to the increasing debt ratio was found negative, the fiscal policy was found active, but the monetary policy was passive. In nutshell, the present financial situation of Japan's government was found unsustainable. Following Doi et al. (2011), Hall (2013) also analyzed the fiscal sustainability of the US by estimating fiscal reaction function supposedly that the US economy follows the Markov process. The study found that the US government inclines to take corrective measures to the increasing level of the public by strongly lowering their primary deficits.

An analysis of debt sustainability in the economy of Pakistan was conducted by Javid and Chandia (2013) by estimating the fiscal reaction function between surplus-to-GDP ratio and lag debt-to-GDP ratio. The study found a positive relationship between the surplus-to-GDP ratio and the lagged debt-to-GDP ratio. However, sustainability exists only in a weak form due to the small coefficient of debt ratio. The study also confirmed the role of past surpluses in the future through estimation of extended fiscal reaction function. To analyze the effects of expenditure and revenue adjustment to debt, the revenue and expenditure reaction functions are estimated with Vector Autoregressive (VAR) model. The estimated results support the fulfilment of the condition of the intertemporal budget constraint. Through the estimation of cointegration between surplus-to-GDP and debt-to-GDP results revealed the presence of long-run association among the two series which confirmed the fiscal sustainability of the country.

Nguyen (2013) estimated the fiscal reaction function using the Autoregressive Distributed Lag (ARDL) model for India for the period 1981 to 2011. The study used tax revenue-to-GDP as the

dependent variable, and debt-to-GDP, output gap, interest rate, inflation and lag tax revenue as an independent variable. The study found that the Government of India strictly follows the fiscal rule in a way that it prevents any sudden shock that could deteriorate economic growth. A positive correlation between tax fee collection and previous period debt was found indicating that the government tries to increase the tax collection to repay the accumulated debt. Similarly, Insukindro (2018) analyzed the behavior of fiscal sustainability using stationary and cointegration test and investigated the fiscal reaction function by applying the VECM model in Indonesia. The study discovered the presence of fiscal sustainability and a positive effect of twin shock[1] on fiscal sustainability behavior. The study also revealed that the key determinant that affects the external debt in the short and long run as the primary deficit.

Mello (2005) analysed the Fiscal reaction function for Brazil's consolidated public sector, central and regional government respectively. The sustainability of public debt is analysed using unit root and cointegration analysis. The results indicate that across all levels of government there is a strong association between country indebtedness, which can be adjusted through primary surplus targets. This association was strengthened more in practise after the introduction of the debt constraining legislation in 1998. For the case of Brazil, the debt dynamics become more sustainable after the introduction of a spend and tax policy.

[1] The twin shock addressed in the study are the economic fluctuations and an unanticipated exchange rate

3 METHODOLOGY

3.1 GEOMETRY OF DEBT SUSTAINABILITY FRAMEWORK

To asses, the sustainability of the external debt 'geometry of debt sustainability' (GDS) developed by Pasinetti (1998) and later elaborated by Vaggi and Prizzon (2013) is used. Pasinetti (1998) discussed conditions of stabilizing the domestic debt ratio in the context of European Monetary Union countries and shows an implicit relationship between debt-to-GDP ratio and the total/primary surplus (deficit) of the country. Later the GDS analytical framework was extended to analysis the case of external debt by (Vaggi and Prizzon 2013).

GDS represents an analytical tool which shows the existence of a precise relationship between the non-current interest account (NICA) to GDP ratio and the debt-to-GDP ratio which describes all combinations of NICA and debt stock that guarantee a non-increasing debt ratio. The GDS shows the analytical relation between the financial and structural dimensions of debt sustainability. The financial dimension of sustainability points to the relationship between the interest rate (***i)*** and growth rate (***g).*** The debt ratio can stabilize if $i < g$ to bring it into the path of non-increasing debt ratio even in a country with NICA deficits. The ratio of NICA to GDP captures the structural dimension of sustainability which in short run affects the stabilization of debt ratio. Above all, only an eternal improvement of NICA can guarantee that the debt will be ever repaid. Thus, "*GDS features the role of NICA in the long-run sustainability of foreign debt and links up with the so-called transversality condition, according to which in the long run a debt must go to zero, i.e. it must be entirely repaid*"[2].

Mostly for fiscal analysis primary surplus is used to analyse the extent of fiscal sustainability, however, in the case of an open economy it is better to considered overall surplus measured through current account rather than NICA. The current account allows for measuring the changes of the net external position vis a vis the rest of the world. For this analysis NICA is used as it excludes the interest payments and therefore provides an improved indicator for overall sustainability. In the long run foreign debt can only be repaid through a positive NICA. For low income countries the NICA is usually negative due to a restricted export base, and it takes time to improve a negative NICA. For the case of foreign debt both short- and long-term sustainability are closely associated. The liquidity condition of a country improves when the debt ratio (d) decreases. However, this decrease might be negligible for the country's debt repayment and its creditworthiness. In GDS the relationship across two time-scales

[2] Cohen (1985) has expressed the condition algebraically by $\lim_{t\to+\infty} \frac{Dt}{(1+i)^t} = 0$, where $\mathbf{D_t}$ is the debt stock at time ***t*** and ***i*** is the nominal interest rate.

is emphasised, while in NICA overall levels of debt sustainability are analysed. An improvement of NICA not only in the long run reduces the stable level of debt ratio but also in the short run provides the improvement in the creditworthiness of the country. The difference between the case of domestic debt and foreign debt is also highlighted in GDS. According to this framework debt is unsustainable when the debt to GDP ratio increases and this ratio crosses a certain there hold. This increase discourages FDA in LDS and compromises their growth. On the other hand, this analysis does not provide information about the exact threshold of debt to GDP ratio, but highlights the important role of nica is setting a stable debt ratio ***(d*).*** A country may not be able to repay its debt, even if the debt ratio discontinues to increase with a soaring level of ***d**** and a large and structurally negative NICA.

Level of debt sustainability is shown by the following formula:

$$\left(\frac{D}{y}\right)_t < \left(\frac{D}{y}\right)_0$$

Where

"D>0: public debt

Y: Annual Gross Domestic Product (GDP) in nominal terms

t: time"

when the ratio D/Y decreases or, at least remain constant the public debt can be defined sustainable, and on the other hand, defined unsustainable if D/Y is increasing.

It must therefore be

"$\frac{\theta}{g}\frac{D}{y} \leq \frac{D}{y}$ **i.e.** $\theta < g$ **;"**

Where

"$\theta = \frac{\Delta D}{\dot{D}}$ growth rate of public debt (annual)

g = nominal growth rate of GDP (annual)"

The stabilization of debt ratio suggests a non-increasing debt ratio which is expressed as:

"d(D/Y)/dt ≤ 0"

Where

"D: overall foreign debt

Y: GDP

o_n = (dY/dt)/Y is the **nominal** growth rate

i_n = is the **nominal** interest rate"

Considering a country as "net external debtor" and each variable is expressed at "current prices" and in "domestic currency", and supposedly the "exchange rate was fixed", but it's possible to consider the "flexible exchange rates".

The "capital account includes only debt-related flows, so it measures the changes in net foreign liabilities" ***(D).*** The equilibrium balance of payment corresponds to the following identities

(NICA –iD) + ΔD = 0

C = NICA = iD – ΔD

Where

"C: NICA

i: nominal interest

D: debt stock

iD: interest payments on debt

multiply the last term of the right-hand side by **D/D**

$$\mathbf{C = iD – \theta D}$$

$\boldsymbol{\theta}$ **= ΔD/D =** growth rate of debt stock

divide by Y $\quad$ **C/Y = iD/Y –** $\boldsymbol{\theta}$**D**

with $\boldsymbol{c}$ **= C/Y** and $\boldsymbol{d}$ **= D/Y** $\quad$ $\boldsymbol{c = (i- \theta)d}$ $\quad$ ***(1)***

D/Y is not increasing if $\theta \leq g$ (**stability condition**) which is met if:

$$\boldsymbol{c \geq (i\text{-}g)d} \qquad \mathbf{(2)}$$

By substituting $\boldsymbol{g}$ with $\boldsymbol{\theta}$ in equation **(1)**

- With $\boldsymbol{g > \theta}$ $\quad$ $(i\text{-}g) < (i- \theta)$ $\quad$ and $\boldsymbol{c > (i\text{-}g)d}$
- With $\boldsymbol{\theta = g}$ we are on the **boundary relation** $\quad$ $\boldsymbol{c = (i\text{-}g)d}$"

Equation (2) can be described in a diagram whose "vertical where the vertical axis represents NICA-to-GDP ratio (***c***), and the horizontal axis is the debt -to-GDP ratio (***d***)"

"Pasinetti's model helps to divide the area into two parts, one with sustainable debt ratio characteristics and others with increasing debt ratio". Depending on the actual values of ***c*** and ***d***, a country can find itself in one of the three positions.

1. "When the country is on the boundary between the two areas, which indicates all combinations of ***c*** and ***d*** such that $\boldsymbol{d} = 0$; the debt ratio is stable (i.e. $\boldsymbol{\theta} = \boldsymbol{g}$)"
2. "When the debt ratio is decreasing ($\boldsymbol{d} < \boldsymbol{0}$) since $\boldsymbol{c} > \boldsymbol{(i-g)d}$ with $\boldsymbol{\theta} < \boldsymbol{g}$, a country finds itself above the boundary line. This area is designated as sustainability are; the area above the boundary relation including the boundary relation itself".
3. "When the debt ratio is increasing ($\boldsymbol{d} > \boldsymbol{0}$) as $\boldsymbol{c} < \boldsymbol{(i-g)d}$, with $\boldsymbol{\theta} > \boldsymbol{g}$ the stability condition is violated and the country will be located below the boundary relation".

The diagram is improved with a debt ratio state equation describing the variation through time of the debt-to-GDP ratio, and it's given by:

$$"\boldsymbol{d} = (\boldsymbol{i} - \boldsymbol{g})\boldsymbol{d} - \boldsymbol{nica}" \qquad (3)$$

The boundary relation and state equation are shown in Figure C: "*Geometry of Debt Sustainability*" (Refer Appendix C)

3.2 DATA SET DESCRIPTION

The data used for this analysis covers the time span from 2008-2017. All the data are collected from different official sources such as the International Monetary Fund, Central Bank and Ministry of Finance due to unavailability of data from one single source. The data chosen for the analysis are expressed in Ngultrum (Nu) millions since more than 70% of the debt is denominated in Indian currency (INR). Moreover, the Bhutanese currency (BTN) is fully pegged with the Indian rupee. The following variables are used for this analysis and their descriptions are given below.

Table 2: Data description

Name of variables	Symbol	Description	Sources
Debt Stock	D	Public and publicly guaranteed debt including a loan for hydropower projects (total external debt)	Annual Financial Statement, Ministry of Finance
Gross Domestic Product	GDP	Nominal GDP in current Prices	Statistical Yearbook, National Statistical Bureau
Current Account	CA	Trade balance + primary income +secondary income	Authors calculation based on the data from Bhutan Trade Statistics & Royal Monetary Authority of Bhutan
Growth Rate	g	Nominal GDP growth rate[1]	Authors calculation
Interest rate	i	The official interest rate on external borrowing and implicit interest[2]	Department of Public Accounts, Ministry of Finance and authors calculation
Non-interest current account	NICA	Current account + total interest payment on external debt	Authors calculation
nica	nica	Non-interest current account scaled by GDP[3]	Authors calculation based on non-interest current account and GDP
d'	d'	Changes in debt stock (ΔD) [4] scaled by GDP	Authors calculation based on debt stock data obtained from World Bank, International Debt Statistics
Debt ratio	d	Debt stock/GDP	Authors calculation

1. *nominal GDP growth rate* = $\frac{GDPY_1 - GDPY_0}{GDPY_0} \times 100$
2. *implicit interest rate = interest payments/debt stock*
3. *nica = NICA/GDP*
4. *ΔD = Debt stock in Year$_1$- debt stock in Year$_0$*

3.3 METHODOLOGICAL APPROACH

The analysis is been carried out by segregating the total external debt stock into hydropower and non-hydropower debt. It would be more meaningful to study the sustainability for two different debts separately since the composition of debt is unique for Bhutan. More than 70% of the total external debt is rupee-denominated debt related to hydropower owed to the Government of India. The foreign currency related debt account for about 20% of the total external debt owed to other Multilateral and Bilateral agencies. From the total foreign currency debt, an outstanding debt related to two hydropower projects[3] is considered under the hydropower debt for this analysis though the debt is owed to the Government of Austria. The loan availed from GoI as Standby Credit Facility, SWAP Facility, and Dungsum Cement Project is included in the non-hydro debt. The Bhutanese currency Ngultrum (BTN) is fully pegged with Indian Rupee (INR) and the interest rate applied on the two debts are different, thus for this analysis, the two different interest rates are considered.

The GDP treated in this study is the nominal GDP. The trade balance with India is considered to calculate the current account balance related to hydropower debt since India is the biggest trading partner for Bhutan in both imports and exports. likewise, the trade balance with other countries excluding India is reflected to calculate the current account balance for non-hydro debt. The non-interest current account (NICA) for two debts are calculated separately by taking out the interest payments made on the two debts from the current account balance of the two separate debts. GDS framework is built based the latest figure (i.e.2017) and similarly, by taking the average of the last ten years (i.e.2008-2017) to see how the position of country's debt is going to change with these two statistics built on the historically available data.

3.4 ECONOMETRIC MODELS.

3.4.1 Intertemporal budget constraint (IBC) Model

The straightforward way to assess the sustainability of public debt is to start from the intertemporal budget constraint of the government. IBC can be obtained from budget identity as given below

$$PL_t - PL_{t-1} = r_t PL_{t-1} + G_t - R_t$$

Where

PL_t is the government debt at the end of period t

G_t are primary public expenditure (net of interest)

[3] Basochu hydropower project and Dagachu hydropower project

R_t is the government revenue

i_t is the interest rate on public debt in period time t-1

The budget constraint can be simplified to obtain the relationship below following Quintos (1995), Gatak and Sanchez-Fung (2006):

$$PS_t = a + \beta PL_t + \varepsilon$$

Where

PS= primary balance to GDP ratio

PL_t= debt-to-GDP ratio

A policy rule or reaction function which is consistent with the rational behavior was derived by Bohn (1998) and his test on debt sustainability determines whether the government is taking corrective measures to confirm intertemporal budget constraint by surplus-to-GDP ratio and debt-to-GDP ratio or not. Following equation was estimated:

$$PS_t = a_0 + a_1 P_{t-1} + \varepsilon t$$

Where

PS_t = surplus-to-GDP ratio net of interest (or alternatively deficit-to-GDP ratio)

PL_{t-1} = debt-to-GDP ratio lagged by one period

The test of significance of α_1 in the above equation suggests determining fiscal sustainability. If the null hypothesis of α_1 is statistically significant against the alternative hypothesis (i.e. $\alpha_1 < 0$) of not significant will imply that the government is on the route of achieving debt sustainability. The theoretical rationale behind the concept is without offsetting the previous accumulation of debt by a large surplus in the current period, debt sustainability cannot be achieved. This condition is positive and significant for debt sustainability. PS_t and PL_t must be stationary to estimate the above equation and if found non-stationary, the cointegration technique shall be performed to determine the long run association of these two variables provided $\boldsymbol{\varepsilon_t}$ is stationary.

This study attempts to investigate the realistic relationship between debt-GDP ratio, primary surplus, and all other primary budget surplus determinants.

$PB_t = \alpha_0 + \alpha_1 PL_{t-1} + \alpha_2 Z_t + \varepsilon_t$

Where Z_t is another set of determinants of the primary surplus.

3.4.2 Fiscal Reaction Function

Through the estimation of fiscal reaction function, establishing how the government reacts to its debt burden can be done. "Fiscal reaction function usually specifies, for annual data, the reaction of primary balance/GDP ratio to changes in the on period lagged public-to-GDP ratio, controlling for other influences" (Burger et al., 2011). The main hypothesis being tested here is that the government alter the primary budget balance in response to changes in indebtedness to ensure the sustainability of debt dynamics over time The model used in this study is based on Bohn (1998) along with other determinants of the surplus-to-GDP ratio which were suggested by (Barro 1979;1986). Inflation and interest rate are also added to capture the monetary impact of primary balance. Nguyen (2013) stated that this acknowledges the relationship between fiscal and monetary policy. The relationship takes the following form of the fiscal reaction function

$$PB_t = \alpha_0 + \alpha_1 PL_{t-1} + \alpha_2 GAP + \alpha_3 INT + \alpha_4 INF + \varepsilon_t$$

Where

PBt = primary balance to GDP ratio

PL_{t-1} = debt-to-GDP ratio

GAP = Difference between actual and potential GDP

GDP GAP is calculated by regressing GDP on time and obtained the fitted values, then the difference between actual and potential is considered for analysis.

INT= Interest rate

INF = Inflation

The examination of fiscal sustainability will be carried out in a three-step approach.

3.4.3 Variables and Data source

This analysis used the annual time series data for the period 1985-2017. The data were obtained from the World Bank and Statistical Yearbook published by the National Statistics Bureau of Bhutan. The choice of the sample period is purely based on the availability of the data. The key variable included is primary balance and external debt since the analysis attempts to evaluate how the government reacts to the increasing level of debt. Both the variables are scaled by GDP to meet the solvency condition. The primary balance is defined as total government resources less total government expenditure excluding interest payments on external debt. Other variables such as GDP GAP, interest rate, and inflation are also included since the level of primary surplus are likely to be influenced by these factors

as well apart from public debt. The other variables are included to evaluate the contribution of economic and monetary factors in a fiscal effort.

3.4.4 Methodological approach

3.4.4.1 Unit root test and cointegration test

The first step adopted is to test for stationary of variables (PB, PL, GAP, INT and INF) used in this analysis. Testing whether the variables are stationary {I(0)} or not stationary {I(1)} is a necessary condition for time series analysis. The sufficient condition for fiscal sustainability is satisfied if the variables are I(1). However, the necessary condition is not yet fulfilled, and this leads to the second step of the analysis. The variables used in this study will be tested for stationery by employing Augmented Dicker-Fuller (ADF) test. The second step to be followed is to check whether the series are cointegrated or not (Bohn, 2007; Muzenda, 2014). To test for cointegration among the variables, ARDL bound test for cointegration will be applied.

The ARDL model is considered to discover the long run relationship between the dependent and independent variables since this model can be used to determine the existence of long-run association between the relevant variables regardless of whether they are I(0), I(1) or mixture of both (Persaran and Shin, 1997; Persaran et al. 2011). Moreover, they proved that the model remains consistent notwithstanding whether the variables are stationary or not and has the superiority of working with a small sample (Persaran et al. 2011) which is the case for this study. The cointegration test makes use of the F-statistics and t-statistics with the null hypothesis that there is no long-run association among all the variables against the alternative hypothesis of the existence of the long-run relationship[4]. Lag length ***p=2*** is chosen for this model given the small sample size since taking more lags will lose the degree of freedom.

3.4.4.2 Estimation of the fiscal reaction function

The third step is to estimate the fiscal reaction function to analyze fiscal sustainability. VECM (Vector Error Correction) model can be employed, if the test for cointegration indicates the existence of long run relationship among the variables included in the study (Bohn, 2007; Muzenda, 2014). The usefulness of VECM according to Hunter et al. (2017) is that it is the restricted VAR (Vector Autoregression) intended to be used with cointegrated series and has a great explanation of short and

[4] ARDL model unlike many tests does not use the standard critical values of F-test and t-test. They rather provide two other sets of critical value referred to as lower and upper bound based of when the variables are I(0) and I(1) respectively. The decision is made by comparing the F-statistics to upper bound, and H_0 is rejected when the F-statistics is higher than the upper bound. Likewise, if the F-statistic is lower than the upper bound, then we cannot reject H_0. Nonetheless, if the F-statistic falls in the middle of between upper and lower bound, we must consider the stationary characteristics of the variables before making the decision.

long run relationships. Furthermore, the error correction model also estimates the speed of adjustment from short run disequilibrium towards long run equilibrium along with short-run and long run dynamics as suggested by (Berti et al.,2016).

The following VECM will be applied:

$$\Delta PS_t = a_0 + \sum_{i=1}^{p-1} a_{1i}\,\Delta PS_{t-i} + \sum_{i=1}^{p-1} a_{2i}\,\Delta PL_{t-i} + \sum_{i=1}^{p-1} a_{3i}\,\Delta GAP_{t-i} + \sum_{i=1}^{p-1} a_{4i}\,\Delta INT_{t-i} + \sum_{i=1}^{p-1} a_{5i}\,\Delta INF_{t-i} + \lambda ECT_{t-i} + \varepsilon_t$$

The error correction term λ captures the adjustment mechanism of the possible short-run disequilibrium of the primary balance to GDP ratio from the long run steadiness. The coefficient of the error term should lie between 1 and 0. A statistically significant coefficient of less than 0 indicates a gradual correction of deviation from long-run equilibrium through a series of partial adjustments. However, a coefficient less than -1 does not provide an economic interpretation since the short run deviation cannot be over-corrected. Likewise, a positive coefficient indicates the failure of short-run disequilibrium correction from long-run path (Barbier-Gauchard and Mazuy, 2018).

4 EMPIRICAL RESULTS AND DISCUSSION

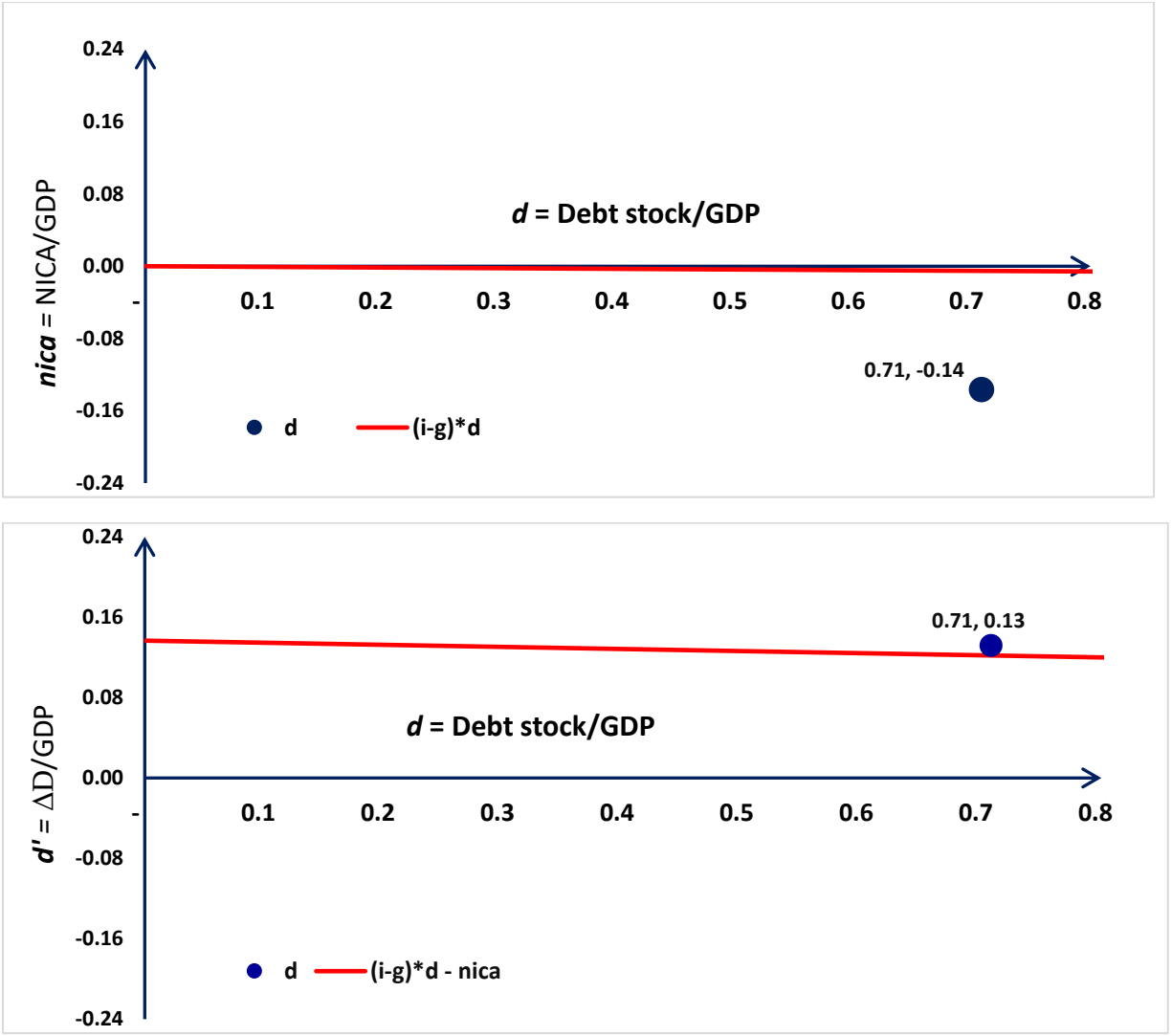
4.1 RESULTS OF GDS ANALYSIS AND DISCUSSION

4.1.1 Hydropower debt

4.1.1.1 Scenario 1

The analysis of the results based on the year 2017 is shown in figure 5. This is built based on the statistics shown in Appendix B.

Figure 5: Hydropower debt 2017



The vertical axis shows the NICA ratio in the upper part of the graph, the horizontal axis represents the debt-to-GDP ratio,***d.*** Based on the actual value of ***nica*** and ***d***, a country can be between any of the three positions as shown in the theoretical framework in Appendix C. In the case of Bhutan's hydropower-related, debt, the country is located below the boundary relation or outside the

sustainability area. The boundary relation is defined where the debt ratio is constant given all combinations of ***nica*** and ***d***. In this case, the country will find itself located along the slope. The sustainability area is the one above the boundary relation and is defined as the sustainability area in the graph. For hydropower debt, the country is located below the boundary relation indicating an increasing debt ratio. This is because the nominal GDP growth rate of 10% may not be high enough corresponding to the interest rate of 10 % to cover the huge ***nica*** deficit of 14%. The country's debt ratio will stabilize if the state equation [(i-g) d-nica] cross through the horizontal axis at point A in the lower part of the GDS framework *(Figure C)*, then in the upper part of the diagram the country will be located on the corresponding point A' which falls in the sustainability area. However, for Bhutan, the hydropower debt ratio has not stabilized or has not reached an equilibrium point at current level of indebtedness, and it may not reach the stability point even later. This implies that the hydropower debt is unsustainable given this accounting framework which is rigid.

The government of Bhutan has exceeded the capacity to borrow any further based on this analysis and until a bigger measure are taking to bring down the debt ratio to a stable condition. The behaviour of debt ratios over the short to medium term largely depends on the gap between the interest rate on debt and the nominal economic growth ***(i-g).*** In situations where the growth rate is higher than the interest rate, there is a possibility to have short term debt stabilization even with ***nica*** deficits. Thus, for the debt ratio to stabilize for Bhutan, the only way is to either increase the growth rate and improve the ***nica*** or to reduce the interest rate.

For hydropower debt, since the interest rate is non-concessional, though the growth rate is relatively high, a stability point is not being able to achieve. If we assume a special growth rate given that there is a special agreement between GoI and Bhutan related to hydropower debt; Bhutan will export the electricity at cost plus 15 percent net return and GoI explicitly covering the financial and construction risk, or renegotiate the interest rate then there might be a possibility to stabilize the debt ratio in the future

One of the main contributing factors for not being able to maintain the constant debt ratio is the huge ***nica*** deficits which are about 14 % of GDP. Unless a major action is considered to improve the ***nica*** deficits, Bhutan's hydropower debt remains unsustainable given these macro conditions. Until the problem of ***nica*** deficit is addressed it will be difficult for the country to stabilize its debt ratio since financing persistent deficits will increase the debt burden. Mehmood et al. (2014) also found that the key factors contributing to increasing debt ratio are primary fiscal balances and non-interest account balances.

The unsustainability of domestic and external debt is mainly due to the fiscal deficits and ***nica*** deficits, thus it is important to address these twin deficits. Furthermore, Wu (2000) also pointed out that a permanent or persistent deficit can have serious effects such as increasing the domestic interest rate to attract foreign capital, and the accumulation of external debt as a result of persistent deficits will upsurge the interest payments thereby imposing debt burden on future generations. This brings into picture the need for the ***nica*** surplus which can only guarantee the repayment of the debt.

Achieving a stable debt-to-GDP ratio can be economically challenging but can be relatively realized in the short run. But, for a country like Bhutan with undiversified exports moving from ***nica*** deficit to a ***nica*** surplus might require much more time. Moreover, the persistence of ***nica*** deficits raises the concern of whether the deficit is sustainable or not. This is a clear sign of the need for structural changes in the economy. Moreover, the interest rate on hydropower debt of 10% is not concessional, though the nominal growth rate of 10.7% for the country is relatively high.

This finding is consistent with the IMF debt sustainability report 2018 where they found that each indicator breaches its indicative thresholds under the baseline scenario[5]. However, given the unique mitigating factors of hydropower debt which accounts for 77% of external debt from GoI, the assessment concluded Bhutan's debt situation at moderate risk of debt distress.

Nevertheless, the situation is not relaxing for Bhutan. Bhutan started to export its electricity production to GoI since the late 1980s and the export accounts for more than 30% of total export goods in 2017 however, the trade balance has not improved over these years due to huge imports related to hydropower from GoI, and also the export-import composition of the country has not changed over the last decade (for import-export composition refer to National Trade Statistics). Additionally, due to delays in commissioning of two mega hydro projects the growth rate is estimated to stagnate around 5% over the period 2018-2020. This is a clear indication of structural weakness (heavy reliance of one commodity) of the economy which needs policy actions to improve the debt situation.

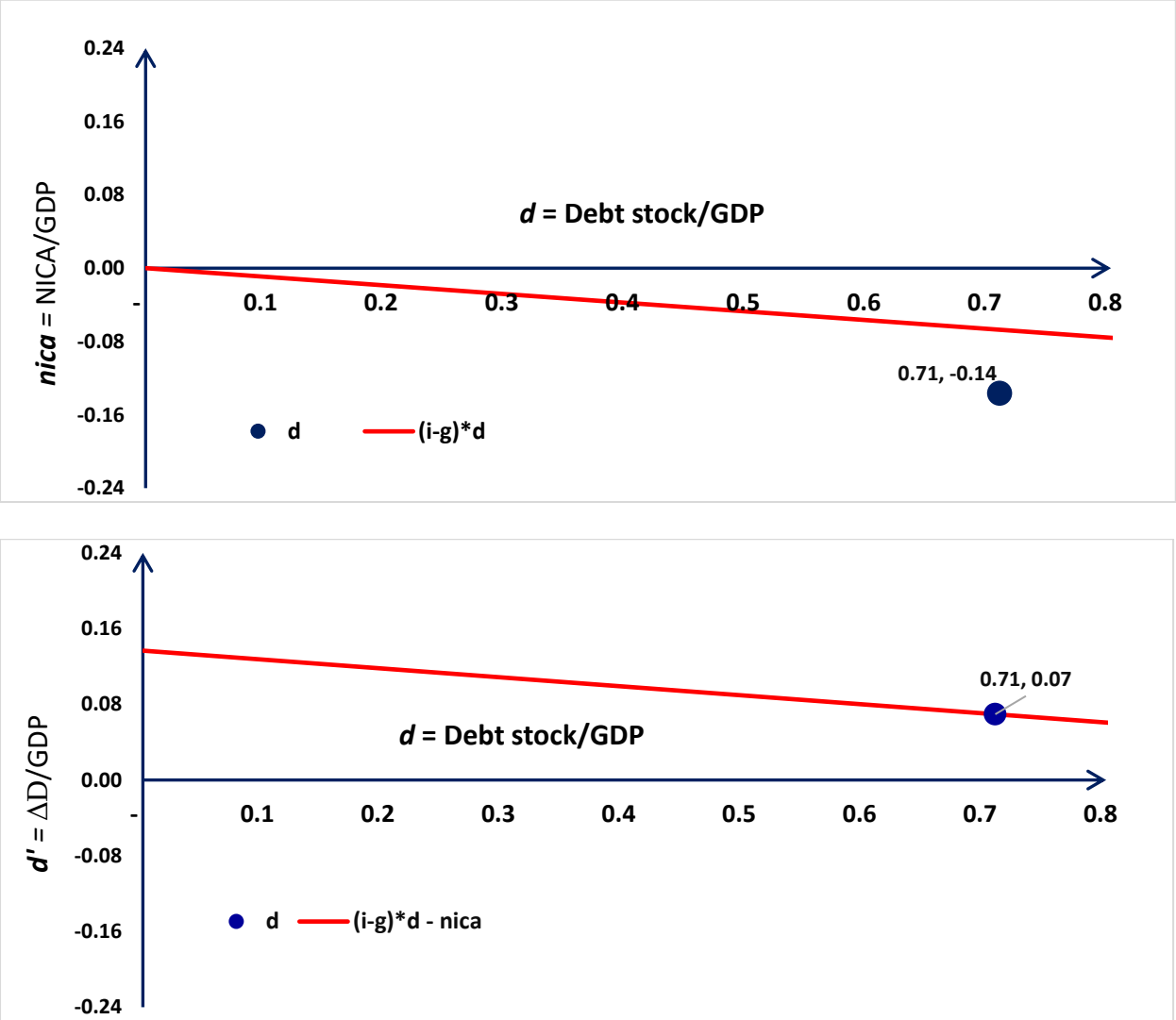
4.1.1.2 Scenario 2

When the implicit interest rate is considered rather than the official interest rate of the hydropower debts. This situation is considered taking into account theat the actual rate of interest applied on the loans is different from the actual interest payment made on the outstanding loan. This variance arises since the actual payment of interest is made on the hydro project loans which are already completed but the debt stock on the ongoing projects has been accumulating. The ongoing projects are in grace

[5] Baseline scenario is when they considered all public and public guaranteed debt including loan for hydropower projects.

period currently. The ***g*** is the average growth rate for the ten years and the debt ratio, ***d*** is the final debt ratio (i.e. the debt ratio for 2017). The implicit interest rate, ***i*** is calculated based on the total interest payment made during the year 2017 divided by the outstanding debt stock as on 2017. The result of the analysis is shown below on figure 6.

Figure 6: Hydropower Debt



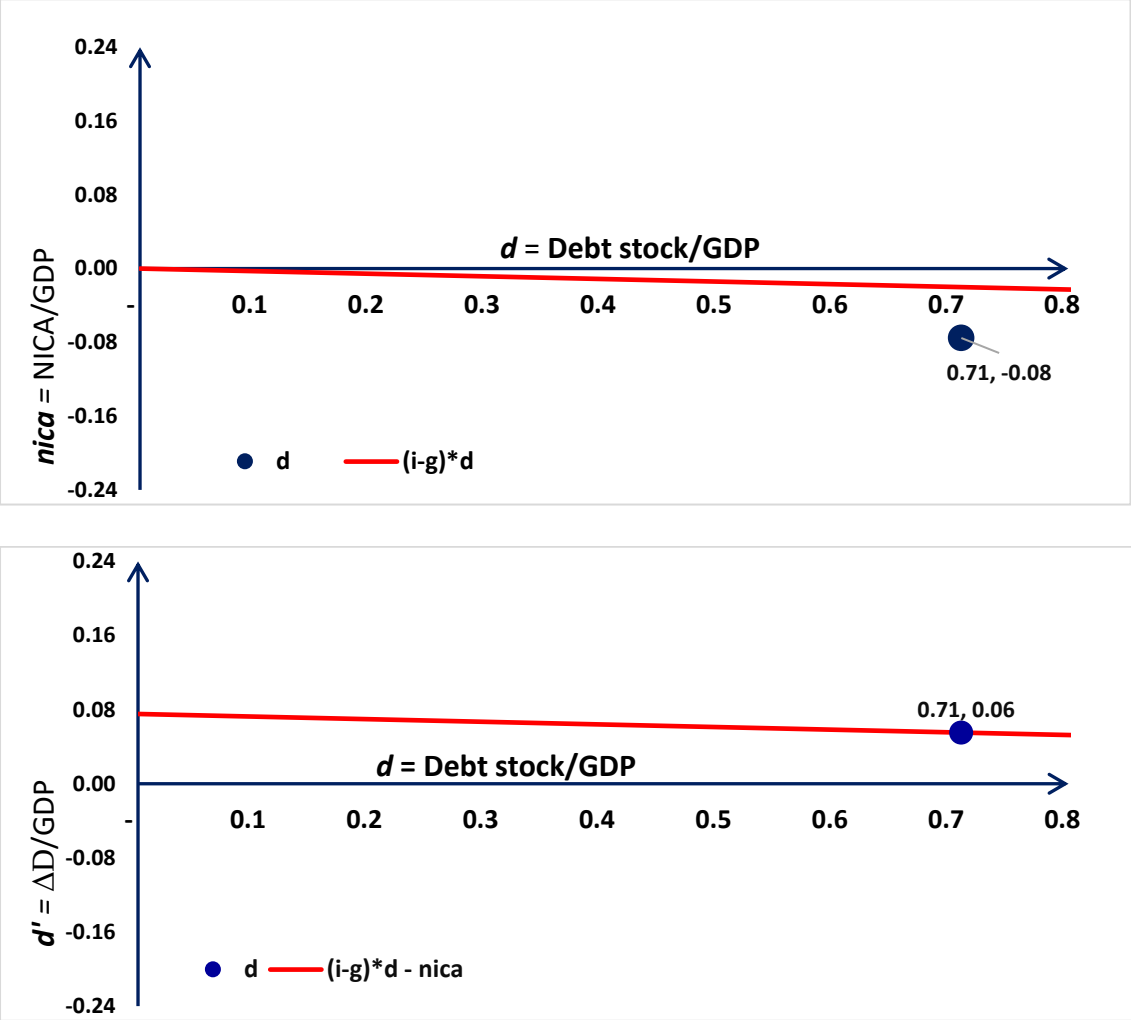
The debt situation is more favourable in this case since the slope of the graph is downward sloping and it can reach the stability point at some point. This occurs because of the lower implicit interest in comparison to the official interest rate since the ***nica*** and ***g*** remained unchanged. Though the country has been accumulating the debt stock, the country has not encountered the problem of debt repayment since the three mega hydropower projects are still under construction. The interest payment in relation to the total outstanding debt is very minimum at present. However, as seen in scenario 1, once all the

ongoing projects are completed there will be a pressure on the debt servicing cost which makes the debt more unsustainable given this macro scenario.

4.1.1.3 Scenario 3

In this case, ***g*** is the average growth rate of ten years, ***i*** is the official interest of 10%, ***d*** is the debt ratio of 2017 as a share of GDP and ***nica*** is ten years average. The result of this scenario is presented below in figure 7.

Figure 7: Average Hydropower Debt (2008-2017)



The debt situation improved slightly when the 10 years average is taken for the analysis. The average growth rate is 13%, higher than the growth rate in 2017. Yet the country lies below the boundary relation but much closer to the boundary relation. Improvement in growth rate or a decrease in interest rate could push the country upwards inside the sustainability area. Another reason for the improvement in the debt position can be attributed to the lower ***nica*** deficits of 8% of GDP against 14% of GDP in

2017. However, the country's debt situation is still unsustainable. The stability point has not been achieved or the debt ratio has not stabilized.

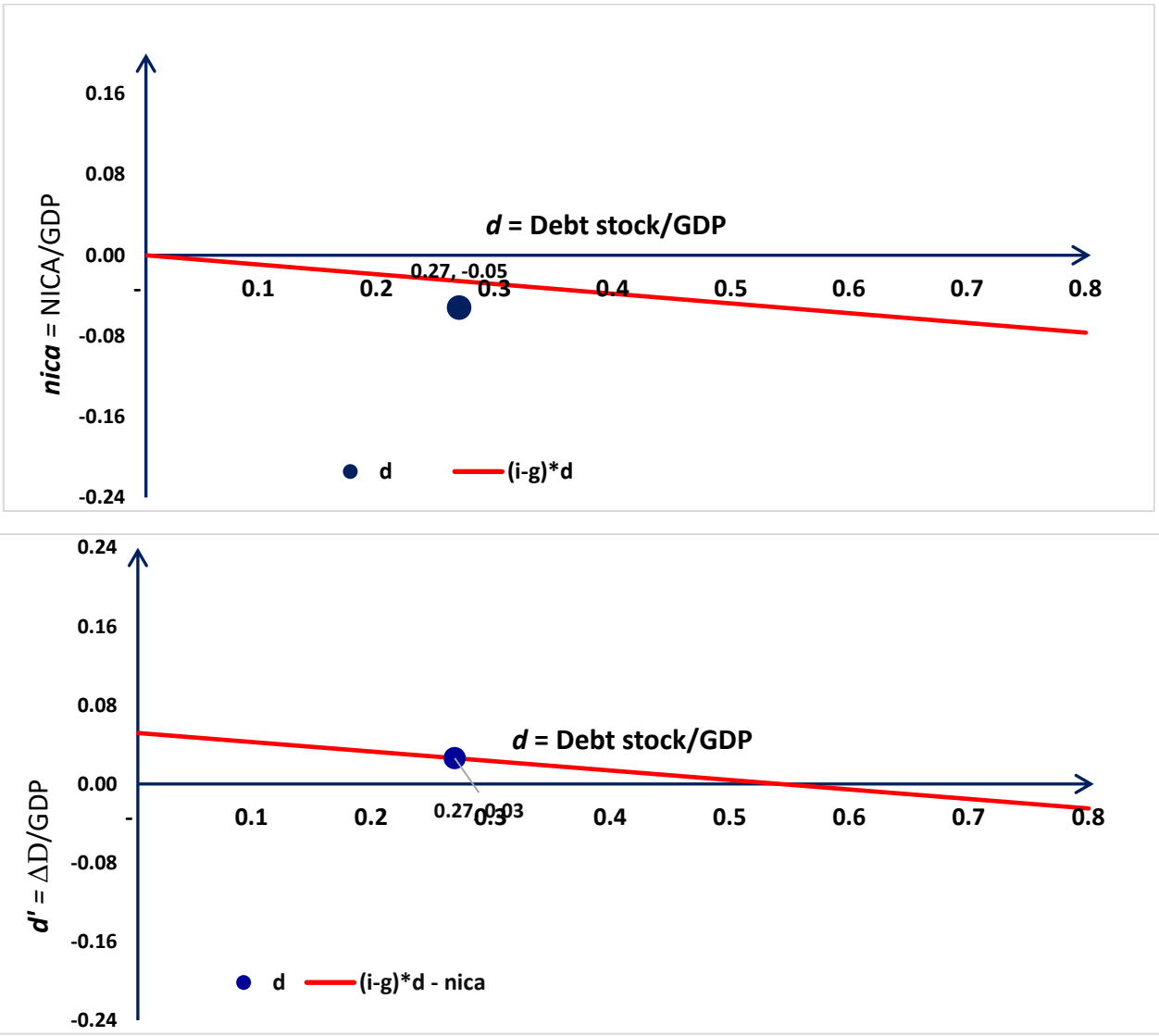
If the slope (state equation) does not cross the horizontal axis in the lower part of the graph it is a clear indication that the country will go on building debt without achieving a stable debt ratio even in the short run. Nevertheless, the slope of the graph started to gently slop downwards and there is a possibility in the long run for the debt ratio to stabilize depending on the growth rate, interest rate, and ***nica.*** If the "*interest rate is higher than the growth rate* ***(i > g),*** *both the boundary relation and state equation slop upwards*". In this kind of situation to achieve a stable debt ratio, even a positive ***nica*** would not be sufficient and the ratio may fail to converge to any stable point (Vaggi and Prizzon, 2013). In this type of scheme, the flatter is the slope, given the ***nica*** deficits the debt ratio may not stabilize.

4.1.2 Non-hydro debt

4.1.2.1 Scenario 1

This is build based on the one-year latest data. The ***g*** is the nominal growth rate for the year 2017 and similarly, the ***r*** is the implicit rate for the year derived based on the actual interest payment made and outstanding debt stock. The ***nica*** is the ***nica*** deficit related to non-hydropower debt for the year 2017. The result of the analysis is given below in figure 8.

Figure 8: Non-hydro debt 2017

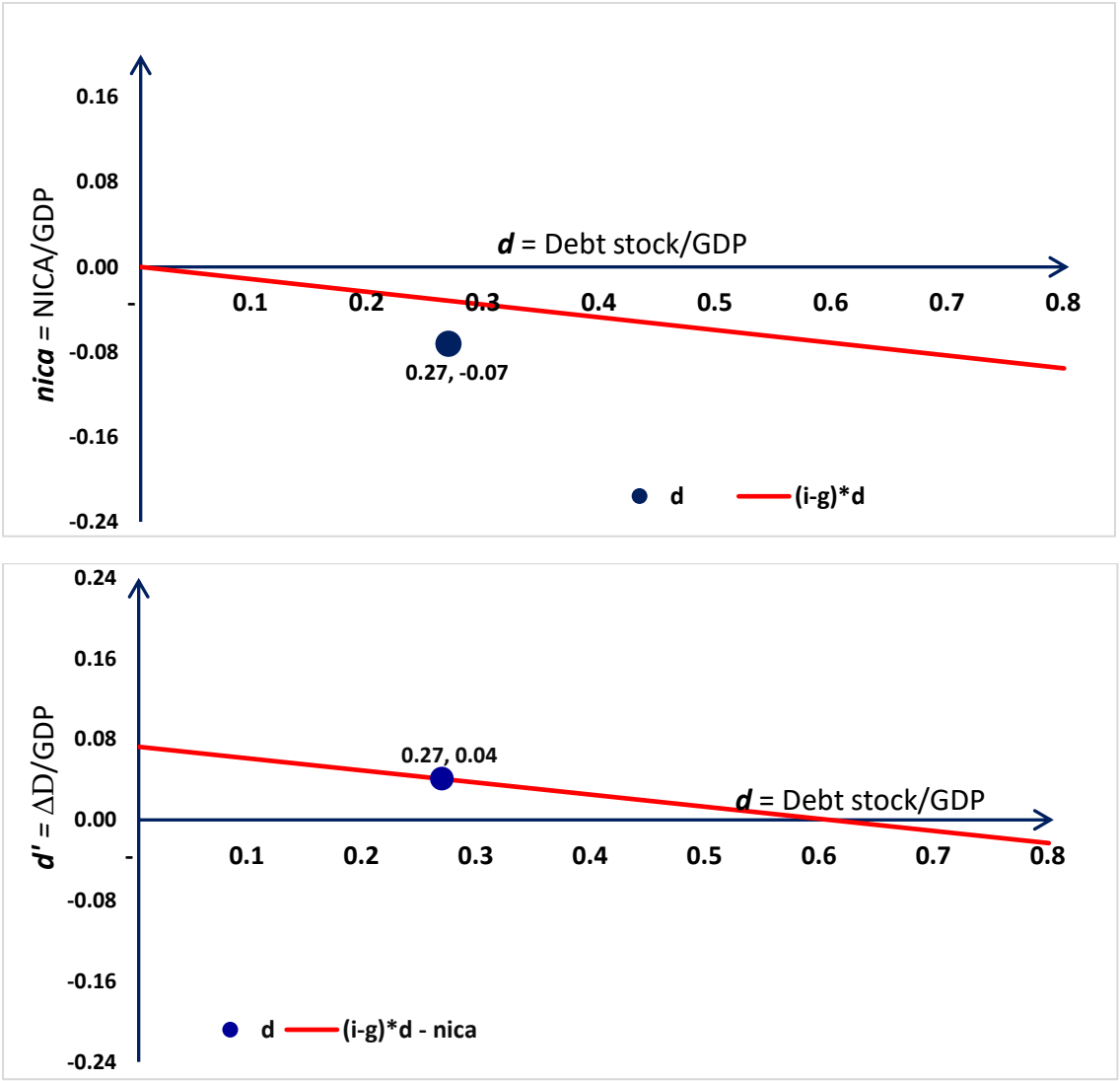


The initial non-hydro debt position falls outside the sustainability indicating that the debt ratio will continue to increase through time, other things remaining constant. However, the situation is strengthened compared to hydropower debt mainly because of the interest rate which is concessional. And moreover, the accumulated debt stock is lower as compared to hydro debt. Since the nominal growth rate of 10.7% is higher than the interest rate 1.09% a stability point/level can be seen at 0.5 on the horizontal axis of the lower part of the graph, even when there is a ***nica*** deficit of 5.2 %. This simply implies the compatibility of a ***nica*** deficit with a sustainable debt ratio when $i < g$. The debt position of the country is located far from the steady state which in principal suggest that the country has the capacity to borrow more. The non-hydro debt situation is more sustainable as compared to the hydropower debt.

4.1.2.2 Scenario 2

In this illustration ***g*** is the average growth rate of ten years, ***i*** is the implicit average interest rate, ***d*** is the debt ratio as a share of GDP in 2017 and ***nica*** is the ten years average related to non-hydro debt. The analysis result is shown in figure 9.

Figure 9: Average non-hydro debt



The situation remains almost identical to the previous result and the country debt position is located outside the sustainability area. The nominal average growth rate of 13% is higher than the growth rate in 2017 while the interest rate is lower as compared to 2017 and debt ratio remained unchanged. Even with higher ***g*** and lower ***I,*** the stability point has changed mainly due to the deteriorating of ***nica*** deficits. The stability point is shifted away from 0.5 to around 0.6 particularly due to the increase in average ***nica*** deficits from the 2017 ***nica*** deficits. This *"underlines the role of* ***nica*** *deficit in setting the country on different routes" (PP)*. Unlike the hydropower debt, the debt situation related to non-

hydro appears more sustainable primarily due to lower interest rate and lower nica deficits. The country has still the capacity to borrow until the debt ratio reaches its stability point.

This analysis indicates that there is a significant and a positive relationship between the financial and structural dimension of debt sustainability. The financial dimension is captured by the relationship between ***i*** and ***g*** where a debt ratio can be stabilized by bringing it to the non-increasing path if ***i < g***, even if a country has ***nica*** deficits. However, depending on the gap between ***i-g*** and the level of the deficit this may not hold true. If the gap between i and g is not huge enough to compensate for the enormous ***nica*** deficit, a debt ratio may not stabilize. The ***nica*** captures the structural dimension which in the short run affects the stabilization of debt ratio. But, can guarantee the repayment of the debt only through permanent improvement of ***nica.*** In the case of Bhutan, ***nica*** deficits played a major role in concluding that the hydropower debt is unsustainable. This can be attributed to the structural weakness of the economy which is also highlighted by ABD as one of the development challenges faced by increasing economy dependence on the export of electricity without diversification of the economy.

4.2 FISCAL REACTION FUNCTION EMPIRICAL RESULTS AND DISCUSSION

4.2.1 Descriptive statistics

The descriptive statistics of the variables employed are shown in Table 3. The descriptive statistics were calculated to understand the structure of the data.

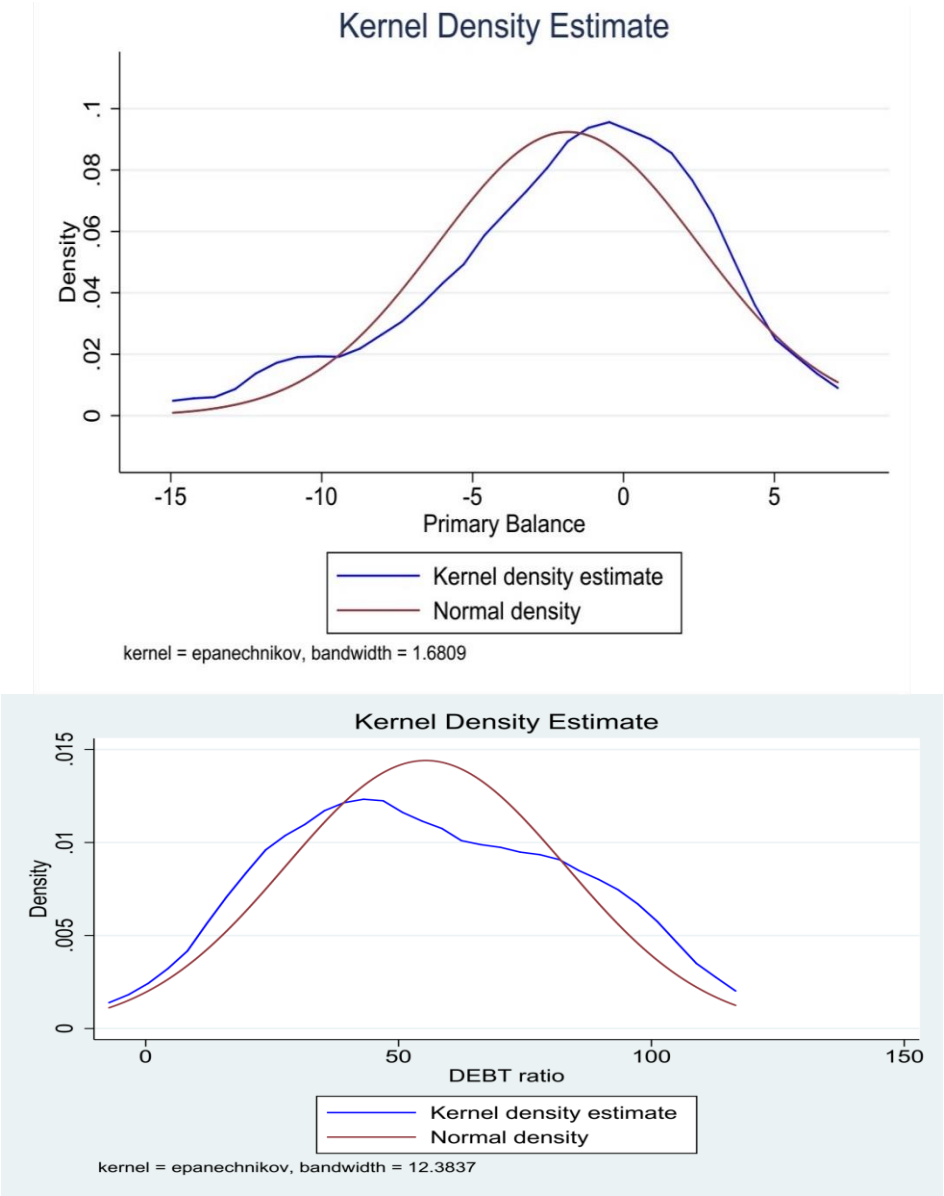
Table 3: Descriptive Statistics

Variables	Statistics						
	Mean	**Standard deviation**	**Variance**	**Minimum**	**Maximum**	**Skewness**	**Kurtosis**
Primary balance	-1.83	4.31	18.64	-13.25	5.42	-.71	3.15
Debt ratio	55.37	27.68	766.69	5.13	104.26	.12	2.01
GDP -GAP	-.72	1.98	3.94	-11.33	.61	-4.80	26.27
Interest	7.94	2.89	8.36	.26	14.54	-.23	3.70
Inflation	6.42	5.47	29.98	-18.11	15.98	-2.62	13.44

Over the period from 1985 to 2017, the country's debt ratio averaged 55.37 percent. The minimum debt ratio was recorded at 5.13 percent of GDP and the maximum was 104.26 percent. The standard deviation of 27.68 indicates that the debt ratio has varied over the years. The average primary balance was recorded -1.83 percent of GDP reaching a minimum of -13.25 and maximum of 5.42 respectively. The minimum interest rate recorded was .26 and maximum of 14.54 with an average of 7.9 percent.

The inflation level averaged at 6.42 with a minimum of -18.11 and maximum of 15.89 respectively. The mean GDP-GAP was recorded at -.72 with a standard deviation of 1.98 indicating that the deviation of the actual GDP from the potential GDP is minimum. From the data, it is visible that the variable GDP-GAP, Interest rate and inflation are negatively skewed indicating a left tail while primary balance and the debt ratio are skewed towards the right. The skewness level zero shows that the distribution of the series is normally distributed. Primary balance and interest rate are normally distributed since the kurtosis value is around 3 while the debt ratio is below 3 indicating a platykurtic distribution. The other two variables have a value higher than 3 which implies that the distribution is leptokurtic/peaked. Figure 10 depicts the density function of the key variables, debt ratio and primary balance.

Figure 10: Kernel Density Function Debt Ratio and Primary Balance



4.2.2 Stationary test for unit root

ADF and Phillips Perron test are performed to examine whether the variables employed are stationary or not. The decision rule for unit root test is that if ADF and PP values are higher than the critical values in absolute terms, we reject the null hypothesis (the series has unit root) and accept the alternative of no unit root and stationery. Lag length 1 is included to solve the problem of autocorrelation and to enhance the robustness of the results. Table 4 shows the results of ADF and the variables are stationary at a different level since the critical values are higher than t-statistics. Interest rate and GDP-GAP are stationary at a level while primary balance, debt ratio and inflation are stationary after first difference without trend at 5 % significance level. Similarly, Table 5 presents the result from Phillips Perron test and all the variables are found stationary at level except for debt ratio. The debt ratio is test for stationary at first difference by including trend term as there is a presence of a trend. The variable became stationery after first difference.

Table 4: Augmented Dicky-Fuller Test for Unit Root

Variables	5% critical values	t-statistics	Stationary
Primary Balance (PS)	-5.646	-2.983	I(1)
Debt ratio (PL)	-3.078	-2.986	I(1)
Inflation	-5.624	-2.986	I(1)
Interest rate	-3.299	-2.983	I(0)
GDP_GAP	-3.309	-2.983	I(0)

Table 5: Phillips-Peron test for Unit Root

Variables	5% critical values	t-statistics	Stationary
Primary Balance (PS)	-4.437	-2.980	I(0)
GDPGAP	-5.057		
Interest rate	-5.359		
Inflation	-3.930		
Debt ratio (PL) [With trend]	-4.087	-3.576	I(1)

4.2.3 Testing for cointegration using ARDL bound test

After the stationary test and stating that the variables are integrated at a different level, the next step is to perform the ARDL bound test for cointegration. Since the variables used in the study are found to integrated at a different level as a result of ADF, the ARDL bound test for cointegration is carried out. The estimation results of the test are shown in Table 6. The hypothesis tested here is there is no level relationship among the variables as a null hypothesis against the alternative of level relationship.

Table 6: Pesaran/Shin/Smith (2001) ARDL Bounds Test for Cointegration

Test	Value	Significance level	Bound critical value	
			Lower Bound	Upper Bound
F-statistics	5.056	10%	2.45	3.52
		5%	2.86	4.01
Adjusted R^2		0.39		

Based on the value of F-statistics which is greater than the I_1 bound (upper bound) at 5% and 10% significance level respectively, it can be concluded that there is the long-run relationship among the variables. Thus, the existence of fiscal sustainability in Bhutan cannot be rejected.

4.2.4 VECM Results

4.2.4.1 Short Run

The results for error correction term and short-run coefficients estimates are presented in Table 7. The coefficient of the cointegrating regression residual (_ce1) is between 0 and 1, and as well statistically significant at the 10% significance level.

Table 7: Error correction term and short-run coefficients

	Coef.	Std. Err.	z	P>z	95%Confidence Interval	
Primary Balance						
Error correction equation						
L1.	-.708	.408	-1.74	0.083	-1.509	.091
Primary Balance						
LD.	.186	.380	0.49	0.625	-.559	.931
L2D.	.170	.262	0.65	0.515	-.343	.685
Debt ratio						
LD.	-.219	.130	-1.69	0.092	-.473	.035
L2D.	-.021	.142	-0.15	0.879	-.300	.257
GDP_GAP						
LD.	-.352	.449	-0.78	0.433	-1.233	.528

L2D.	.484	.369	-1.31	0.189	-1.209	.239
Interest rate						
LD.	.880	.412	2.13	0.033	.071	1.688
L2D.	.123	.305	0.40	0.687	- .474	.721
Inflation						
LD.	-.191	.190	-1.01	0.314	-.563	.181
L2D.	-.292	.166	-1.75	0.080	-.619	.034
Constant	1.170	.981	1.19	0.233	- .752	3.093

$$\Delta PB_t = 1.170 + 0.186PS_{t-1} - 0.219PL_{t-1} - 0.352GAP_{t-1} + 0.8801INT_{t-1} - 0.191INF_{t-1} - 0.708ECT_{t-1}$$

The adjustment term ECT (-0.708) is statistically significant at 10% significance level suggesting that the previous year's errors (or deviation from long-run equilibrium) are adjusted within the current year at a convergence speed of 70.8%. This can be also said that the error correction term for primary balance to GDP ratio equation indicates a fiscal response to deviations from the long run relationship is equal to 70.8%. This implies that around 70% of the deviation is corrected in the first period after the occurrence of deviation. In the short run, past primary balance though positive, but the coefficient is statistically insignificant. The lagged debt ratio has a negative and statistically significant effect on primary balance at 10% significance level. This could be explained as a lack of policy reaction in short run as debt dynamics may not require strong reaction to ensure sustainability.

4.2.4.2 Long run coefficients

The results of long-run coefficients of VECM is depicted in Table 8. In this cointegrating equation table containing the long run components, the signs of the coefficients should be reversed during interpretation, "a minus sign in front of the parameter indicates a positive relationship between the variable to which the parameter applies and the variable on which the vector is normalized"(Burger et al. 2011). In this equation, the restriction is placed on the primary balance ratio which I have indicated as my target variable.

Table 8: Johansen normalization restriction imposed

Beta	**Coef.**	**Std. Err.**	**z**	**P>z**	**95% Conf. Interval**	
Cointegration Equation						
Primary Balance	1					
Debt ratio	-.028	.011	-2.48	0.013	-.050	-.005
GDP_GAP	-1.394	.233	-5.96	0.000	-1.852	-.935
Interest rate	1.121	.173	6.46	0.000	.780	1.461
Inflation	-.301	.088	-3.41	0.001	-.474	-.128
Constant	-3.840					

Table 8 Johnson Normalization Restriction Imposed

A positive relationship is found between country indebtedness and primary balance. A positive and statistically significant coefficient of debt ratio indicates that the government responds systematically to rising debt ratio to ensure fiscal sustainability. This satisfies the condition of sustainable fiscal policy proposed by Bohn (1995,1998). The estimation result is inconsistent with previous studies by de Mello (2005); Afonso and Jalles (2017); Javid and Chandia (2013) where they found a positive relationship between primary balance and debt ratio.

In Bhutan's case, an increase in external debt by one percentage point leads to an increase in primary balance by 0.02 percentage points, ceteris paribus. The coefficient of GDPGAP is positive and statistically significant at 5% significance level indicating that a positive GDPGAP increases the primary balance. In other words, the positive coefficients GDPGAP indicates that the primary balance is estimated to be countercyclical. The finding is compatible with findings of Shastri, Giri, and Mohpatara (2017) where the output gap has a positive impact on the primary surplus in five South Asian countries.

The Interest rate has a significant negative effect on primary balance while inflation has a significant positive effect on primary balance. The positive sign of inflation can be explained that it improves the primary balance and public finance. Higher inflation rate could possibly lead to increase in wages which in turn increase the income tax revenue and VAT due to growth in household consumption as discussed by (Ghosh et al.,2013; Berti et al.,2016). The negative sign of interest rate indicates an improvement in primary balance when the interest rate decreases thereby reducing the debt burden.

In the long run debt ratio, GDPGAP and Inflation has a positive relationship on the primary balance, while the interest rate has a negative relationship. The coefficients are statistically significant at the 5% significance level. (i.e. the coefficients of these variables are relevant to predict the movements or changes in the primary balance-to-GDP ratio).

5 CONCLUSION AND POLICY RECOMMENDATION

5.1 CONCLUSIONS

This study investigated the debt sustainability of Bhutan through two different approaches. Firstly, the external debt sustainability is analyzed based on the geometry of the debt sustainability framework. The investigation is carried out by separating the external debt into hydropower debt and non-hydro debt. The results indicated that the hydropower debt is unsustainable since the country is currently building three mega power plants with non-concessional loans from GoI. Moreover, Bhutan has a huge trade deficit with India due to the increasing import of capital goods for hydropower construction without an equivalent increase in exports. The sustained trade deficit for almost a decade is identified as one of the contributing factors. Other factors can be due to significant delays in the completion of the projects and cost escalations which lead to less export of electricity and larger fiscal deficits. The non-hydro debt appears sustainable due to lower interest rate and less trade deficit. The debt ratio can be stabilized, and a steady state can be attained over the years after a series of interest payments assuming a stable value of interest rate, growth rate, and non-current interest account/GDP.

Secondly, to determine the government's reaction towards the increasing level of external debt, fiscal sustainability is investigated by estimation of fiscal reaction function. The estimation results showed that the government responds to the increasing debt level by adjusting the primary balance. A positive and significant relationship between primary balance and debt ratio, in the long run, suggest that fiscal authorities make considerable adjustment by increasing primary balance to ensure fiscal sustainability. In nutshell, during the sample period, there is the coherence of government fiscal behavior with intertemporal budget constraint. Nevertheless, with budgetary grant declining over the years and decrease in export of electricity, Bhutan might face the challenge of ensuring financial sustainability in years to come.

Though the hydropower debt appears potentially unsustainable given the current scenario, it can be concluded that the government is taking corrective measures/actions when the debt ratio increases. The debt might eventually become sustainable if there is a corrective policy response from the government. Moreover, given the special consideration of hydropower debt due to its unique mitigating factors discussed by IMF and World Bank, external debt could become sustainable in the future.

5.2 POLICY RECOMMENDATIONS

The following policy recommendations are presented in view of the findings of the study.

1. The sustainability of external debt is closely related to the sustainability of hydropower projects yet, delay in commissioning of hydropower projects along with huge cost escalations will negatively affect growth. Thus, it is important for the government to strengthen the capacity to evaluate and manage risks associated with these projects. Furthermore, it is crucial for Bhutan to maintain the trade agreement of cost plus15 net return for the sale of electricity. With recent emerging issues and concerns regarding accelerated hydropower projects, the policy on hydropower development needs to be reviewed.
2. Bhutan's heavy reliance on the export of electricity to India as a main source of revenue leaves the country vulnerable to external shocks. The economy needs to diversify its growth drivers in sectors like Information Communication Centre (ICT), Food Processing and Private Sector development.
3. The decreasing trend in donor financing and budgetary grants, it is vital for the economy to explore alternative financing to cover government expenditure and service debt. Domestic revenue mobilization through broadening the tax base and introduction of value-added tax (VAT) could help the government in smoothing its economic activities.
4. More than a decade, Bhutan has faced sustained current account deficit except for a year mainly due to the huge trade deficit with India. financing the persistent deficit needs more borrowing which increases the debt level of the country. Thus, it is vital for the country to diversify its export basket

REFERENCES

Adams, C., Ferrarini, B., & Park, D. (2010). Fiscal sustainability in developing Asia.

Afonso, A., & Jalles, J. T. (2017). Fiscal reaction functions across the world: a battle of statistical (in-) significance. REM Working Paper, 016-2017.

Arnone, M., Bandiera, L., & Presbitero, A. F. (2005). External debt sustainability: Theory and empirical evidence. Catholic University of Piacenza Economics Working Paper, 33, 1-47.

Arnone, M., Bandiera, L., & Presbitero, A. F. (2005). External debt sustainability: Theory and empirical evidence. Catholic University of Piacenza Economics Working Paper, 33, 1-47.

Barbier-Gauchard, A., & Mazuy, N. (2018). Country-specific scale reaction functions: what lessons for EMU?

Berti, K., Colesnic, E., Desponts, C., Pamies, S., & Sail, E. (2016). Fiscal reaction functions for European Union countries (No. 028). Directorate General Economic and Financial Affairs (DG ECFIN), European Commission.

Blanchard, O. J. (1990). Suggestions for a new set of fiscal indicators.

Bohn, H 1998, 'The Behavior of U.S. Public Debt and Deficits', The Quarterly Journal of Economics, vol. 113, no.3, pp. 949-963

Bohn, H. (1995). The sustainability of budget deficits in a stochastic economy. Journal of Money, Credit and Banking, 27(1), 257-271.

Bohn, H. (2007). Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint?. Journal of Monetary Economics, 54(7), 1837-1847.

Buiter, W. H. (1985). A guide to public sector debt and deficits. Economic policy, 1(1), 13-61.

Caliari, A. (2006). The debt–trade connection in debt management initiatives. The need for a change in paradigm. Artigo preparado para seminário UNCTAD Debt Sustainability and Development Strategies" Geneva.

Caliari, A. (2006). The New World Bank/IMF Debt Sustainability Framework. A Human Development Assessment. CiDSE/Ci.

CAMPAIGN, J. (2019). Crisis deepens as global South debt payments increase by 85%. Retrieved from https://jubileedebt.org.uk/press-release/crisis-deepens-as-global-south-debt-payments-increase-by 85?fbclid=IwAR0csd3LtYGc9dGdY_jFnW03qO1s0lLnlIENDyD6eC3VFykmB9SBKhiGjK8

Caner, M., Grennes, T., & Koehler-Geib, F. (2010). Finding the tipping point: when sovereign debt turns bad. Sovereign Debt and Financial Crisis, 64-75.

Chalk, M. N. A., & Hemming, M. R. (2000). Assessing fiscal sustainability in theory and practice (No. 0-81). International Monetary Fund.

Chandia, K. E., & Javid, A. Y. (2013). An analysis of debt sustainability in the economy of Pakistan. Procedia Economics and Finance, 5, 133-142.

Claessens, S. (1996). Analytical aspects of the debt problems of heavily indebted poor countries (No. 1618). World Bank Publications.

Cohen, D. (1993). Low Investment and Large LDC Debt in the 1980's. The American Economic Review, 437-449.

Cohen, D. (2001). The HIPC initiative: true and false promises. International Finance, 4(3), 363-380.

Cuddington, J. T. (1999). Analyzing the sustainability of fiscal deficits in developing countries. The World Bank.

Das.,B.(November 2017).Are South Asian countries sinking into a debt trap?. International Debt Statistics 2018. World Bank Blogs. Available at: https://blogs.worldbank.org/opendata/are-south-asian-countries-sinking-debt-trap?fbclid=IwAR2PYW1cq59vXuJvYEwS1heCB6-UDg4Qdv2qFDH6N6SA3pOpzhw12fBbwJY

de Mello, L 2005, 'Estimating a Fiscal Reaction Function: The Case of Debt Sustainability in Brazil',

OECD Publishing.

De Mello, L. (2008). Estimating a fiscal reaction function: the case of debt sustainability in Brazil. Applied Economics, 40(3), 271-284.

Doi, T., Hoshi, T., & Okimoto, T. (2011). Japanese government debt and sustainability of fiscal policy. Journal of the Japanese and international economies, 25(4), 414-433.

Elliot,L.(April, 2019). Debt crisis warning as poorest countries' repayment bills soar. The Global Economy. The Guardian. Available at: https://www.theguardian.com/business/2019/apr/03/debt-crisis-warning-as-poorest-countries-repayment-bills-soar?fbclid=IwAR3d6PnSFWjFCcbIfA-jGPGfXk21P9DKHYhJ0f4AsbmV2c6PbI2H5t6aq7U

Fosu, A. K. (2007). The external debt-servicing constraint and public expenditure composition: Evidence from African economies (No. 2007/36). Research Paper, UNU-WIDER, United Nations University (UNU).

Ghosh, A. R., Kim, J. I., Mendoza, E. G., Ostry, J. D., & Qureshi, M. S. (2013). Fiscal fatigue, fiscal space and debt sustainability in advanced economies. The Economic Journal, 123(566), F4-F30.

Goldstein, M. (2003). Debt sustainability, Brazil, and the IMF. Institute for International Economics Working Paper, (03-1).

Gunter, B. G. (2003, February). Achieving long-term debt sustainability in all Heavily Indebted Poor Countries (HIPCs). In XVI Technical Group Meeting of the Group of (Vol. 24).

Haidar, S. (2017). Hydropower debt, delays biggest challenge in ties with India, say Bhutan officials. [online] The Hindu. Available at: https://www.thehindu.com/news/national/hydropower-debt-delays-biggest-challenge-in-ties-with-india-say-bhutan-officials/article19630701.ece [Accessed 14 Mar. 2019].

Hall, R. E. (2014). Fiscal Stability of High-Debt Nations under Volatile Economic Conditions. German Economic Review, 15(1), 4-22.

Hall, R. E. (2014). Fiscal Stability of High-Debt Nations under Volatile Economic Conditions. German Economic Review, 15(1), 4-22.

Hansen, B. E. (2017). Regression kink with an unknown threshold. Journal of Business & Economic Statistics, 35(2), 228-240.

Hunter, J., Burke, S. P., & Canepa, A. (2017). Multivariate Modelling of Non-stationary Economic Time Series. Basingstoke: Palgrave Macmillan.

IMF. (2018). 2018 ARTICLE IV CONSULTATION—PRESS RELEASE; STAFF REPORT; AND STATEMENT BY THE EXECUTIVE DIRECTOR FOR BHUTAN.

IMF. (2018). BHUTAN Joint Bank-Fund Debt Sustainability Analysis- 2018 Update. Thimpu: INTERNATIONAL DEVELOPMENT ASSOCIATION.

Insukindro. (2018). THE EFFECT OF TWIN SHOCK ON FISCAL SUSTAINABILITY IN NDONESIA. ECONOMICS & SOCIOLOGY, 11(1), 75-84.

Inter-Agency Task Force on Financing for Development. (2016). Addis Ababa Action Agenda: Monitoring Commitments and Actions: Inaugural Report 2016. UN.

Islam, A., & Faisal, F. (2012). External debt of Bangladesh: sustainability and future concerns. Elixix international journal, www. elixirpublishers. com.

Jooste, C., Cuevas, M. A., Stuart, I. C., & Burger, P. (2011). Fiscal sustainability and the fiscal reaction function for South Africa (No. 11-69). International Monetary Fund.

Jooste, C., Cuevas, M. A., Stuart, I. C., & Burger, P. (2011). Fiscal sustainability and the fiscal reaction function for South Africa (No. 11-69). International Monetary Fund.

Jooste, C., Cuevas, M. A., Stuart, I. C., & Burger, P. (2011). Fiscal sustainability and the fiscal reaction function for South Africa (No. 11-69). International Monetary Fund.

Krejdl, A. (2006). Fiscal Sustainability: Definition, Indicators and Assessment of Czech Public Finance Sustainability. Na Příkopě: Czech National Bank, Economic Research Department.

Krugman, P. (1988). Financing vs. forgiving a debt overhang. Journal of development Economics, 29(3), 253-268.

Llorca, M. (2017). External debt sustainability and vulnerabilities: Evidence from a panel of 24 Asian countries and prospective analysis (No. 692). ADBI Working Paper Series.

Mahmood, T., Arby, M. F., & Sherazi, H. (2014). Debt sustainability: A comparative analysis of SAARC countries. Pakistan Economic and Social Review, 15-34.

Ministry of Finance. (2017). ANNUAL FINANCIAL STATEMENTS of the ROYAL GOVERNMENT OF BHUTAN for the YEAR ENDED 30 JUNE 2017. Thimpu: Department of Public Accounts Ministry of Finance. Government of Bhutan

Muzenda, A. (2014). An empirical assessment for fiscal sustainability in South Africa. Journal of Economics and Sustainable Development, 5(23), 1-7.

National Statistical Bureau (2017). 2017 POPULATION & HOUSING CENSUS OF BHUTAN. National Statistical Bureau, pp.15,54.

Nguyen, T. (2013). Estimating India's fiscal reaction function. Australia South Asia Research Centre, (2013-05).

NSB. (2013). National Account Statistics. Royal Government of Bhutan Thimphu: Bhutan. National Statistics Bureau.

NSB. (2018). National Account Statistics. Royal Government of Bhutan Thimphu: Bhutan. National Statistics Bureau.

OECD (2013), "Fiscal sustainability", in *Government at a Glance 2013*, OECD Publishing, Paris,https://doi.org/10.1787/gov_glance-2013-11-en.

Pasinetti, L. L. (1998). The myth (or folly) of the 3% deficit/GDP Maastricht 'parameter'. Cambridge journal of economics, 22(1), 103-116.

Pesaran, M. H., & Shin, Y. (1998). An autoregressive distributed-lag modelling approach to cointegration analysis. Econometric Society Monographs, 31, 371-413.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of applied econometrics, 16(3), 289-326.

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. American Economic Review, 100(2), 573-78.

Reinhart, C. M., Reinhart, V. R., & Rogoff, K. S. (2012). Public debt overhangs: advanced-economy episodes since 1800. Journal of Economic Perspectives, 26(3), 69-86.

Reinhart, C. M., Rogoff, K. S., & Savastano, M. A. (2003). Debt intolerance (No. w9908). National Bureau of Economic Research.

Rinzin,C. (2018). Sustainability Energy: Is Hydropower the Answer? The Druk Journal.

Sachs, J. D. (1989). The Debt Overhang of Developing Countries. Debt Stabilisation and Development. G. Calvo, R. Findlay, P. Kouri and JB d. Macedo.

Sachs, J. D. (2002). Resolving the debt crisis of low-income countries. Brookings papers on economic activity, 2002(1), 257-286.

Shastri, S., Giri, A. K., & Mohapatra, G. (2017). An empirical assessment of fiscal sustainability for selected South Asian economies. Theoretical & Applied Economics, 24(1).

Sheikh, M. R., Abbasi, M. N., Iqbal, S., & Masood, S. External Debt Sustainability Analysis: A Case of SAARC Countries.

Solomon, R., Greenspan, A., Kareken, J.H. and Ohlin, G., 1977. A perspective on the debt of developing countries. Brookings Papers on Economic Activity, 1977(2), pp.479-510.

United Nations General Assembly. (2016). External debt sustainability and development. Report of the Secretary-General. United Nations General Assembly. Retrieved from https://unctad.org/meetings/en/SessionalDocuments/a71d276_en.pdf?fbclid=IwAR3d6PnSFWjFCcbIfA-jGPGfXk21P9DKHYhJ0f4AsbmV2c6PbI2H5t6aq7U

Vaggi, G., & Prizzon, A. (2013). On the sustainability of external debt: is debt relief enough?.Cambridge journal of economics, 38(5), 1155-1169.

World Bank. (2018). Debt Vulnerabilities in IDA Countries. The World Bank. Retrieved from http://documents.worldbank.org/curated/en/896041540087366658/pdf/debt-vulnerabilities-in-ida-countries-10042018
636756697620872725.pdf?fbclid=IwAR3bdWCukAU6OyCMZrTDDJ44hav7jSigQMNZSNKDQoMDtrHp0U3084LopZA

World Bank. (2019). Global Economic Prospects Darkening Skies. Washington D.C: The World Bank Group.

World Bank Open Data | Data. (2019). Retrieved from https://data.worldbank.org/

Wu, J. L. (2000). Mean reversion of the current account: evidence from the panel data unit-root test. Economics Letters, 66(2), 215-222.

APPENDIX

APPENDIX A: TABLE SHOWING SIZE AND MAGNITUDE OF EXTERNAL DEBT

Table A Size and magnitude of External Debt

Bhutan's External debt stock, Debt service, Net transfers on debt and Concessional debt.					
Years	**External debt stock**	**Debt service**	**Net transfers on debt**	**Growth in debt**	**Concessional debt/total debt**
	In Million US $			**In %**	
1990	83.55	5.21	4.22	-	74.00
1991	86.34	7.24	0.07	3.33	79.80
1992	89.20	5.89	4.11	3.31	83.79
1993	96.62	7.12	5.38	8.31	86.53
1994	104.51	7.53	2.23	8.16	90.67
1995	105.77	9.80	0.08	1.20	93.04
1996	113.04	6.92	8.35	6.87	95.91
1997	119.62	7.20	11.45	5.80	96.44
1998	171.04	9.18	49.10	42.98	69.50
1999	192.03	7.35	2.97	12.27	68.14
2000	211.57	7.04	27.31	10.17	63.12
2001	272.71	6.47	71.48	28.89	50.26
2002	386.05	6.61	92.23	41.56	48.34
2003	493.63	7.34	88.37	27.86	42.76
2004	601.32	12.19	75.99	21.81	39.79
2005	656.60	7.10	82.85	9.19	37.20
2006	721.11	10.66	42.57	9.82	38.20
2007	801.24	32.13	1.76	11.11	38.53
2008	693.08	81.57	-59.90	-13.49	45.50
2009	786.65	75.52	39.47	13.50	45.06
2010	934.63	87.49	91.36	18.81	42.44
2011	1071.60	85.42	186.85	14.65	40.70
2012	1449.65	130.49	345.53	35.27	33.28
2013	1603.15	78.53	214.21	10.58	30.82
2014	1836.09	82.93	272.33	14.50	27.33
2015	2013.10	128.97	228.39	9.64	24.44
2016	2313.03	110.60	313.06	14.89	20.33
2017	2635.76	78.52	143.29	13.95	20.54

Data Source: World Bank, International Debt Statistics

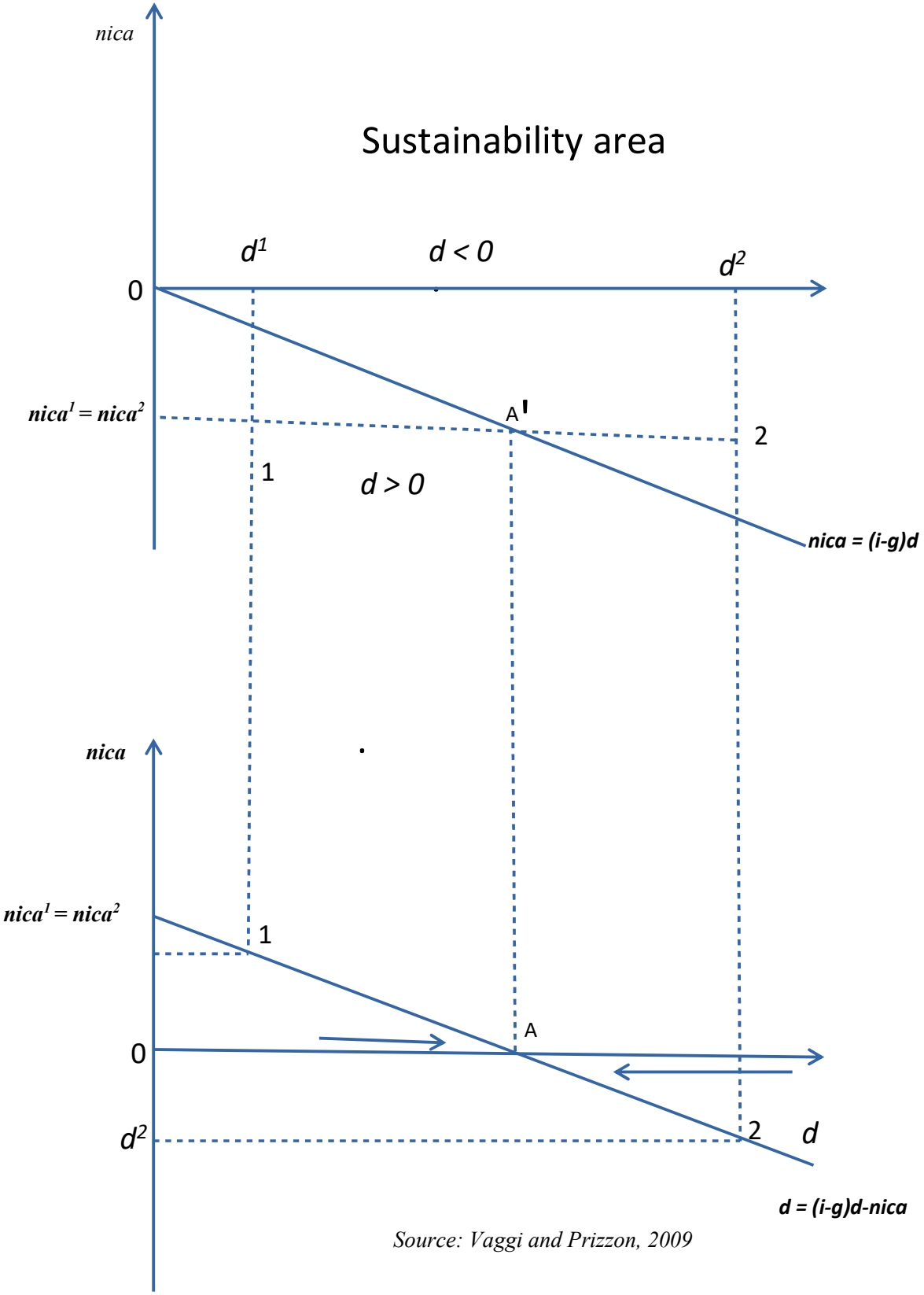
APPENDIX B: CALCULATIONS FOR GDS ANALYSIS OF HYDRO AND NON-HYDRO POWER DEBT

Table B: Calculations for GDS analysis for Hydro and Non-Hydropower Debt

Year	g (nominal growth rate)	Debt Stock		Interest rate (i)		nica		d (debt stock/GDP)		d' (ΔD/GDP)		(i-g)*d		(i-g)*d - nica	
		Hydro	Non-hydro	Hydro	Non-hydro	Hydro	Non-hydro	Hydro	Non-hydro	Hydro	Non-hydro	Hydro	Non-hydro	Hydro	Non-hydro
2017	0.11	116535.42	43664.00	0.100	0.01	-0.14	-0.05	0.71	0.27	0.06	-0.03	-0.07	-0.03	0.07	0.03
2008-2017	0.13	116535.42	43664.00	0.100	0.01	-0.08	-0.07	0.71	0.27	0.08	0.04	-0.02	-0.03	0.06	0.04

APPENDIX C: Figure Showing Geometry of Debt Sustainability

Figure c: Geometry of Debt Sustainability



Source: Vaggi and Prizzon, 2009