Analyzing Public Debt Sustainability: An Empirical Evidence from Selected South Asian Countries

BY

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I declare that the thesis **Analyzing Pubic Debt Sustainability: An Empirical Evidence from Selected South Asian Countries** submitted by me in partial fulfillment of my MPhil degree, is my original work, and has not been submitted or published earlier. I also solemnly declare that it shall not, in the future, be submitted by me for obtaining any other degree from this or any other university or institution.

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ABSTRACT

The purpose of this study is to examine the sustainability of the debt of selected South Asian nations. The majority of South Asian countries have stated that they will attempt to fulfill the Sustainable Development Goals (SDGs) that the United Nations has set. Supporting efforts to attain these goals, particularly those relating to the elimination of poverty, the development of infrastructure, and the provision of social welfare is dependent on effective debt management and fiscal sustainability. The advanced statistical methods are applied to analyze debt sustainability in South Asian nations. The focus is on understanding the relationship between various economic factors and debt dynamics, without delving into the complexities of specific tests and models used. This approach provides clear insights into fiscal management and sustainability. The analysis, while complex, reveals key insights into the dynamics of public budget management in relation to external revenue, trade openness, and organizational governance in South Asian nations. It indicates the necessity for ongoing research and refinement in fiscal policy modeling to enhance debt sustainability and support the achievement of Sustainable Development Goals in these regions. The study concludes that for South Asian nations, effective debt risk management is pivotal in ensuring fiscal sustainability and achieving Sustainable Development Goals (SDGs). It recommends the creation of comprehensive debt risk management frameworks, emphasizing the importance of conducting detailed stress tests and vulnerability assessments. This approach is vital for these countries to manage their debt responsibly, mitigate risks, and ensure economic stability in the face of potential external shocks.

Keywords: public debt sustainability, primary balance, South Asian countries, SDGs, 2SLS, etc.

Table of Content

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DEDICATION

This thesis is devoted to my family, especially my parents, in appreciation of their love, unending support, and inspiration. Dad, I breathe with you in mind.

ALSO DEDICATED TO

My Teachers

CHAPTER 01
INTRODUCTION

Background of Study:

Debt encompasses the financial obligation of individuals, groups, or governments to repay borrowed funds to another entity or creditor, usually with interest.It is crucial in the modern economy, enabling the financing of various activities, investments, and expenditures that might otherwise be financially challenging in the short term. However, as Mankiw (2016) notes, excessive or unsustainable levels of debtcan lead to financial instability and economic challenges. Broadly, debt is categorized into private and public sectors.

Private debt is incurred by entities such as individuals, households, and private enterprises, utilizing mechanisms like credit card debt, mortgages, personal loans, and corporate bonds (Mishkin & Eakins, 2018). This becomes a viable option when these entities lack sufficient funds from their own resources to support initiatives, purchases, or investments. On the other hand, "public debt" represents the debt accumulated by governments to fund public spending and address budget deficits. Governments typically issue bonds and other debt instruments to borrow money from the general public, financial institutions, or foreign nations (Auerbach et al., 2014). Public debt often finances infrastructure projects, social welfare programs, and various governmental initiatives. However, the accumulation of excessive public debt raises concerns about its sustainability and the potential burden on future generations (Reinhart & Rogoff, 2010).

Understanding the impact of debt on the economy involves considering various complexities and viewpoints. While research by Ramey and Shapiro (1998) suggests that debt can stimulate economic growth by financing investments in research and development (R&D), education, and infrastructure, an excess of debt may deter private investment, leading to increased interest rates and a reduction in borrowing for productive purposes, potentially hindering economic expansion. According to Alesina et al. (2019), governments utilize debt as a tool for fiscal policy to control the economy. In periods of economic downturns, deficit spending through debt issuance can stimulate

demand and revive economic activity. However, chronic deficit spending and rising public debt levels can raise concerns about the sustainability of the fiscal situation and potential adverse impacts on economic stability over the long run.

Mian and Sufi (2014) argue that elevated private debt levels in an economy can pose a threat to financial stability, potentially leading to defaults and systemic risks when borrowers struggle to meet their obligations. The risk becomes pronounced when borrowers are unable to fulfill their debts either in full or on schedule, and the rapid accumulation of debt within the financial sector can contribute to the formation of asset bubbles and financial crises. Similarly, consumer debt, including credit card debt and personal loans, may initially stimulate economic growth by boosting consumer spending, as outlined by Dynan et al. (2004). However, an excess of consumer debt can result in financial hardships for households, limiting their ability to contribute to economic activity.

Reinhart and Sbrancia (2015) highlight that elevated government debt levels have the potential to drive up interest rates, subsequently increasing borrowing costs for both consumers and businesses, which could impede overall economic activity. The term "debt sustainability" refers to a nation's capacity to manage its debt load effectively without jeopardizing long-term fiscal stability, economic growth, and financial well-being. Governments grapple with the challenge of ensuring debt sustainability to avoid undesirable consequences, such as heightened borrowing costs, reduced investment, fiscal constraints, and increased vulnerability to external shocks. The International Monetary Fund (IMF) provides economic guidance and financial assistance to nations facing economic difficulties, utilizing the Debt Sustainability Framework to assess and monitor the debt sustainability of low-income nations. Reinhart and Rogoff's (2010) research emphasizes the importance of maintaining manageable debt levels, as exceeding a certain threshold in public debt can correlate with a slowdown in economic growth, highlighting the need for prudent debt management for sustained economic prosperity.

Cecchetti et al. (2011) conduct a comprehensive study delving into the tangible effects of elevated debt levels on economic growth. Their research underscores the

potential repercussions of excessive public and private debt, emphasizing the likelihood of diminished economic development and heightened financial instability. Throughout their exploration, a consistent theme emerges, underscoring the critical necessity of maintaining a manageable debt level to proactively preempt adverse impacts on the economy.

In tandem with this research, the World Bank (2017) meticulously scrutinizes recent developments in global debt and associated concerns. Their report analyzes factors contributing to the rise in debt levels and delves into the potential implications of heightened debt on economic stability. Offering valuable insights, the report provides policy recommendations geared towards ensuring that debt remains at a sustainable level. Central to this discourse is the concept of public debt sustainability, defined as a government's adept management of its debt levels without compromising the nation's long-term economic stability and well-being. Striking a careful balance between borrowing for essential public expenditures and maintaining a manageable debt level relative to the nation's economic capacity emerges as a crucial consideration.

The imperative of maintaining public debt at a sustainable level becomes increasingly evident when considering the risks associated with heightened debt, including rising interest rates, diminished investor trust, and the looming specter of a debt crisis. Policymakers, as highlighted by Cottarelli (2011), must engage in meticulous assessments of debt sustainability. This involves considering factors such as economic growth, fiscal deficits, interest rates, and the cost of debt payments to ensure that public debt remains within a reasonable and fair range.

A global imperative emerges for governments to uphold sustainable public debt levels, becoming a cornerstone of effective economic management. This commitment ensures responsible and manageable borrowing practices, ultimately reducing the likelihood of defaults and financial crises. By maintaining a sustainable public debt level, governments position themselves to finance vital public expenditures like infrastructure development and social welfare programs without burdening future generations with excessive debt repayments. Despite the role of debt as a fiscal tool during economic slumps, policymakers must strike a delicate balance to prevent financial instability. The sustainability of debt is intrinsically linked to fiscal discipline

and efficient governance, as responsible fiscal policies play a pivotal role in managing debt buildup and ensuring that debt levels remain within sustainable boundaries (Cecchetti et al., 2011).

The exploration of China's growth model and its implications for stable finances underscores the paramount importance of responsible public debt management. While the primary focus is on China, the research findings extend their relevance globally, offering valuable insights for nations navigating the complexities of ensuring the sustainability of public debt amid evolving economic landscapes (Cottarelli, 2011). The World Bank's investigation, articulated by Kose et al. (2019), accentuates the critical need for countries to prioritize debt sustainability, recognizing its fundamental role in mitigating potential adverse effects on economic growth and stability. This emphasis provides nuanced insights into the intricate challenges associated with adeptly managing public debt amidst the dynamic shifts in the global economic arena.

Reinhart and Rogoff's exploration in 2010 reinforces the imperative of maintaining manageable debt levels for sustained long-term economic growth. The inherent risks tied to elevated public debt levels underscore the necessity of prioritizing debt sustainability as a foundational principle for economic resilience. The collective body of research, spanning both empirical and theoretical perspectives on the connection between governmental debt and economic expansion, raises concerns about relying on public borrowing to stimulate growth. The intricate dynamics revealed by Gong and Zou's (2000) findings regarding borrowing from abroad, along with Lin and Sosin's (2001) examination of the relationship between foreign aid and economic development across 77 nations, highlight the nuanced considerations essential for nations aiming to strike a balance between debt management and long-term economic prosperity. In essence, these insights collectively emphasize the pivotal role of prudent and sustainable debt management practices in fostering enduring economic stability and growth.

The specific selection of these countries, Pakistan, India, Bangladesh, and Sri Lanka is based on their comparable debt ratios.

• Pakistan seeks financial support from the IMF to tackle its fiscal deficits and external debt, with a particular emphasis on policy talks and implementation of economic reforms.

• Even though Bangladesh has had debt problems, the country has worked to improve its economic resiliency and draw in foreign investment.

• India's economy is beset by non-performing assets, state debt, and budget deficits. The government analyzes the debt-to-GDP ratio and implements economic measures to solve structural difficulties.

• With its significant foreign debt, budgetary deficits, volatile currency rates, and debt repayment commitments, Sri Lanka is looking to the international community for financial support to overcome these economic obstacles.

In the aftermath of the 1980s, the crucial variables affecting production development in many developing countries became evident in the rate of debt accumulation and increased debt payments. These countries faced a decline in global competitiveness due to inadequate adjustments to exchange rates, contributing to slower growth rates. Economic instability, governance challenges, and deteriorating trade terms collectively resulted in a host of issues, from increased interest rates to reduced export earnings and diminished domestic output (Luis et al., 2016).

South Asian countries experienced shifts in their public debt circumstances over time, reflecting changes in economic standings. Pakistan's ranking declined from a "moderately indebted low-income country" in 1997 to a "severely indebted low-income country," while India improved from a "moderately indebted low-income country" to a "less indebted low-income country" (World Bank, 2001). Escalating debt levels in South Asian nations raised concerns about hindrances to growth processes, amplified repayment burdens, and necessitated rescheduling of economic and political resources. The region's vulnerability to debt accumulation was obscured by heavy reliance on multiple government entities, state-owned companies, public-private partnerships, and state-owned commercial banks (Guha & Bari, 2001).

South Asia's susceptibility to "hidden debt" from state-owned commercial banks (SOCBs), state-owned enterprises (SOEs), and public-private partnerships (PPPs) is

further exacerbated by its reliance on these entities (Lopez & Nahon, 2017). The research underscores critical policy areas and reforms to leverage public wealth effectively for economic growth. The COVID-19 pandemic brought attention to the rapid increase in public debt in South Asia, emphasizing the region's dependence on government involvement in various markets for economic growth (Harrison, 2021). Despite robust growth, South Asia faces macroeconomic challenges, with substantial government debt compared to similar regions. While Bangladesh and India have reduced their current account deficits, India and Pakistan grapple with macroeconomic issues (Teles & Mussolini, 2014).

India's current account deficits have risen due to rapid annual loan growth, including countries like Bhutan. Although capitalization in the region is generally sufficient, high levels of nonperforming loans (NPLs) constrain financial intermediation effectiveness, raising risks in the financial system. Despite domestic challenges in some economies, the overall outlook for South Asia remains positive. Limited integration into global value chains helps mitigate the negative impact of global trade tensions. However, recent escalations in trade tension between the United States and China, along with regional geopolitical tensions, have increased risks. The region's total growth rate is projected to increase from 6.8% in 2019 to 7.0% in 2020, largely driven by India's positive economic trajectory. Pakistan's growth is expected to decline as authorities address macroeconomic imbalances, while Bangladesh maintains robust growth at approximately 8.0% in FY2019 (Jiang et al., 2019).

In the fiscal year 2019, Bangladesh is expected to sustain a robust growth rate of around 8%, primarily driven by regional domestic demand due to limited international trade integration. The controlled inflation in most economies of the region, supported by positive food price inflation, contributes to stable economic conditions (Intartaglia et al., 2018). Conversely, Pakistan anticipates an inflationary uptick to approximately 13% in the fiscal year 2019–20, attributed to currency devaluation and rising energy prices, with a gradual decline to 5–6% projected in the medium term. Despite the region's impressive growth, South Asia contends with elevated public debt levels surpassing comparable regions, emphasizing ongoing macroeconomic susceptibility (Herzog & Dausch, 2015).

While Bangladesh and India have seen a reduction in their current account deficits, these countries still grapple with significant macroeconomic challenges. Bhutan and India, experiencing accelerated annual loan growth, contribute to increased current account deficits in India. Although capitalization levels are generally acceptable across the region, the financial sector faces challenges with efficiency due to elevated levels of non-performing loans (NPLs), posing underlying vulnerabilities (IMF, 2019).

Research Gap:

The previous empirical study on public debt sustainability in several South Asian countries, namely Bangladesh, Pakistan, Sri Lanka, and India, offers insights into the variables influencing debt sustainability in the region. While there are numerous studies on debt sustainability in South Asia, the specific selection of these countries—Pakistan, India, Bangladesh, and Sri Lanka—is based on their comparable debt ratios. The specific selection of these countries, Pakistan, India, Bangladesh, and Sri Lanka is based on their comparable debt ratios.

These underdeveloped nations are currently facing similar debt situations, justifying their inclusion in the study for a more focused analysis.

The research aims to examine the impact of the debt-to-GDP ratio on the overall primary balance in the selected countries and assess how the output gap influences their primary balances. The study also evaluates the effectiveness of policies and measures adopted by these countries in maintaining a healthy fiscal situation. It seeks to determine whether a country's public debt is sustainable, considering that a country’s ability to manage its debt and sustain fiscal health can be significantly influenced by various economic factors.

While the study briefly touches on economic aspects, there is a critical requirement for a more thorough investigation delving into how specific economic factors unique to each nation impact public debt sustainability and contribute to the fiscal health of these countries. Policymakers aiming to formulate effective debt management strategies must possess a comprehensive understanding of these economic factors, including Debt to GDP ratio, Output Gap, Inflation, Exchange Rate, and Trade Openness. This knowledge is crucial for tailoring policies to the distinct economic

conditions of each country, ensuring a more customized and effective approach to debt management.

The primary thrust of the research is on debt management; however, it underscores the significance of debt sustainability. Conducting a meticulous analysis to comprehend how economic determinants influence public debt sustainability in the chosen South Asian countries is an area of research that has not been adequately explored.

Objectives of the Study:

Examining the sustainability of the debt is the study's main goal of the particular South Asian countries. The following specific objectives are set forth to achieve the following:

1. To look into how Debt to GDP ratio affects overall primary balances.
2. To assess the output gap's total impact on the primary balance.

Research Questions:

The main research inquiries are as follows:

1. In what ways do the overall primary balances of specific South Asian countrieschange in relation to their ratios of total debt to Gross Domestic Product (GDP)?
2. What is the impact of the difference between actual and potential economic output (output gap) on the overall primary balance?

Significance of the Study:

This research is significant as it addresses a crucial gap in the existing literature by focusing on the sustainability of public debt in key South Asian nations - Bangladesh, Pakistan, Sri Lanka, and India. The analysis of public debt sustainability in selected South Asian countries offers valuable insights for policymakers, economists, and stakeholders. This study aims to assist South Asian governments in assessing the sustainability of public debt through a comprehensive analysis of existing fiscal plans and the economic factors that affect public debt sustainability.

Understanding factors like Debt to GDP ratio and Output Gap effecting primary balances of the chosen countries for determining public debt sustainability is crucial for policymakers to address fiscal difficulties and reduce future debt crises by identifying weaknesses and areas for improvement. The research examines the economies of selected South Asian countries' debt (Pakistan, India Bangladesh, and Sri Lanka) sustainability in great detail. It also looks at the primary surplus to GDP ratio and the debt to GDP ratio to see if the debt policies are sustainable.

Effective debt management policies contribute to stable macroeconomic conditions, such as lower inflation rates, stable currency values, and reduced government spending deficits, which in turn foster economic expansion and growth. According to the literature on the subject of public debt, it is sustainable if debt growthdoes not outpace GDP growth. This study contributes to scholarly research on selected South Asian nation's public debt sustainability, offering empirical facts and analysis, potentially inspiring further research in this area.

CHAPTER 2

REVIEW OF LITERATURE

Within the context of emerging market economies, this chapter examines the theoretical and empirical research that supports the concepts of debt structure and debt sustainability.

Theoretical background:

The Debt Overhang Theory, developed by Jeffrey Sachs in 1989, is a critical concept in understanding the economic implications of high external debt in countries, particularly in the developing world. The core of this theory lies in its identification of how excessive debt can stifle economic growth; a phenomenon known as 'debt overhang'.

Debt overhang occurs when a nation’s external debt is so large that it becomes a deterrent to additional investment and economic growth. It is characterized by two main effects: the illiquidity effect and the disincentive effect. The illiquidity effect refers to the immediate financial burden of repaying debt, which can drain a country's resources. The disincentive effect, on the other hand, pertains to the reduced incentive for the government and investors to undertake new investments or reforms due to the belief that the benefits will primarily go towards repaying existing debt, rather than stimulating the economy.

Initially, the theory was focused on the direct impact of debt on economic growth. However, it has since been expanded to encompass the liquidity effect, highlighting how the sheer size of debt can create a liquidity crisis, further hindering a country’s ability to manage its financial obligations and invest in growth.

Sachs’ theory gained prominence in discussions about debt rescheduling and forgiveness, especially in the context of the 1980s' debt crises in Latin America and Africa. It suggests that in situations where the debt will eventually have to be forgiven, rescheduling is an inadequate response. Instead, debt forgiveness or significant relief is necessary to restart economic growth and encourage investment.

The theory has profound implications for international financial institutions and creditor nations. It suggests that continuing to lend to heavily indebted countries without addressing the root causes of their debt burden can be counterproductive. Instead, measures like debt forgiveness, along with economic reforms and support for investment in key sectors, are crucial for restoring financial health and encouraging sustainable development.

In conclusion, the Debt Overhang Theory by Sachs (1989) offers a framework for understanding the complex relationship between high external debt and economic stagnation, emphasizing the need for comprehensive solutions including debt relief and strategic economic planning.

Theoretical Literature Review:

This section conducts a comprehensive review of existing hypotheses, exploring the intricate connections between primary balances, debt sustainability, and the accumulation of debt. Beginning with foundational terms and concepts, the narrative progresses through an evaluation of established models to aid in the development of novel hypotheses. Central to this discussion is the debt overhang theory, asserting that anticipated debt-service expenditures act as a deterrent to both domestic and international investments, particularly when there is a perceived risk of default. The theory gained prominence in the 1980s, proving instrumental in advising nations on debt restructuring, culminating in the creation of the influential debt overhang model.

The contemporary expansion of the debt overhang theory incorporates considerations of liquidity impact, as defined by Claessens and Diwan (1990). However, Hjertholm (2001) critiques this definition, suggesting it inadequately captures the broader impact on investment, extending beyond tangible assets to encompass endeavors requiring upfront financial commitments for long-term production enhancement. Johansson (2010) contributes by asserting that debt overhang discourages both public and private sector investments, hindering economic growth by fostering uncertainty among private investors about governments' capacity to meet debt servicing obligations.

A critical concern raised is the potential burden on future generations if substantial debt continues to accrue. Barro (1979) distinguishes between obligations to domestic and foreign

creditors, contending that only the latter passes on the debt burden to subsequent generations. The neoclassical school of thought posits that debt financing negatively impacts capital production, burdening future generations through diminished disposable income and consumption. The Debt Sustainability Analysis, developed by the World Bank and the International Monetary Fund, is instrumental inmanaging the risk of unmanageable debt accumulation for low-income nations, with Missale and Blanchard's (1990) "taxation gap" and Talvi and Végh's (2000) macro- adjusted primary deficit indicator providing valuable tools within this framework. This multifaceted review synthesizes diverse perspectives on the complex interplay between primary balances, debt sustainability, and the repercussions of debt accumulation, paving the way for further exploration and refinement of these critical economic concepts.

Public Debt:

Dynamics of infrastructure funding:

This section critically examines the dynamics of long-term infrastructure funding, predominantly sourced through borrowing to meet substantial capital demands. Borrowing, while facilitating the distribution of costs to future generations benefiting from these investments, necessitates responsible management by monetary and budgeting authorities to avert detrimental impacts on the economy (Adebusola et al., 2007; Alfred, 2006). Effectual strategies are crucial to prevent public debt from escalating beyond the government's repayment capacity, emphasizing the need for prudent financial management practices (Bakar & Hassan, 2008).

Deceptive conclusions regarding debt profiles can arise without comprehensive monitoring and strategic fiscal policy actions, underscoring the significance of accurate debt sustainability analysis (Baldacci, 2006). The definition of public debt extends beyond the simplistic obligation to make return payments; it involves the transfer of financial control to the government for a specified duration, with commitments to future payments and associated interest (Buchanan & Wagner, 1967). The liquidity of debt securities correlates with the maturity period, prompting governments to diversify their debt portfolios with varying maturities (Baldacci, 2006; Buchanan & Wagner, 1967).

While nations inevitably incur debt, the challenge lies in managing the ongoing need to roll over accumulated debt, especially when reaching maturity. The urgency of financing ongoing social spending adds complexity to debt management, necessitating

sustainable approaches (Baldacci et al., 2009). Refinancing, altering maturities, and reducing overall debt load are options available to governments, but challenges persist,

highlighting the need for astute debt management (Bohn, 1995). A key theme emerges: ongoing payments toward outstanding debt are imperative, regardless of the total amount or maturity structure, emphasizing the critical role of prudent debt management in sustaining emerging economies (Bohn, 2008). This review underscores the multifaceted considerations and strategic imperatives inherent in the discourse on public debt management. Nonetheless, due to the extremely multi-faceted nature of the problem, theorists have quite a task when attempting to outline the origins and effects of the uncontrollable increase in national debt and an illustration of the phenomenon's borders (Wyplosz, 2011). In addition, the absence of a clear and concise operational definition of debt sustainability is one of the most aggravating elements in the body of scholarly research on the public debt sustainability study, and it is also an issue that is fundamental (Chalk & Hemming, 2000).

Debt Sustainability:

The inadequacy of a clear and concise definition for debt sustainability hinders the provision of normative advice, given the broad spectrum of possibilities for judgment (Debrun, 2015). The root cause of the ambiguity associated with the term "debt sustainability" lies in the vagueness of the concept of "sustainability," which, broadly defined, refers to activities persisting over extended periods in the same manner. Examining the notion of maintenance offers insight into the justification for sustainability, suggesting that sustaining the value or composition of debt over an extended period is closely tied to the sustainability of public debt (IMF & UNCTAD, 2011).

Salsman (2017) underscores the importance of the government's responsible and affordable borrowing, coupled with its ability to ascertain the sustainability of public debt, ensuring the delivery of public goods and services without compromising sovereignty or the rights, liberties, and prosperity of citizens. The challenge of defining debt sustainability persists, with various attempts by economists yielding no universally accepted definition. Historically, the term "solvency" has been more prevalent than

"sustainability" in economic discussions, although the two concepts, while intertwined, do not require absolute alignment (Butts, 2009). The adaptability of governmentpolicies in response to changing circumstances allows an unsustainable policy to yield

sustainable outcomes, necessitating the capacity to commit and reverse policies for a financially sound government to maintain a sustainable fiscal policy (Horne, 1991).

The complexity of defining public debt sustainability is exacerbated by the diverse debt profiles in emerging economies. In contemporary economies, the size of a nation's debt is overshadowed by the legitimacy of the nation, enabling more in-depth comparisons across nations. Contingent liabilities, challenging to measure precisely, often surpass outstanding assets, adding complexity to debt management. The presence of contingent obligations makes it more challenging to control debt effectively, leading to implicit leverages being lower than explicit leverages in many countries. This practical complexity defies the predictions of prevailing economic models (Carmen & Reinhart, 2011).

Debt Overhang:

Throughout economic history, theorists have traditionally focused on the government's capacity to pay its debts rather than the sustainability of the debt. The adoption of the Keynesian paradigm, a pivotal shift triggered by the Great Depression of the 1930s, transformed the approach to public finance administration. Keynesians, in contrast to the Classical school of thought, viewed debt not as a burden but as a potential benefit to the entire country. The aftermath of the Great Depression fundamentally altered economists' perspectives on the economy, shaping the present framework for fiscal policy (Carmen et al., 2011).

This paradigm shift in economic thinking posits that borrowing during severe economic downturns holds the potential to reinvigorate the economy. However, this holds true only if the borrowed funds are channeled into the real economy through increased levels of public spending. In contrast to Classical economists, Keynesians advocate for budget deficits, enabling the government to boost spending and, consequently, promote national economic growth, challenging the preference for budget surpluses held by the Classical economists (Chen et al., 2017). By deliberately

maintaining an unbalanced budget, the government can leverage fiscal policy instruments to direct financial resources beyond budgetary capacity into the actual economy, thereby stimulating real demand across the entire economy. Keynesians, while not discouraging insolvency outright, offer support in certain contexts, albeit not endorsing unsustainability (Buchanan et al., 1999).

Debt instruments serve as fiscal policy tools explicitly designed to absorb excess cash during economic booms and inject liquidity into the economy during recessions, playing crucial roles in maintaining a healthy economic cycle (Salsman, 2017). However, chronic high public debt levels expose the nation to potential vulnerabilities, risking both financial hazards and adverse economic developments. Theprospect of an unexpected halt in financial flows looms large, driven by factors such asglobal changes in risk preferences or negative shocks originating from overseas markets. For developing nations heavily reliant on external financing, a sudden stop infinancial resources can have debilitating effects, necessitating continuous internationalfinancing to manage existing debt obligations (Chiu et al., 2017).

These abrupt stops often catch nations off guard, resulting in severe consequences, including potential capital outflows and a decline in the sovereign nation's credit rating. A subsequent drop in the credit rating can trigger far-reaching repercussions, encompassing restrictions on capital accounts, sharp cuts in government spending, currency and banking crises, recession, and even debt default (Eichengreen & Gupta, 2016). Moreover, an escalation in the economy's risk premium leads to a significant surge in interest rates, discouraging private investment. From a public finance perspective, a government faces constrained budgetary space in the event of economic growth slowdown, particularly when burdened by high and unsustainable debt levels. This limits the government's flexibility to boost spending for socialpurposes due to the existing high debt load (Chaudhury, 2017).

The term "debt overhang" encapsulates a scenario often born from the aforementioned circumstances. It manifests when prospective investors hesitate to make new investments due to concerns that the country may struggle to meet its obligations, primarily because of the anticipated high tax burden resulting from the current debt levels (Sachs & Huzinga, 1987). This hesitancy extends to consumers who,

fearing the economic uncertainty, curtail their purchases, directly impeding overall economic activity. In this context, economic participants perceive creditors as the sole beneficiaries of impending primary surpluses (Edwards, 1991).

Businesses, wary of the formidable policy adjustments and increased tax burdens, exhibit reluctance to embark on new investments that could otherwise stimulate economic activity. The resultant decrease in investments leads to a slowdown in economic growth, subsequently reducing government revenue. This, in turn, limits the availability of funds for the budget's social and economic objectives, raising the specter of a potential default on the country's debts and a looming financial collapse (Égert, 2015).

These conditions set the stage for a self-perpetuating cycle characterized by diminished investment levels, slower growth, reduced income, heightened borrowing needs, and an elevated risk of default (Krugman, 1989). As a direct consequence, economic activity plunges, and the state of fiscal balances rapidly deteriorates, creating a recessionary environment that undermines the economy's ability to sustain its debt levels.

Moreover, the spillover effect ripples back into the private sector, contributing to increased risk premiums and diminished sovereign credit ratings. Vigilant monitoring of the capacity to service public debt becomes imperative for preserving economic stability and preventing the cascade of adverse economic events (Harrison, 2021). This underscores the importance of strategic economic management to avert the detrimental impacts of debt overhang and sustain a healthier fiscal and economic trajectory.

Debt Structure of South Asian Countries:

Public Debt and Borrowing:

The escalating and rapid surge in public debt within developing countries serves as a telltale sign of economic slowdowns and ineffective debt management. Acknowledged causes of this mounting public debt encompass inappropriate structural reforms, flawed macroeconomic policies, a weak export base, ineffective borrowing

practices, and an unfavorable political climate (Zaidi, 2015). This burgeoning debt not only diminishes both domestic and international investment but also impedes the rate of capital accumulation and overall productivity. The colossal public debt levels result in a reduction of available physical capital and disrupt the development of human capital (Serieux & Samy, 2001).

Economic theorists widely agree that prudent borrowing can enhance financial performance by bolstering investment levels and fostering output expansion, especially in economically developing countries with lower total capital stocks and limited investment opportunities. However, the mounting burden of increasing debt undermines macroeconomic stability and discourages local and international investment in these developing economies. While the infusion of resources from internal and external sources is crucial for economic growth acceleration, persistent growth in public debt poses significant challenges to the economy over time. The impact of public debt on economic growth is influenced by both the composition of the debt and its utilization.

Productive use of public debt can be beneficial to the economy, generating returns that contribute to the repayment of the initial amount along with associated service fees (Adebusola et al., 2007). In South Asian nations and other developing economies grappling with resource shortages, reliance on domestic and foreign debt to bridge revenue-expenditure gaps persists. The burden of public debt in these nations continues to swell due to twin deficits, significantly impeding economic growth.

The failure of many nations to adeptly adjust their exchange rates results in a loss of comparative advantage in the global market. Factors such as the rate of growth, deterioration of terms of trade, financial mismanagement, and poor governance exacerbate the situation, particularly in heavily indebted nations. These countries contend with increased servicing costs, diminished resource inflow, low domestic production, limited export potential, and reduced imports (Rewrite to enhance consistency and rhythm).

In the early 1980s, Pakistan experienced a surge in domestic debt, reaching a pinnacle of 8 percent initially and progressively escalating to 22 percent by the end of the decade (Anwar, 1995). The subsequent decade witnessed a deterioration in both

domestic and international debt situations. Contrary to the 34 percent external debt to GDP ratio in 1990–1991, this ratio climbed to 43 percent by 1998–1999. Simultaneously, Pakistan's internal debt exhibited an annual increase of 13.7 percent throughout the 1990s. Despite receiving substantial aid, South Asia, constituting over 22 percent of the global population, faced challenges, with 46 percent illiteracy and more than 500 million people destined for poverty (UNDP, 1997).

Debt Levels and Economic Growth:

Zaidi's 2015 research underscored South Asia's emergence as one of the most heavily indebted regions globally, revealing an adverse and statistically significant relationship between foreign aid and economic expansion in Africa. Conversely, the association was reversed for industrialized nations and Latin American countries, albeit statistically insignificant. A similar, albeit statistically insignificant, favorable association was found in Asian nations.

Ward et al. (2002) delved into the link between elevated foreign debt levels and rapid economic growth, analyzing data from 93 developing nations spanning 29 years (1969–1998). Their findings, employing Generalized Methods of Movement (GMM) and the Fixed Effect Model, indicated that doubling the total debt could lead to a growth rate reduction ranging from fifty to one hundred percent. Maghyereh's (2003) exploration of Jordan's growth performance in relation to international debt, using data from 1970 to 2000, revealed a positive impact on growth of up to 53 percent of GDP debt, turning negative beyond that threshold.

Mohamed (2005) investigated Sudan's debt-economic growth nexus over 23 years (1978–2001), unveiling an inverse relationship between external debt and economic expansion. Gurbuz et al. (2007) explored debt management and sustainability in Turkey, analyzing quarterly data from 1998 to 2002. The econometric analysis signaled Turkey's national debt as unsustainable in the long run, attributing the lack of sustainability to specific contributors (Rewrite to enhance consistency and rhythm).

A complex interplay of economic factors shapes the relationship between debt and economic growth, as evidenced by various studies across different regions and time periods. Bakar and Hassan's (2008) examination of Malaysia's economic data from 1970 to 2005, using the VAR method, revealed a negative association between the nation's elevated foreign debt levels and overall economic growth. Similarly, Butts (2009) studied 27 economies in Latin America and the Caribbean from 1970 to 2003, finding a two-way relationship between growth and foreign

debt. The short-term dynamics were suggested to be influenced by policy responses and macroeconomic shocks tied to the nations' foreign debt levels.

Reinhart and Rogoff's comprehensive analysis in 2010, covering 44 developed nations, unveiled a connection between price inflation, declining economic performance, and escalating public debt. Their findings indicated detrimental effects on economic growth in industrialized nations when the debt-to-GDP ratio exceeded a certain threshold, typically at least 90 percent. Amassoma's (2011) investigation into

Nigeria's economic performance from 1970 to 2009 using VAR and VEC methodologies found a causal link operating in both directions between internal borrowing and growth.

These studies collectively highlight the nuanced relationship between debt and economic growth, demonstrating the importance of considering various factors such as policy responses, macroeconomic shocks, and the threshold levels of debt. The findings underscore the need for prudent debt management to foster sustainable economic development.

2.2 Empirical Literature Review:

Early perspectives on debt and economic growth:

Debt and Calvo (1998) identified a critical relationship between high debt levels and low economic growth, highlighting how debt service burdens lead to heavier taxation on capital, reducing investment returns and slowing economic expansion. Mendoza and Ostry (2008) used a dynamic stochastic general equilibrium model focusing on fiscal solvency in their cross-country analysis, finding a clear and strong negative impact of public debt on primary balances.

Cross Country Analyses:

Chandia and Javid (2013) investigated debt sustainability in Pakistan, uncovering a long-term correlation between the primary surplus-to-GDP and the debt-to-GDP ratios. Ghosh et al. (2013) proposed that the primary surplus cannot increase indefinitely alongside rising current debt, eventually reaching a threshold beyond which further debt accumulation is unsustainable for the government. Eberhardt and Presbtero (2014) examined the public debt-economic growth relationship in various developing countries, applying both linear and non-linear panel methods. Their research indicated

an inconsistent relationship between fiscal debt levels and long-term growth, with country-specific variations.

Regional Outlook on Fiscal Health:

Baharumshah (2016) employed a Markov-Switch model to assess fiscal health in developing market economies from 1980 to 2014. The study concluded that public debt levels above 55% of GDP start showing a weak correlation with economic activity due to a unidirectional link between debt and growth. The analysis also suggested that temporary economic disruptions could deviate economies from sustainable fiscal paths.

Ngan (2018) set a benchmark for assessing the risk of default in 14 developing countries between 1999 and 2016. The study indicated that non-Latin American economies might sustain their current debt in the short term if it stays well below 40% to 50% of GDP. However, a continued increase in debt would require building fiscal safeguards to prevent an unsustainable debt situation.

Paret (2017) applied probability theory and simulation to predict the medium-term public debt trajectory of emerging economies. The research advised developing nations' governments to revise policies to reduce currency risk exposure, particularly by tightening fiscal measures to maintain debt sustainability amid rising debt levels. It cautioned countries at high default risk, especially those with weak fiscal consolidation, against implementing countercyclical fiscal policies that could steer the economy towards unsustainability.

Economic Development and External Debt:

Adepoju et al. (2007) examined the adverse effects of international debt on Nigeria's economic development, using time-series data to demonstrate how high external debt impedes the country's progress. Georgiev (2012) further analyzed this relationship, using linear and nonlinear models to confirm the detrimental link between increasing debt and Nigeria's slowing economic growth, highlighting how this debt accumulation is reducing national savings.

In contrast, Edwards and Tabellini (1992) presented a different viewpoint. Their study indicated that an increase in Nigeria's debt stock, measured by the debt-to-GDP

ratio, actually led to an 18.5% growth in the economy. However, their approach faced criticism for focusing solely on public sector debt and ignoring Balance of Payments (Bop) considerations, along with the assumption of constant government spending, revenues, interest rates, and exchange rates.

Battaile et al. (2015) delved into the causes of rising foreign debt, emphasizing the impact of current account deficits and foreign direct investment inflows. They identified vulnerabilities in debt financing profiles and the burden they bring, advising Sub-Saharan African policymakers to consider the implications of fluctuating commodity prices and the economic downturns in China and Europe.

Fiscal Crisis, OBOR and Market Vulnerability:

Ramachandran (2019) critiqued the Chinese OBOR initiative, arguing that it potentially traps vulnerable countries in perpetual debt. This narrative, though, may not fully represent the dynamic changes in the South Asian region, where there is a pressing need for benchmarks for external debt accumulation. However, the lack of a definitive standard for sustainable debt levels poses challenges for policymakers.

Geiger (1990) explored the impact of external debt on economic growth using a distributional model with lags, suggesting an inverse relationship. However, his study, limited to a 12-year span in nine South American countries, didn't find conclusive evidence that debt hampers the economic prosperity of developing nations.

Global Outlook and Threshold Analyses:

Reinhart and Rogoff, in their 2010 study, proposed measures such as tax increases, government spending cuts, public sector downsizing, and privatization for fiscal recovery. Krugman (2015) noted these as a basis for austerity measures post the Great Financial Crisis. Yet, their research, criticized for over-representing data from developed countries and overlooking various debt aspects, also brought attention to the issues with broad country classifications like "Emerging Markets," "High-Income Countries," and "Low-Income Countries." Eventually, they moved away from the IMF's classification to a more detailed grouping based on year-end gross debt figures, reflecting a broader shift towards more specific, region-focused research.

Understanding the debt threshold effect is crucial for managing economic growth and stability in developing nations, yet research in this area has been limited, particularly in South Asia and on a global scale. Studies typically use a variable's coefficient as a threshold indicator, looking for significant changes after crossing a certain limit. This essay aims to delve into significant research that identifies the external debt tipping point for developing countries.

A comprehensive study encompassing 152 developing countries from 1977 to 2002 found a negative linear relationship between foreign debt, economic growth, and investment, particularly in low-income countries. This study highlighted that debt overhang and the displacement of public investment due to uncertainty are key factors negatively influencing an indebted nation's economic health. An analysis of 59 developing countries over 32 years showed a notable negative correlation between total external debt and economic growth, with a less pronounced effect in the case of private external debt. The results indicated that the public debt-to-GDP ratio's inverse relationship with economic growth suggests that public spending, more than the combined impact of public and private external debt, hinders growth.

Hasan and Butt's 2008 study on Pakistan, covering 1975 to 2005, examined external debt as a key factor influencing the country’s economic growth. Their research concluded that Pakistan's external debt, mainly used for non-productive purposes, did not significantly contribute to economic development.

Kumar and Woo's 2010 research, which focused on 38 emerging economies but mostly excluded South Asian nations except India and Pakistan, found that an initial increase in debt relative to GDP has a detrimental effect on subsequent economic growth. Their findings showed that a 10-percentage point rise in initial debt correlates with a 0.2 percentage point reduction in annual GDP growth, an insight gaining relevance after the Great Financial Crisis.

Reinhart and Rogoff's influential 2010 study, widely discussed in academic and policy circles, emphasized the impact of debt duration. They noted that countries reliant on short-term borrowing are more vulnerable to financial crises. Their analysis on a global scale revealed that national debt levels up to 90% of GDP do not significantly

affect growth, but beyond this threshold, there is a correlation with reduced growth rates.

Neaime (2012) highlighted the direct, restrictive effects of public debt on primary balances, revealing varied fiscal sustainability among select economies. Tunisia showed strong fiscal health, Egypt had low sustainability, and Jordan and Turkey faced complete unsustainability, with Morocco's status remaining uncertain. Mendoza and Ostry (2008) attributed Egypt's fiscal issues to ineffective privatization in the 1990s, while Morocco's fluctuating performance was linked to inconsistent fiscal reforms. Both Jordan and Turkey struggled with fiscal imbalances and banking sector challenges, marking their economies as unstable.

Osei (1995) used probabilistic methods to simulate Ghana's debt trajectories, suggesting that debt remission limits resource allocation to creditor nations, impacting growth prospects. He proposed that debtor nations view debt as a return of economic resources to mitigate the crisis's severity. Supporting this, Amoating and Amoaku (1996) recommended allocating a larger portion of export earnings to debt repayment, especially for external debt. While effective in the short term, this approach raises concerns about maintaining adequate foreign exchange for long-term investment and growth.

Kong et al. (2019) examined the high interest rates on loans to OBOR member countries, with about 40% exceeding a 5% annual rate, in contrast to lower rates offered by institutions like the World Bank and the Asian Development Bank. The skepticism surrounding these loan agreements contributed to the electoral losses of South Asian leaders supportive of OBOR. Attempts to renegotiate these terms with China often resulted in more favorable outcomes for China, and the large size of these loans raised concerns about their repayment feasibility.

Chalk (2000) utilized a general equilibrium approach, incorporating consistent budget deficits into an overlapping generation model. His findings suggested that certain advanced economies could manage perpetual deficits if GDP growth remains below the steady-state interest rate. Neaime (2014) investigated the time-series aspects of financial data in European countries, identifying a potential fiscal crisis unless corrective actions are taken.

Fournier & Fall (2017) observed that most OECD countries are vulnerable to macroeconomic shifts and market responses due to high debt levels. Their study in advanced economies didn't pinpoint a specific debt threshold where servicing becomes unsustainable. Conversely, Elbadawi et al. (1997) expanded their research to 89 countries in emerging regions, including Latin America, Sub-Saharan Africa, Asia, and the Middle East. Their nonlinear panel analysis identified three ways debt hinders economic growth in these areas: past debt accumulation, current inflows relative to GDP, and the debt service ratio. They noted a critical 97% debt-to-GDP ratio, well above the 70% regional average.

The impact of debt on economic growth gained renewed focus after Reinhart and Rogoff's 2010 publication. They noted that while debt levels below 90% of GDP had minimal impact on growth, exceeding this threshold led to a significant slowdown. This effect was more pronounced in lower-income countries, where negative impacts surfaced when external debt exceeded 60% of GDP. Checherita and Rother (2012) identified a gross debt threshold in the range of 90-100% of GDP. In contrast, Égert (2015) suggested multiple potential tipping points for debt, with some as low as 30% of GDP, after reanalyzing Reinhart and Rogoff's data.

Chen et al. (2017) observed a positive correlation between debt and growth up to a 59.72% debt-to-GDP ratio, after which growth began to decline sharply. This ongoing debate about the intricate debt-growth relationship continues, fueled by diverse empirical data. This study aims to determine the optimal external debt level for South Asian countries, examining the link between foreign debt and economic growth. It finds that growth correlates positively with debt levels up to 59.72% of GDP, but beyond this point, the correlation becomes negative.

Defining Foreign Debt:

The IMF defines foreign debt as liabilities owed to non-residents by residents of an economy, requiring future payments of principal and/or interest. This includes borrowing from international financial institutions, foreign governments, or commercial banks, and is distinct from other foreign investments, like foreign ownership, due to the repayment obligations.

Chowdhury's 1994 study, which conducted Granger causality tests in seven Asian countries including Bangladesh and Sri Lanka from 1970 to 1988, suggested that high external debt in emerging countries might be more of a symptom than a cause of slow economic growth. This view, however, is not universally accepted in these countries. Chowdhury's analysis also indicated that a 1% increase in a country's total external debt could result in a 20% increase in its GNP. In the case of Sri Lanka, there was no significant correlation between GNP growth and the accumulation of external debt. Long-term observations showed that servicing external debt has a slight but negative impact on Sri Lanka's GNP, and no significant short-term relationship was evident between debt service payments and GNP. The primary focus of this research was to assess the debt overhang hypothesis and the impact of credit write-offs on Sri Lanka’s GNP following the tsunami.

Nguyen et al. (2003) investigated the relationship between high external debt, public investment, and economic growth in low-income countries from 1970 to 1999. They identified a debt threshold at 115–120 percent of exports, approximately 30–37 percent of GDP, supporting the debt overhang concept outlined in the Laffer curve analysis.

Non-linear Impacts on Economic Growth:

Through the year 2000, there was a close correlation between the public and external debts of developing nations. Reinhart and Rogoff, in their 2010 study, observed a nonlinear relationship with government debt, noting that surpassing a 90 percent debt-to-GDP ratio could reduce the growth rate of industrialized economies by 1%, with potentially greater impacts on developing economies. In their focus on emerging markets, Reinhart and Rogoff (2010) found that when foreign debt reached 60% of

GDP, it could lower economic growth rates by up to 2%. Wanniarachchi (2019) suggested that exceeding a 90 percent foreign debt threshold could significantly harm the economies of emerging nations.

Checherita and Rother in 2012 conducted a cross-country study using a conditional convergence equation to explore the nonlinear influence of debt on economic growth. They pinpointed the gross debt threshold between 90-100% of GDP. Their findings also indicated that adverse effects on growth could begin at lower debt-to-GDP ratios, between 70-80 percent, due to increased interest obligations and rising default risks. However, later research has highlighted certain limitations in Reinhart and Rogoff's 2010 analysis.

Summary:

The academic debate on identifying a universal debt threshold across various economies remains contentious. Research by Kraay & Nehru (2006) and Ghosh et al. (2013) suggests that debt thresholds are country-specific and defy global standardization. In contrast, studies by Bick (2010), Kidochukwu (2015), and Ngan (2018) advocate for a common threshold, arguing it's a reliable indicator of debt default, especially among countries within the same developmental category. This debate raises a critical question: are debt sustainability regression estimates uniform across all samples, or do they vary significantly? To address this, Hansen's (1999) unison threshold model emerges as a key analytical tool.

The World Bank and the International Monetary Fund's Debt Sustainability Analysis (DSA) framework is widely recognized for its role in debt trajectory analysis and threshold setting for developing countries (Paret, 2017; Kidochukwu, 2015). Many middle and low-income countries strive to stay within their DSA thresholds to avoid defaulting. However, some argue, like Nwankwo (2014) and Kidochukwu (2015), that the DSA framework, despite its influence, might limit growth in these nations due to two main limitations: its neglect of macroeconomic projection uncertainties and the mistaken assumption that all countries uniformly respond to economic shocks.

Addressing these limitations, researchers like Beti (2013) and Neaime (2015) have developed stochastic frameworks. A significant advancement in this area is the

fan-chart method, initially introduced by Celasun et al. (2006) and refined by Paret (2017). This method, based on a fiscal reaction function and a panel VAR estimation, assesses the impact of macroeconomic variables on debt and governmental responses to debt changes. However, it falls short in identifying the nature of the debt threshold and determining the minimum confidence interval for sustainability assessment.

This study builds upon Hansen's threshold model, incorporating two unique aspects to address the specific debt dynamics in growing sub-Saharan African nations. Firstly, it includes a fiscal reaction function that accounts for currency risk exposure in describing the impact of debt ratio and output gap changes on primary balances. Secondly, it integrates a sovereign default risk factor into the model, providing an early warning indicator of debt default in South Asian countries. The threshold value and regime parameters are determined using the least squares minimization method, and the threshold's significance is evaluated using bootstrap critical values.

CHAPTER 3

VARIABLES AND SOURCE OF DATA

Variables:

Table 3.1 of this study methodically analyzes several key macroeconomic variables, employing data from a range of reputable sources to evaluate the dynamics of public debt and its implications on various aspects of economic health and growth.

The primary balance (Pb), a critical fiscal measure, is analyzed using data from ES and WDI. This variable represents the difference between the government's total interest payments on consolidated liabilities and its net borrowing or lending. It serves as a key indicator of the government's fiscal health, excluding the costs of existing debt, and provides insights into the current fiscal policy stance. The primary balance is calculated using the following formula:

Primary Balance = Government Revenue – Government Expenditure (Excluding interest payments)

Public debt (Pd) data, sourced from the WDI, encompasses the total financial obligations undertaken by the government to fund its development budget. This variable is pivotal in understanding the government's borrowing dynamics and its subsequent impact on economic stability and growth.

Exchange rate (Exc) data, essential for evaluating the international economic position of a country, is obtained from International Financial Statistics (IFS). It reflects the value of a country's currency in comparison to others, impacting trade, investment flows, and asset valuation in different currencies.

Trade openness (Open), another crucial variable, gauges a country's economic integration with the global market. Derived from IFS data, it measures the ratio of a country's total exports and imports to its GDP, offering insights into the level of economic openness and dependency on international trade.

Inflation (Inf) data, indicative of the rate at which the general price level of goods and services rises, also comes from the IFS. This variable is significant for economic policymaking, influencing decisions related to interest rates, exchange rates, and investments.

Debt to GDP ratio (DGDP) The debt-to-GDP ratio, which is represented as a percentage and relates a nation's total debt to its GDP, is a tool used to evaluate a country's debt management capabilities in relation to the size of its economy. The formula for calculating the debt-to-GDP ratio is:

$$\text{Debt-to-GDP Ratio} = \left(\frac{Total\ Debt}{GDP}\right) \times 100$$

An essential economic metric is the debt-to-GDP ratio, which evaluates a country's financial standing by contrasting its overall debt load with the size of its GDP. While a high ratio indicates a potentially difficult situation, as the country may face difficulties repaying its debts, potentially leading to economic instability, a low ratio suggests a manageable level of debt and a reduced reliance on borrowing to sustain economic activities. Insights on a country's fiscal sustainability and ability to satisfy financial obligations without endangering long-term economic stability are provided by this ratio, which policymakers and economists closely examine.

Output Gap (OG), An economic indicator that helps policymakers decide whether to stimulate or contract the economy is the output gap, which is the difference between an economy's actual output and its potential output at full capacity. It gives information about whether an economy is operating above or below its potential.

The output gap is typically expressed as a percentage of potential output. The formula to calculate the output gap is as follows:

$$\text{Output Gap} = \left(\frac{Actual\ Output - Potential\ Output}{Potential\ Output}\right) \text{x } 100$$

Source of data:

In this research, focused on understanding the impact of public debt on economic dynamics, table 3.1 plays a crucial role in summarizing the key variables andtheir data sources.

In this research, the primary variable of interest is primary balance, and the study meticulously collects data from several authoritative sources including International Economic Statistics (IES), World Development Indicator (WDI). The aim is to construct a comprehensive theoretical framework that captures the nuances of various macroeconomic factors and their interplay with public debt.

Table 3.1: Data Description:

Variables	***Description***	***Definition***	***Data Source***
Pb	Primary Balance	"Primary balance" is the difference between the total amount of interest payments on consolidated government liabilities and the total amount of net borrowing or net lending by the government, according to the Organization for Economic Co-Operation and Development (OECD).	ES and WDI
Pd	Public Debt	Public debt refers to the total sum, including all obligations, which the government has borrowed to cover its development budget.	WDI
Exc	Exchange Rate	The value of one country's currency in relation to the currencies of other nations or economic zones is known as an exchange rate. For the sake of demonstration, how many US dollars are needed to buy one euro?	IFS

Open	Trade Openness	The proportion of a nation's overall exports to its imports to its gross domestic product is one definition of trade openness.	IFS
Inf	Inflation	The rate at which the value of a currency decreases and, as a direct result of the inflation rate is the general increase in the level of prices for goods and services.	IFS
DGDP	Debt to GDP Ratio	The debt-to-GDP ratio is the ratio between a country's government debt (measured in units of currency) and its gross domestic product (GDP) (measured in units of currency per year).	Author Calculated
OG	Output Gap	The output gap is an economic measure of the difference between the actual output of an economy and its potential output.	Author Calculated

Panel data from selected Asian countries was used in this research from year 1980 to 2020

DATA AND METHODOLOGY

This section outlines the research process, evaluates the outcomes, and explains the study's conclusions. The topic's theoretical foundations, empirical model formulation, and estimating method, some of the elements covered here include variable descriptions, data sources, diagnostic tests, findings presentations, and discussion of outcomes.

The model uses continuous functions of time to represent public debt (B (t)), interest rates (r (t)), and the primary surplus (s (t)), the latter being government revenue

minus non-interest expenditures. For a sustainable path of public debt, the model asserts that the limit of public debt, discounted by the integral of the interest rate over time, approaches zero as time extends to infinity. The progression of the nation it is possible to define debt as follows:

$$\dot{B} = r(t)B(t) - s(t) \quad \text{..... (1)}$$

Consists of government revenues and fewer core expenses, such as those that do not involve interest payments. Every variable is a continuous, real-world function of time

t. If the government does not engage in a Ponzi scheme, that is, if holds, then a particular trajectory of public debt is seen as sustainable.

$$\lim_{t\to\infty} B(t)^{to^{-\int r(r)\,dt}} = 0 \quad \text{..... (2)}$$

Next, assume that the primary surplus relative to GDP, S/Y, is given by,

$$\frac{S(t)}{Y(t)} = \omega(t) + p(t)\left(\frac{B(t)}{Y(t)}\right) \quad \text{..... (3)}$$

With $p\,(t) \epsilon\, IR$ belongs to IR the potentially time-varying coefficient that expresses how the primary surplus responds to public debt as a percentage of GDP. Other factors on the primary surplus are captured by the coefficient, which may also fluctuate over time. One such influence is the impact of business cycles for example,

From an economical perspective $\omega(t)$ was bounded, i.e., $|\omega| < \infty$ like replacing $\omega\,(t)$ based on the upper- or lower-bound of it by $\bar{\omega}$. Consequently, the progression of national debt can be expressed as

$$\dot{B} = (r(t) - p(t))B(t) - \bar{\omega}Y(t) \quad \text{..... (4)}$$

Solving Equation 4 and multiplying both sides by $e^{-\int_{t_0}^{t} r(u)du}$ to get present values leads to

$$e^{-C_3(t)}B(t) = e^{-C_1(t)}B(t_0) - \bar{\omega}Y(t_0)e^{\equiv -C_1(t)} \times \int_{t_0}^{t} e^{C_1(\tau)}e^{C_2(\tau)}e^{-C_3(\tau)}d\tau$$

Where

$$\int_{t_0}^{\tau} \rho(\mu)d\mu \equiv C_1(\tau) \quad \text{..... (5)}$$

$$\int_{t_0}^{\tau} \gamma(\mu)d\mu \equiv C_2(\tau)$$

$$\int_{t_0}^{\tau} \mathrm{r}(\mu)d\mu \equiv C_3(\tau)$$

With γ the GDP growth rate. Equation 5 shows averaged out; a positive reaction coefficient indicates that the government meets its intertemporal budget constraint. It should be underlined that while the government's response to the debt ratio may occasionally be negative, on the whole, it must be positive for sustainability. A good reaction coefficient, however, does not ensure that the debt ratio stays constrained. A good reaction coefficient, however, does not ensure that the debt ratio stays constrained. We define b = B/Y as the Debt to GDP ratio.

$$\dot{b(t)} = (r(t) - p(t) - Y(t))\,\mathrm{b}(t) - \bar{\omega} \text{ ..... (6)}$$

With the constants defined in Equation 6 the solution of this equation can be written as

$$b(t) = e^{-C_1(t)-C_2(t)+C_3(t)}b(t_0) - \bar{\omega}e^{-C_1(t)-C_2(t)+C_3(t)} \times \int_{t_0}^{t} e^{C_1(\tau)}e^{C_2(\tau)}e^{-C_3(\tau)}d\tau \text{ ..... (7)}$$

Further, the model integrates a variable coefficient p (t), which reflects how the primary surplus as a percentage of GDP responds to the public debt ratio. This coefficient is subject to change, potentially influenced by various economic factors like the business cycle.

Mathematically, the model is encapsulated in several equations that define the relationships and dynamics between these economic variables. It concludes that a positive response coefficient is essential but not solely sufficient for debt sustainability; it must also exceed the difference between the interest and GDP growth rates on

average. The model also notes that while an increasing debt ratio can coexist with a sustainable fiscal policy over short periods, this may not hold in the long term due to the theoretical and practical constraints on the primary surplus-to-GDP ratio.

In the empirical segment that follows, the model's theoretical underpinnings will be put to the test using data from various Asian countries, with a focus on the responsiveness of the primary surplus to changes in public debt and the stationarity of the deficit, including interest expenses.

Sustainability of this debt trajectory hinges on the condition that the present value of future debt does not grow without bounds—a principle that would be violated in the case of Ponzi financing. This leads to an examination of the primary surplus to GDP ratio, influenced by a coefficient that varies with time and reflects the government's fiscal response to debt. The model posits that a sustainable fiscal policy requires this coefficient to not only be positive but to exceed the gap between the interest and GDP growth rates, on average.

Addressing potential endogeneity in the relationship between the debt ratio and lagged primary balance is critical for the empirical analysis. This includes implementing the Durbin test and the Hausman test to decide between fixed effects and random effects models, each with distinct assumptions about the nature of unobserved heterogeneity.

To adjust for the bias arising from simultaneity and other endogeneity concerns, the model discusses the application of econometric techniques such as the Generalized Method of Moments (GMM) and Two Stage Least Squares (2SLS). GMM leverages the orthogonality conditions to produce consistent estimates, while 2SLS utilizes instrumental variables to correct for endogeneity.

The discourse on fixed versus random effects considers the suitability of each approach for analyzing panel data, weighing the assumptions and implications of each. The fixed effects model assumes correlation between unobserved heterogeneity and explanatory variables, while the random effects model does not. The choice between these models

Influences the interpretation of dynamic panel data and the credibility of the empirical findings.

Empirical Framework:

A fiscal reaction function is a concept that may be found in economic theory. It is used to describe how the primary balance responds to variations in factors that are thought to be important drivers of debt dynamics. The estimation of a panel regression model is required to create a model that can be applied to several countries over several different periods.

As a consequence of equation (7), the following is a statistical model of financial reaction that demonstrates the main balance and the government debt ratio are related:

$$pb_{it} = \beta_0 + \beta_1 d_{it-1} + \mu_{it} \quad (8)$$

Where; $pbit$ is the primary balance to GDP ratio, dit-1 is the percentage of GDP that is governmental debt, and it is the random error term. Because it does not consider any of the other important variable determinants of primary balance, Equation

(8) is a relatively simple expression.

The research published to date has uncovered additional state variable primary balance factors. To achieve the study's first two objectives, the panel regressionfunction is shown below, which links the output gap, primary balance, and other controlvariables to the lag primary balances, is essential.

$$pb_{it} = \beta_0 + \beta_1 pb_{it-1} + \beta_2 OG_{it} + \beta_3 d_{it-1} + \beta_t z_{it} + \mu_{it} \quad (9)$$

Where $pbit$ indicates primary balance, $dit{-}1$ is the debt to GDP lag ratio, $OGit$ isthe output or fiscal gap, and zit is a collection of vector-based control variables. Country and time are indicated by the indices *i* and *t*. correspondingly $\mu it$is the phrasefor random error. As a consequence of this, the research includes a random element tocontrol for these time-invariant and country-specific factors to guarantee that the findings are consistent.

The research further adjusts for the effects of Using variable, price fluctuation, continuous depreciation on main balances, and erratic government revenue, exchange rate, and trade openness. This is done to avoid omitted variable bias, which can occur

When a variable is left out of the analysis. Combes (2002), Edwards (1991), Schuknecht 1999). Equation (9) therefore becomes:

$pb_{it} = \beta_0 + \beta_1 pb_{it-1} + \beta_2 OG_{it} + \beta_3 d_{it-1} + \beta_4 Inf_{it} + \beta_5 Exrate_{it} + \beta_6 Open_{it} + f_i + \mu_{it}$ ………………………………………………............…. (10)

Where; fi indicates country-specific unobserved effects, $Infit$ is inflation, $Exrateit$ is the rate of exchange, and $Openit$ demonstrates the country $I's$ trade openness during period *t*.

Theoretical Framework of Research:

The theoretical framework begins with an examination of Bohn's 1998 hypothesis, which suggests a positive relationship between public debt ratios and primary surpluses in the context of GDP. The hypothesis under test is whether a rise in the debt-to-GDP ratio acts as a stimulant for an increase in the primary surplus, thereby initiating a mean reversion process in the progression of national debt. The presumption is that as the debt-to-GDP ratio climbs, it should theoretically lead to a larger primary surplus relative to GDP, creating a counterbalance that could stabilize or reverse the growth of the debt ratio over time. This theoretical relationship is described using a deterministic economic model where public debt's trajectory is sustainable if it does not lead to a Ponzi scheme-like condition.

The theoretical basis of this research is based on Bohn's (1998) hypothesis, which states that primary balance in the context of GDP and public debt ratios are positively correlated. According to this theoretical perspective, an increase in the debt-to-GDP ratio leads to an increase in the primary surplus, which in turn initiates a mean reversion process in the national debt trajectory. Using an unpredictable economic model, the study examines whether rising debt-to-GDP ratios lead to comparably bigger primary surpluses with respect to GDP, hence reducing or reversing the debt ratio's long-term development. In order to adjust for potential correlation between regressors, the suggested model incorporates the enhanced residual test for endogeneity, which is also known as the Durbin test. A number of independent variables, including public

debt, exchange rate, trade openness, inflation, debt-to-GDP ratio, and output gap, have a significant impact on the dependent variable, primary balance.

The relationships between these variables and the primary balance are supported by theories of economics. More specifically, the argument is put forth that in order to maintain fiscal sustainability, larger levels of public debt require higher primary surpluses. On the other hand, the dynamics of trade-related revenues can have an impact on the primary balance through exchange rates and trade openness. It is expected that inflation, as a variable, will affect the primary balance because of its effect on real debt levels and interest rates. An output gap that is positive is anticipated to have a beneficial impact on the primary balance through an influence on tax collections. The debt-to-GDP ratio is a crucial indicator of fiscal stability. Essentially, these interactions serve as a crucial window through which to view the complicated relationships that influence a country's financial condition (Bohn, 1998; Durbin, 1978).

Proposed Model:

Equation (10) is likely to experience issues with substantial correlation because the debt ratio and lagged primary balance share certain unobserved country-specific characteristics captured by $\boldsymbol{f}_i$. To account for the possibility of correlation between regressors, the research uses a technique known as the augmented residual test for endogeneity, which is also known as the Durbin (1978) test.

This test recasts the residuals of the endogenous explanatory variable as a function of the regressors of the basic model. The stochastic variable that represents nation-specifics and the independent variables in the model are connected by the Hausman specification test. If a correlation is present, this suggests that the null hypothesis should be accepted and that the Gauss Markov OLS assumption of the best linear approximation has been broken (BLUE).

In addition, the primary balance has the potential to turn lagging debt into endogenous debt because the main deficit may be funded through borrowing. Continuous borrowing also results in a growth in the debt stock, which results in simultaneity bias for the model given in equation 10. To overcome this issue, the research makes use of the conventional fixed and random effects, and the Generalized

Methods of Moments (GMM) method, both of which are better suited for static models, and are well recognized for their application to dynamic models.

The disparities between them stem from the fact that each possesses a unique capacity to address endogeneity issues. For example, the fixed effect model investigates heterogeneity on the premise that separate impacts are related to one another the random effect, however, assumes that individual heterogeneity is unrelated to the other independent factors.

To determine whether to use fixed effects or random effects, one must first carry out a Hausman test.

Hausman Test:

A statistical technique known as the Hausman test is employed in econometrics to evaluate the veracity of the presumption that the analysis of panel data is appropriate for the random effects model. It helps, for instance, when deciding whether to analyze panel data using a fixed effects model or a random effects model.

The primary objective of the Hausman test is to compare the accuracy of the random effects estimate with the reliability of the fixed effects estimator. Both estimators will be consistent if the random effects model's presumptions are true, but the random effects estimator will be more effective (have fewer standard errors). The Hausman test determines whether there is a statistically significant difference between the coefficients of the two estimators.

The alternative hypothesis of correlation is contrasted with the null hypothesis, which states that there is no association between the explanatory variables and individual heterogeneity. The fixed effect is preferred over the random effect, or the opposite is true, if the null hypothesis is not accepted.

The Hausman test's outcomes are utilized as the basis for conducting additional diagnostic tests of heterogeneity bias. These tests consist of the Breush-Pagan test for Random-effect models and the F test for fixed-effect models. One of the regressors in equation (10) includes the lagged dependent variable that lends the expression of dynamic quality.

Both the fixed and random effects estimators are rendered inconsistent as a result of this property. The reason for this is that they are unable to completely tackle the problem of endogeneity that exists between the primary balance and its lag of primary balance.

Although the fixed effect model can account for the time-invariant and country-specific determinants of primary balances (fi) for inside transformation, the endogeneity bias will still exist when a lagged dependent variable is used as an explanatory variable, as shown in the following equation: From

$pb\text{it} = \beta_1 pb_{\text{it-1}} + \beta_2 OG_{\text{it}} + \beta_3 d_{\text{it-1}} + f_{\text{i}} + \mu_{\text{i}}$

Letting Xit represent state variables (such as the debt-to-output ratio and the output gap), and after deducting the initial difference between the relevant variables, the following outcome is obtained:

$$pb_{\text{it}} - pb_{\text{it-1}} = \beta_1 (pb_{\text{it-1}} - pb_{\text{it-2}}) + \beta_{\text{t}} (X_{\text{it}} - X_{\text{it-1}}) + (f_{\text{i}} - f_i) + (\mu_{\text{it}} - \mu_{\text{it-1}})$$

……. (11)

To simplify the equation (11) can be adjusted to;

$$\Delta pb_{\text{it}} = \beta_1 \Delta pb_{\text{it-1}} + \beta_{\text{t}} \Delta X_{\text{it}} + \Delta \mu_{\text{it}} \quad \text{.....(12)}$$

The fixed effects transformation has removed the within endogeneity, but the correlation between the error term and the lagged respondent variable has persisted. Which is;

$\Delta\mu_{\text{it}} = \Delta\mu_{\text{it}} - \Delta\mu_{\text{it-1}}$ and $\Delta pb_{\text{it-1}} = pb_{\text{it-1}} - pb_{\text{it-2}}$

Hence Corr $(\Delta\mu_{\text{it}}, \Delta pb_{\text{it-1}}) \neq 0$

The association between the lagged regressor and the new endogeneity issue may be readily seen $(\Delta pb_{\text{it-1}})$ and the stochastic error term $(\Delta\mu_{\text{it}})$ is made. The Generalized Method of Moments (GMM), which was established by Arellano and

Bond, is utilized in this work so that the authors can address this issue (1991). To get consistent estimates, this approach ensures the unpredictability of the disturbance term and can account for endogeneity biases. It does this by using a randomization mechanism.

The orthogonality conditions (instrument validity) between the lagging dependent variable and the disturbance can be used to acquire new instruments, according to the GMM. This is one of the key tenets of the GMM.

The assumption that the chosen instruments required to create consistent estimators are "internal" is one of the GMM's most important features. The lagged dependent variable is used by the model to construct the instruments as a result. Because of this property, the Anderson-Hsiao Instrumental Variable estimator is superseded as the most efficient estimator by this one (Baum 2013). Below is an illustration of this: From

$$\Delta pb_{it} = \beta_1 \Delta pb_{it-1} + \beta_t \Delta X_{it} + \Delta \mu_{it}$$

As instruments for the lagged dependent variable, larger lags are introduced:

$$pb_{it} - pb_{it-1} = \beta_1 (pb_{it-2} - pb_{it-3}) + \beta_t (X_{it} - X_{it-1}) + (f_i - f_i) + (\mu_{it} - \mu_{it-1})$$

Reorganizing and simplifying the giving;

$$\Delta pb_{it} = \beta_1 \Delta pb_{it-2} + \beta_t \Delta X_{it} + \Delta \mu_{it} \quad \text{.....(13)}$$

Where,

$\Delta \mu_{it} = \Delta \mu_{it} - \Delta \mu_{it-1}$ and $\Delta pb_{it-2} = (pb_{it-2} - pb_{it-3})$ Hence Corr $(\Delta \mu_{it}, \Delta pb_{it-2}) = 0$

Demonstrating full randomness Moreover, there is no link between the stochastic term, the lagged dependent regressor, and the random component. In another case, if GMM was not used due to a different number of cross-sectional units being less than the needed number of observations then 2SLS was used for further analysis. Two Stage Least

Squares (2SLS) is a general estimate method that is used to handle endogeneity in regression models. It consists of two stages of least squares. It is frequently utilized in circumstances in which there are endogenous variables that are linked with the error term, which, if traditional least squares estimation were to be used, would result in results that were biased and inconsistent. There are two primary categories of 2SLS, namely:

1. Single-equation 2SLS:

When there is only one endogenous variable to be modeled, a single-equation 2SLS is the sort of 2SLS that is implemented in the model. Finding appropriate instruments for the endogenous variable and estimating its parameters using the two processes outlined above are required steps in this process.

2. System 2SLS:

When there are several endogenous variables in the model, System 2SLS is utilized. In this scenario, instruments are chosen for each endogenous variable on its own, and then the two steps of 2SLS are utilized to simultaneously estimate the parameters of the complete system of equations.

Estimation takes place in two steps throughout the 2SLS approach. In the first stage of the process, estimates of the endogenous variables are calculated using instrumental variables (IVs). The endogenous variables are correlated with the IVs, however, there is no link between the error term and the IVs. The relevance and homogeneity of these instruments to the model are the primary considerations in their selection.

The model for the second stage uses the predicted values of the first stage's endogenous variables as explanatory variables, which occurs after the first stage. These anticipated values are referred to as "exogenous" values, and they are utilized in the estimation process for the parameters of interest by employing the ordinary least squares (OLS) method.

When referring to distinct kinds of effects in the context of panel data analysis, the phrases "fixed" and "random" are frequently used terminology that is routinely used. To consider time-invariant heterogeneity, fixed effects models incorporate fixed effects

for specific entities (such as countries, corporations, or individuals), whereas random effects models assume that the unobserved impacts are unpredictableand unrelated to the explanatory factors. Fixed effects models are more common.

Chapter 4

Results and Discussion

The chapter titled "Results and Discussion" within a research study delves deeper into the findings generated through data analysis and empirical investigation. Its purpose is to provide a comprehensive and clear interpretation of these findings, obtained using the research methodology described in the preceding chapters. This often entails the use of tables, charts, graphs, and descriptive statistics to effectively visualize the key scientific outcomes.

When assessing the viability of governmental debt in Pakistan, Bangladesh, Sri Lanka, and India, it is imperative to commence by examining the present economic conditions of each country before determining the viability of their existing levels of public debt. Over several decades, India's national debt has exhibited consistent and noticeable growth.

As of 2020, India's total public debt constituted more than 90% of the country's GDP. Despite this, India's debt-to-GDP ratio has demonstrated limited change in recent years when compared to other countries. The Indian government has taken measures such as fiscal consolidation efforts and reforms aimed at augmenting revenue and controlling expenditures, all too effectively manage and alleviate the burden of the country's debt.

Recent years have presented challenges for Sri Lanka in maintaining the sustainability of its public debt. Apprehensions have arisen concerning the country's public debt, projected to exceed 80% of GDP by 2020. Sri Lanka has encountered difficulties in meeting its debt obligations, raising concerns about its ability to uphold economic stability. In response, the administration has actively pursued fiscal reforms, sought assistance from foreign financial institutions, and explored debt restructuring options as potential solutions.

The management of Bangladesh's public debt has witnessed significant progress recently. The proportion of a country's total debt relative to its GDP has displayed a consistent decline and was approximately 40% in 2020. The government has implemented prudent fiscal policies, with a primary focus on enhancing tax collection and reducing reliance on external borrowing. While indicators point toward positive

debt sustainability in Bangladesh, challenges persist in effectively overseeing the quality and composition of public debt.

Achieving sustainable levels of public debt in Pakistan has required overcoming multiple obstacles. In 2020, Pakistan's debt-to-GDP ratio is expected to be more than 90%. Pakistan has struggled to rectify fiscal imbalances, characterized by inadequate revenue collection and high expenditures. To effectively manage the debt load, the government has implemented reforms to enhance revenue collection, control spending, and seek support from alternative sources.

This figure 1 debt-to-GDP ratio spanning the years 1980 to 2020. In the initial period, from 1980 to 1985, the ratio displayed conspicuous instances of both peaks and troughs, underscoring its pronounced volatility. Subsequently, a consistent upward trend prevailed until 1990, characterized by a gradual augmentation of the ratio. Following this phase, a sequence of fluctuations unfolded, with a distinct decline in the ratio manifesting between 1995 and 2000. This was succeeded by another ascending phase until 2005, succeeded yet again by a discernible descent.

From an economic vantage point, the ratio of debt to GDP serves as a pivotal gauge, illuminating a country's debt load relative to its economic output. Peaks in the ratio denote periods during which the country's debt expands at a swifter rate than its economic growth, potentially stemming from amplified borrowing or economic deceleration. Conversely, troughs in the ratio might signal endeavors to curtail debt or a robust economic performance that surpasses debt accrual. The overarching trend of this ratio provides valuable insights into a country's fiscal well-being and its efficacy in managing debt concerning its economic expansion.

Analyzing Public Debt Dynamics

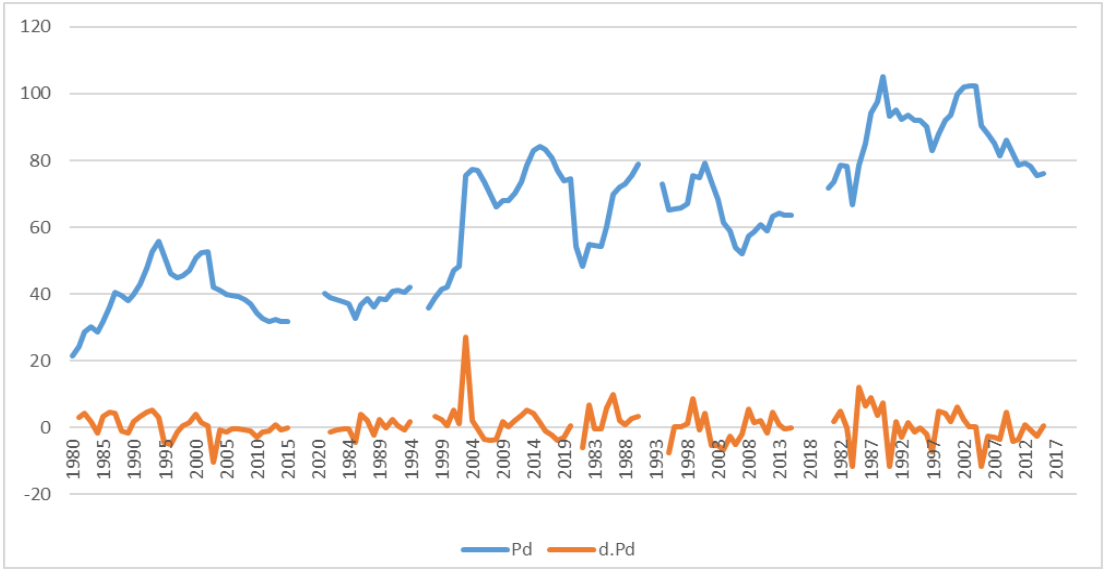

Figure 1: Public Debt Level and its Year-on-Year Change (1980-2017)

Figure 1 represents the graph you've provided depicts two time series: the original series labeled "Pd," which represents public debt, and the transformed series labeled "d.Pd," which indicates the differenced public debt data.

The blue line, representing "Pd," shows the public debt levels from 1980 to 2017. The trend in the original series suggests variability over time with noticeable fluctuations, which could correspond to various economic cycles, policy changes, or financial events that have influenced the levels of public debt.

The orange line, representing "d.Pd," illustrates the changes in public debt from one period to the next, achieved by subtracting the previous year's debt level from the current years. This transformation is a common technique in time series analysis to attain stationarity — a state where the statistical properties of the series such as mean and variance are constant over time. The graph indicates that the differencing process has significantly dampened the trends and fluctuations, providing a series that fluctuates around a mean with no apparent trend over time, which is indicative of stationarity.

Analyzing gross domestic product

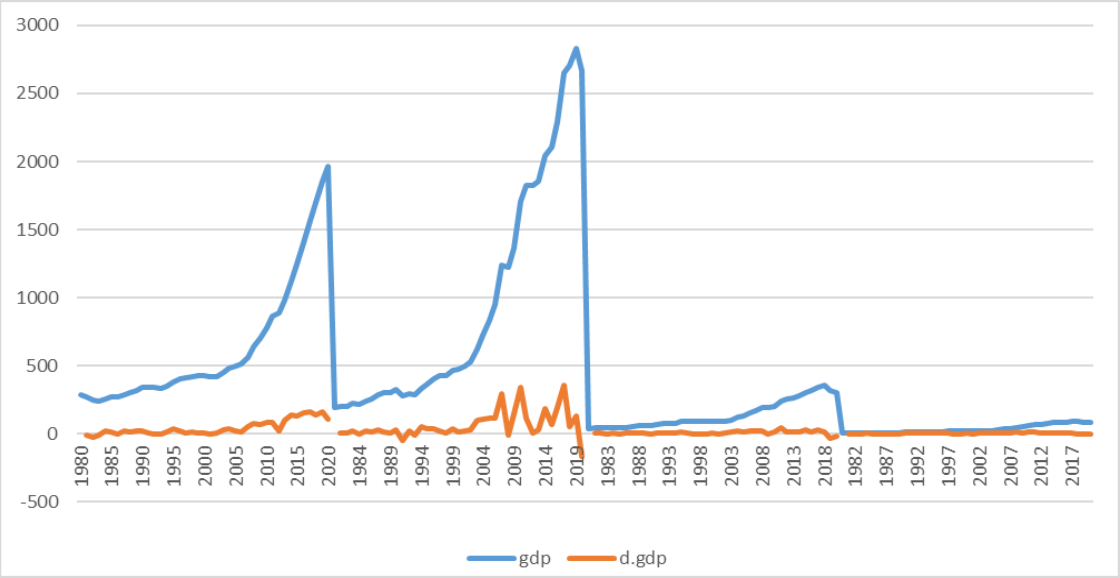

Figure 2: gross domestic product and its Year-on-Year Change (1980-2017)

In figure no 2 present the graph portrays two data series related to economic performance from 1980 to 2017. The blue line, labeled "gdp," likely signifies the gross domestic product (GDP) of a country or region, measured annually. This line shows significant growth over time, with a particularly sharp increase before a steep decline and subsequent leveling off. Such a pattern might reflect a period of economic boom followed by a sharp recession or financial crisis, then a return to more stable growth rates.

The orange line, labeled "d.gdp," represents the first difference of the annual GDP data, which is a common transformation in time series analysis to achieve stationarity. This line illustrates the year-over-year changes in GDP, showing the incremental increases or decreases rather than the absolute level. The differencing process typically removes trends and seasonality, highlighting the volatility and identifying periods of significant economic change.

Analyzing Inflation Rate

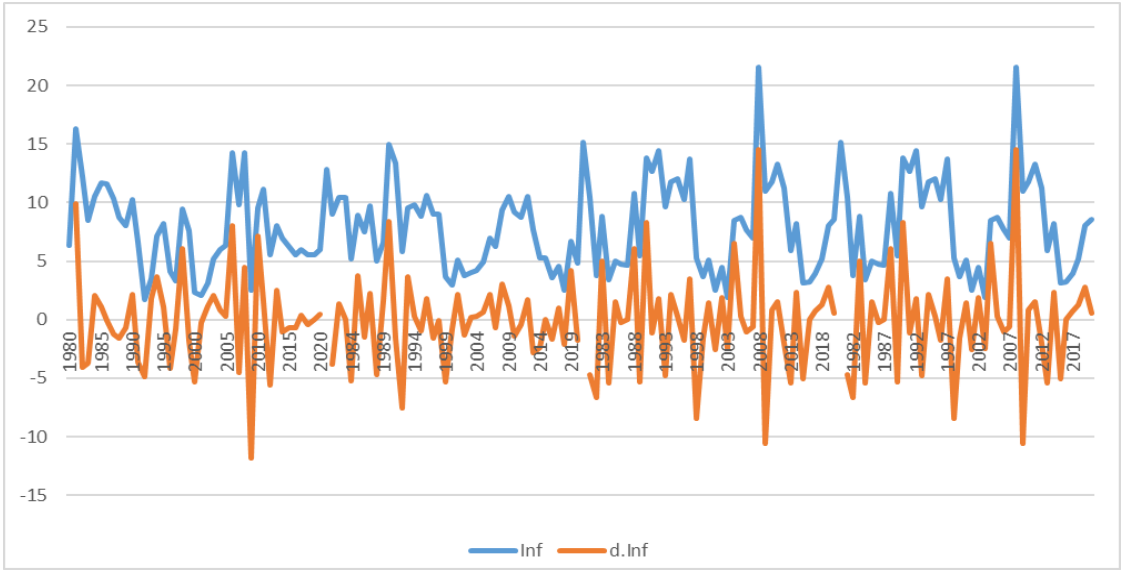

Figure 3: Inflation Rate and Its Year-on-Year Variability (1980-2017)

The figure 3 graph showcases two series related to inflation from 1980 to 2017. The blue line, labeled "Inf," likely represents the inflation rate, which is the percentage change in the price level of goods and services over time. This line shows considerable fluctuations over the examined period, with some peaks indicating higher inflation rates that could correspond to periods of economic overheating, policy changes, or other inflationary pressures.

The orange line, labeled "d.Inf," represents the first difference of the inflation rate data, meaning it shows the change in the inflation rate from one year to the next. This transformation is often used in time series econometrics to achieve a stationary series, which is a series whose statistical properties such as mean and variance are constant over time. The differenced inflation rate line is more volatile, with its peaks and troughs reflecting the acceleration or deceleration of inflation from year to year, rather than its absolute level.

Analyzing Trade Openness

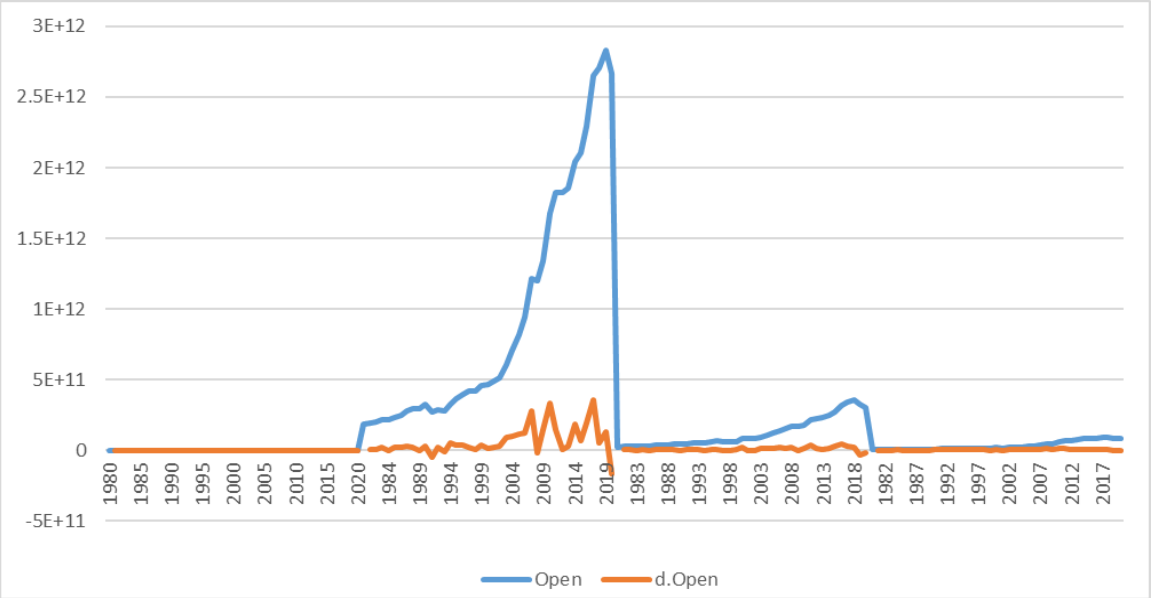

Figure 4: Trade Openness and Year-on-Year Changes (1980-2017)

Figure no 4 represents graph displays two series from 1980 to 2017 that seem to be related to trade openness. The blue line, labeled "Open," likely represents a measure of trade openness, which could be quantified as the total value of a country's exports and imports as a proportion of its gross domestic product (GDP). The graph shows a dramatic increase in this measure, peaking sharply before a precipitous drop. This could be indicative of a period of rapid globalization or integration into the world economy, followed by a significant contraction, possibly due to a global financial crisis, changes in trade policy, or other major economic events.

The orange line, labeled "d. Open," represents the first difference of the trade openness data, which is calculated by subtracting the value of one year from the next. This line captures the year-over-year changes in trade openness, rather than its absolute value. The differenced data oscillates above and below zero, reflecting periods when trade openness increased or decreased compared to the previous year.

Analyzing Primary Balance

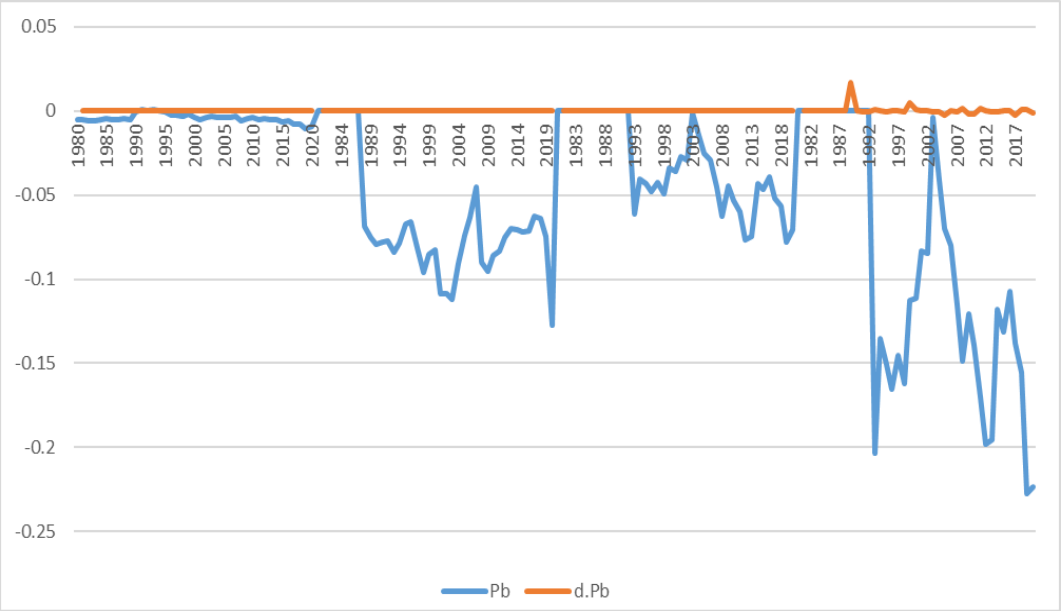

Figure 5: Primary Balance and Its Yearly Adjustments (1980-2017)

The graph 5 illustrates two series from 1980 to 2017 related to the primary balance, a fiscal indicator. The blue line, labeled "pb," likely represents the primary balance as a percentage of GDP, which measures the fiscal surplus or deficit of a government excluding interest payments on debt. Positive values indicate a surplus, where government revenues exceed non-interest expenditures, while negative values indicate a deficit.

The blue line shows fluctuations around zero with several dips into negative territory, suggesting periods when the government was running deficits before returning to near-balance or surplus. The most notable feature is the sharp downward spikes, which could represent times of significant fiscal stress, possibly due to economic downturns or increased spending.

The orange line, labeled "dpb2," seems to be the second difference of the primary balance data, which indicates the change in the year-over-year fiscal performance. The second difference is a further step to eliminate trends or cyclicality to achieve stationarity in time series data. The "dpb2" line is closer to zero and less volatile, which

could indicate that taking the second difference has removed underlying trends and seasonal effects, offering a more stationary series for econometric analysis.

Descriptive Statistics:

Table 4.1 delivers a comprehensive overview of key economic indicators through Descriptive Statistics. These indicators are represented in symbolic terms and are accompanied by their respective statistical characteristics. The purpose is to gain deeper insights into the dynamics and drivers of public debt sustainability in the considered countries. This can be achieved through a detailed empirical analysis utilizing panel dataspanning the years from 1980 to 2020.

Table 4.1: Descriptive Statistics

Variables	Mean	SD	Probability	N	Skewness	Kurtosis	Median	Sum	Sum Sq. Dev	Jarque-Bera
DGDP	60.817	21.137	0.0111	156	0.383	0.325	62.738	9703.315	54143.715	4.234
ER	57.297	37.540	0.0000	164	-0.18	-0.164	64.797	10114.817	235565.627	1.133
OG	-96.121	0.7971	0.0897	164	0.084	0.095	-96.203	-15770.917	96.435	0.211
PB	-0.0488	0.0679	0.0000	152	-0.09	0.51	-0.046	-7.039	0.639	1.51
INF	8.0942	4.1109	0.0000	157	0.159	-0.556	8.254	1279.272	2799.1	2.828
TO	2.7400	5.7900	0.0000	164	0.114	-0.033	2.141	371.291	4569.865	0.379

"Note: DGDP= debt Gross domestic product; ER= Exchange rate; OG= Output Gap; PB= Primary Balance; INF= Inflation; TO= Trade openness"

One significant metric examined in Table 4.1 is the debt-to-GDP ratio, which gauges how much a country owes in comparison to how much it produces economically. The

typical debt-to-GDP ratio across the sample is 60.817, with a notable standard deviation of 21.137. This variability suggests differing levels of debt burden among the countries. The associated probability of 0.0111 points to a statistically significant relationship. In economic terms, consequently, changes in the debt-to-GDP ratio have a considerable effect on the fiscal health of a nation influencing its overall economic stability and potential for growth.

The exchange rate, another crucial metric, holds an average value of 57.297 with a substantial standard deviation of 37.540. The exceptionally low probability of 0.0000 underscores its profound significance. This suggests that the exchange rate is crucial to the economies of the countries under study. Exchange rates impact various aspects such as international trade competitiveness, capital flows, and inflation. The high volatility, as reflected by the standard deviation, suggests that sudden fluctuations in exchange rates can have significant repercussions for these economies.

Turning to the output gap, an average value of -96.121 reveals that the economies are operating below their full potential. However, with a likelihood of 0.0897, the statistical significance is limited. This implies that the output gap's impact on the broader economic landscape might not be as pronounced. An output gap signifies the difference between actual and potential GDP, reflecting economic inefficiencies or underutilization of resources.

Examining the primary balance, with a standard deviation of 0.0679 and a mean of -0.0488 the exceptionally low probability of 0.0000 indicates its remarkablesignificance. The primary balance, representing fiscal deficits without considering debt interest, suggests the sustainability of debt in the studied South Asian countries is in question. High deficits could potentially lead to increasing debt burdens over time.

Inflation, with an average rate of 8.0942% and a standard deviation of 4.1109, carries substantial economic weight as indicated by the probability of 0.0000. Elevated and unpredictable inflation rates can disrupt economic stability, affecting the real value of debt, investor confidence, and overall fiscal planning.

Trade openness, denoted by an average of 2.7400 and a high standard deviation of 5.7900, holds statistical significance with a probability of 0.0000. This implies that the

extent to which a country engages in international trade has noteworthy implications for its economic performance.

Correlation:

Table 4.2 illuminates significant correlations among diverse economic variables, furnishing crucial insights into their interactions and the possible causal connections that shape the economies under scrutiny. These insights can play a pivotal role in aiding policymakers to fathom the nuanced intricacies that steer economic stability and the sustainability of debt.

Table 4.2: Correlation

	DGDP	ER	OG	PB	INF	TO
DGDP	1					
ER	0.3160	1				
OG	-0.532	-0.163	1			
PB	-0.581	-0.323	0.366	1		
INF	0.111	0.081	-0.24	-0.24	1	
TO	0.245	-0.266	0.562	-0.15	-0.08	1

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

For instance, the statistically significant positive correlation (0.3160) between Exchange Rate (ER) and Debt-to-GDP Ratio (DGDP) holds important implications. An elevated DGDP corresponds to a heightened ER, implying that an increase in a country's debt relative to its GDP is associated with a currency appreciation. Nonetheless, the strength of this correlation falls within the moderate range, suggesting a discernible yet not overpowering link between the two.

The significant negative correlation (-0.532) between the Output Gap (OG) and DGDP is equally noteworthy. This linkage implies that as DGDP rises, the disparity between actual and potential economic output shrinks. In essence, higher public debt levels are intertwined with a reduced output gap, indicating a potential impact of debt on the utilization of an economy's productive capacity.

Primary Balance (pb), signifying the fiscal surplus or deficit, showcases a notable negative correlation (-0.581) with DGDP, ER, and OG. As pb rises, DGDP, ER, and OG tend to decline. This correlation underscores how fiscal conditions, as measured by primary balance, co-vary with these economic variables. An expansion in fiscal surplus or deficit reduction corresponds to lower DGDP, ER, and OG, signifying a complex interplay between fiscal policy and broader economic performance.

A slight positive correlation (0.111) between Gross Domestic Product (DGDP) and Inflation (Inf) is observed. This suggests that as DGDP ascends, there is a modest tendency for inflation to follow suit. However, this correlation lacks robust statistical support, indicating the need for caution in interpreting this relationship.

Regarding Trade Openness (TO), its positive correlation (0.245) with DGDP contrasts with the negative correlation (-0.266) with ER. This indicates that as economies grow (DGDP increases), they tend to become more open to trade, potentially capitalizing on increased economic activity. However, this greater openness is associated with a decreased ER, implying a complex interplay between trade dynamics and currency valuation.

It is essential to acknowledge that while greater trade openness can bolster debt-to-GDP ratios, it also exposes economies to vulnerabilities such as external shocks and sector-specific reliance. This nuanced relationship hinges on multifaceted factors including monetary policies, economic growth trajectories, inflation trends, and external economic perturbations.

Unit Root Test:

The GMM estimator, specifically the Arellano-Bond (1991) approach, can face limitations when the endogenous variable and the measurement tool might be correlated. This issue becomes particularly problematic if the endogenous variable possesses a unit root and follows a stochastic random walk. This correlation tends to weaken as the time gap between observations increases, making higher time lags less suitable as instruments.

The findings of the unit root test conducted by Levin, Lin, and Chu (1995) are detailed in Table 4.3. These tests, proposed by Levin, Lin, and Chu, delve into the stationary

attributes of several significant economic variables: DGDP, Exc, OG, pb, inf, and TO. Their outcomes unveil crucial insights into the temporal dynamics of these variables.

Table 4.3: Unit Root Test

Levin, Lin & Chu			
	t-Stat	**Prob.***	**Order of Integration**
DGDP	-5.01936	0.0000	I (1)
ER	-5.76109	0.0000	I (1)
OG	-3.81775	0.0001	I (2)
PB	-4.45704	0.0000	I (1)
INF	-2.57621	0.0050	I (0)
TO	-7.24423	0.0000	I (2)

"Note: DGDP= Debt to GDP ratio; FB= Fiscal balance; IN= Inflation; TO = Trade Openness; ER= Exchange rate; RIR= Real interest rate; OG= Output Gap"

Beginning with DGDP, its p-value of 0.0000, alongside a t-statistic of -5.01936, clearly signifies its non-stationary character. The marked negativity of the t-statistic and the remarkably low p-value strongly refute the null hypothesis. The integration order of one (I (1)) for DGDP indicates that it becomes stationary after undergoing a first differentiation.

Following a similar trajectory, the Exc variable yields a t-statistic of -5.76109 and an exceptionally low p-value of 0.0000. This concurs with the findings for DGDP, reinforcing the rejection of the null hypothesis. Exc also displays an integration order of one (I (1)), implying that initial differencing is required for achieving stationarity.

Shifting focus to OG, its t-statistic registers at -3.81775 with a p-value of 0.0001, firmly establishing its statistical significance and consequent null hypothesis rejection. The integration order of two (I (2)) for OG suggests that dual differencing stages are necessary to render it stationary.

The pb variable displays a parallel pattern with a t-statistic of -4.457004 and a p-value of 0.0000 reflecting comparable significance. It also carries an integration order of one (I (1)), with its stationarity achieved through initial differencing.

Transitioning to Inflation (Inf), it presents a t-statistic of -2.57621 and a p-value of 0.0050, underscoring its statistical significance. Inf's integration order of zero (I (0)) implies inherent stationarity in its levels, negating the requirement for differencing.

Lastly, TO's t-statistic of -7.24423 and its p-value of 0.0000 highlight pronounced significance resulting in the null hypothesis being disproved. TO's integration order of two (I (2)) signifies its demand for second-order differencing to attain stationarity.

The results of the unit root test, which are presented in Table 4.3, offer important information about the stationarity properties of economic variables, such as the primary balance (PB). According to the test, PB has a first-order integration (I (1)), which means that in order to obtain stationarity, the first difference must be implemented. Furthermore, it is understood that the second difference of PB, represented as "dpb2," is stationary and has an integration order of zero (I (0)). This suggests that the original PB data are successfully stripped of trends and cyclicality by the second differencing, making "dpb2" appropriate for econometric study without raising issues related to non-stationarity. Consequently, the use of the second difference ensures the attainment of stationarity in the "dpb2" series, enhancing the accuracy and dependability of analytical and modelling projects.

In essence, the outcomes of these unit root test, pioneered by Levin, Lin, and Chu (1995), offer invaluable insights into the stationary attributes of these economic variables. The statistical significance of these results sheds light on the necessity of employing differencing methods to attain stationarity, thereby enhancing the precision of modeling and analytical endeavors.

Panel Least Squares Test:

Table 4.4 presents results from a panel regression analysis, revealing relationships between economic variables and the dependent variable. Coefficients and p-values signify variable significance in predicting the dependent variable. The analysis exposes

how distinct economic factors connect to the dependent variable. Insights into significant predictors emerge from coefficients and p-values, highlighting their role in prediction. Yet, conclusions are model-specific and lack inherent causal inference.

Table 4.4: Effects of Economic Variables on Primary Balance: A Panel LeastSquares Regression (1980-2020)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006328	1.564971	-0.004044	0.9968
ER	-0.000559	0.000345	-1.618962	0.1079
INF	-0.001461	0.001876	-0.778481	0.4377
DGDP	-0.000820	0.000523	-1.568614	0.1192
TO	-1.67E-14	1.32E-14	-1.259116	0.2102
OG	-0.000601	0.016392	-0.036643	0.9708
R-squared	0.239453	Mean dependent var		-0.047230
Adjusted R-squared	0.210424	S.D. dependent var		0.066088
S.E. of regression	0.058724	Akaike info criterion		-2.789120
Sum squared resid	0.451759	Schwarz criterion		-2.661238
Log-likelihood	197.0547	Hannan-Quinn criteria.		-2.737152
F-statistic	8.248874	Durbin-Watson stat		0.107152
Prob(F-statistic)	0.000001			

Dependent Variable: PB

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

The focus of the study is on the primary balance (PB), which essentially captures a country's fiscal discipline. In plain terms, the primary balance tells us if a government is living within its means, disregarding the costs of past debts. The analysis spans four different countries over a lengthy 41-year period, but missing data points indicate potential economic events or crises during which data might not have been recorded or was unavailable.

The coefficients give us insight into how different economic indicators influence fiscal discipline. For example, the fact that a one-unit shift in the exchange rate results in a marginal decline in PB may indicate that a country's budget is susceptible to currency swings. This relationship could arise if, for instance, government revenues are closely tied to exports, which are in turn sensitive to exchange rate movements.

However, none of the examined indicators individually show a strong and statistically significant direct impact on PB. This is somewhat surprising given the common belief in the economic literature about the profound effects of factors like exchange rates and inflation on fiscal outcomes. Yet, collectively, these factors do seem to play a role, as the F-statistic suggests. This implies that it's the combined interaction and intertwined effects of these economic factors that might be influencing fiscal outcomes, rather than their isolated impacts.

The R-squared and adjusted R-squared values indicate that while our model captures some of the dynamics at play, a large chunk (around 76-78%) of what determines a country's primary balance remain s unexplained by the chosen variables. In economic terms, this means that there could be numerous other fiscal, institutional, political, or external factors at play that the model does not consider.

Lastly, the high degree of positive autocorrelation flagged by the Durbin-Watson statistic has significant economic implications. It suggests that there are underlying patterns or cycles in the primary balances of these countries that the model doesn't capture. Economically speaking, this could be due to cyclical behaviors in fiscal policy (e.g., governments might consistently spend more in election years) or business cycles impacting government revenues and expenditures. The presence of such strong autocorrelation implies that policymakers cannot simply look at the current year's economic indicators to forecast fiscal outcomes; they must also consider past fiscal behaviors and broader economic cycles.

Fixed Effect:

The utilization of fixed effects, also known as individual-specific or entity-specific effects, plays a pivotal role in the realm of panel data analysis. This statistical technique

is instrumental in accounting for concealed variations inherent among diverse entities or individuals within a dataset. It serves as an alternative approach to the random effects model and offers distinct advantages, particularly when the underlying unobserved heterogeneity remains consistent over time.

At the core of a model incorporating fixed effects lies the premise that each entity or individual possesses a distinct intercept or effect that remains constant throughout the period. These fixed effects encapsulate entity-specific attributes or latent factors that remain unchanged for each entity but may differ across different entities. This integration of fixed effects into the model facilitates more accurate estimations of model parameters, effectively accommodating this concealed variability.

The fixed effects model differs significantly from the random effects model in that the intercept is permitted to vary across entities while remaining constant for each entity over time. This differentiation underscores a primary contrast between these two models. Consequently, the fixed effects model can capture dissimilarities between entities that are not contingent on the passage of time, such as individual preferences, unique abilities, or other latent attributes.

When undertaking the estimation of a fixed effects model, it is imperative to introduce a set of dummy variables, also known as entity dummies or individual dummies, into the regression equation. Each dummy variable corresponds to a specific entity or individual and accounts for the entity-specific intercepts, enabling an accurate reflection of fixed effects.

To derive the values of model parameters, the fixed effects estimator considers the within-entity variation as it evolves. By differencing the data by entity, the fixed effects estimator mitigates entity-specific effects. This process facilitates the consistent estimation of coefficients for independent variables.

The application of the fixed effects model allows for the estimation of coefficients for independent variables, while the entity dummies address intercepts. These estimates enable an examination of the relationship between independent factors and the dependent variable while accommodating latent variation in the data.

In various domains such as economics, social sciences, and public health, fixed effects models are standard practice for analyzing panel data and controlling for hidden variation. They prove particularly valuable in situations where anticipated unobserved heterogeneity remains uniform over time and distinct for each entity or individual.

In table 4.5 the panel least squares regression analysis aims to shed light on the relationships between various macroeconomic factors and the primary balance of different countries. The primary balance, in essence, indicates whether a country is earning more than it spends, excluding the costs related to past debts. With data spanning from 1980-2020 across four countries, it's notable that some data is missing—this could be due to various reasons, such as unrecorded data during certain economic or political events.

Table 4.5: Impact of Macroeconomic Indicators on Primary Balance: A Panel Least Squares Regression with Cross-Section Fixed Effects (1980-2020)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.840960	1.962672	-4.504554	0.0000
ER	0.000634	0.000420	1.507524	0.1341
INF	0.000215	0.001785	0.120338	0.9044
DGDP	-0.000400	0.000548	-0.729782	0.4669
TO	4.41E-14	1.07E-14	4.105150	0.0001
OG	-0.091326	0.020112	-4.540860	0.0000
R-squared	0.432045	Mean dependent var		-0.047230
Adjusted R-squared	0.396547	S.D. dependent var		0.066088
S.E. of regression	0.051338	Akaike info criterion		-3.037320
Sum squared resid	0.337361	Schwarz criterion		-2.845496
Log-likelihood	217.0564	Hannan-Quinn criteria.		-2.959367

F-statistic	12.17122	Durbin-Watson stat	0.150246
Prob(F-statistic)	0.000000		

Dependent Variable: PB

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

When interpreting regression coefficients, understanding that they represent the anticipated change in the dependent variable (in this case, PB) is crucial. When the independent variable changes by one unit, with everything else held constant. For instance, if the exchange rate of a country were to rise by one unit, we would anticipate its primary balance to increase by 0.000634 units. This suggests that a strengthening currency might be associated with stronger fiscal health, perhaps because a stronger currency can increase the purchasing power of a country and positively impact its trade balance. The coefficient on the exchange rate suggests a strengthening currency is associated with better fiscal health. Economically, this makes sense: a stronger currency often boosts a country's purchasing power. This, in turn, can lead to decreased costs for imported goods and services. Moreover, when a country's currency is strong, it often reflects positive investor sentiment and robust economic performance, both of which can indirectly contribute to a healthier primary balance.

T-statistics and p-values are tools to determine the significance of each coefficient. If a coefficient's absolute t-statistic is high and its p-value is below 0.05, it's generally believed that the variable it corresponds to is influencing the dependent variable. From the provided data, `C`, `TO`, and `OG` are statistically significant predictors of PB. Here's the economic intuition:

`C` (often representing a constant in regressions) being significant suggests there might be some baseline level of PB that's influenced by factors outside of the model. The significance of the constant term (C) implies that there are other factors, not included in the model, that influence the primary balance. These could be a combination of historical, geopolitical, or other macroeconomic influences that remain consistent over time.

A country that's more open to trade might have a more significant primary balance. This could be due to the economic benefits of trade, where increased exports can boost government revenues, or it could be indicative of the broader economic policies and governance of open economies. Economically, openness to trade can be a double-edged sword. On one hand, increased trade can lead to higher export revenues and potential surpluses. On the other, it can expose an economy to global shocks. Your result suggests that the net effect is positive, possibly because more open countries tend to adopt policies that foster innovation, competition, and efficiency, leading to healthier fiscal positions.

This represents the difference between the actual and potential GDP of a country. A significant positive coefficient suggests that as the output gap grows (indicating an economy operating below its potential), the primary balance increases. This might be counterintuitive, but one potential explanation could be that during economic downturns or recessions, governments might be adopting austerity measures or getting increased financial aid or investments, which could bolster their primary balance. The positive relationship with PB might seem counterintuitive initially. However, when economies operate below potential, it might trigger policy responses. Governments, aiming to stimulate the economy, might adopt fiscal tightening measures, or they might receive increased external support or investments, all of which can lead to a better primary balance.

The values for R-squared and adjusted R-squared provide insight into the model's robustness. With the model accounting for around 43.20 percent of the variation in PB, it captures a significant portion of the factors affecting primary balances, but there's still much left unexplained. An R-squared value of 43.20% indicates that while the model captures significant factors affecting primary balances, there's more to the story. Economically, this suggests that primary balances are influenced by a myriad of factors, and while macroeconomic variables are essential, other political, social, or global factors play a role.

The Durbin-Watson statistic's value of 0.150246 suggests some degree of positive autocorrelation. In the context of fiscal data, this could imply that fiscal policies and outcomes are influenced by past decisions and outcomes, pointing to potential

momentum or inertia in fiscal policy. The value of 0.150246 indicates positive autocorrelation. From an economic perspective, this suggests that fiscal decisions aren't isolated year-on-year. Instead, they're influenced by previous decisions, reflecting the continuity and momentum in fiscal policies. Governments might be basing their current fiscal stance on the outcomes of past stances or reacting to past fiscal outcomes.

Finally, the utilization of cross-section fixed effects is pivotal. This methodology recognizes that every country (or cross-section) has unique characteristics, like culture, governance structures, or resource endowments, which might affect its primary balance. Regression considers fixed effects to account for these time-invariant, non- observable properties, ensuring that the relationships identified are not confounded by these country-specific factors.

Table 4.5 provides information about the statistics, degrees of freedom (d.f.), and probability values (p-values) associated with the Hausman Test undertaken to assess how well the random effects model and the fixed effects model matched the provided data.

Table 4.5: Examination of Redundant Fixed Effects in a Cross-Sectional Model

	Statistics	d.f.	Prob.
Cross-section F	14.468128	(3, 128)	0.0000
Cross-section Chi-Square	40.003358	3	0.0000

Source: Author's computation

The "Cross-section F" statistic for the Hausman Test, 14.468128, is significant. It compares the efficiency of the random effects model with that of the fixed effects model. Strong evidence is found to be against the null hypothesis, and the corresponding p-value of 0.0000 is exceptionally low. The null hypothesis shows that the random effects model is more appropriate in this situation. The fixed effects model is statistically preferred over the random effects model, according to the low p-value.

The Hausman Test's "Cross-section Chi-Square" value of 40.003358 is another critical component. It compares the fixed effects model to the random effects model. The p-value of 0.0000 is once more very small, and it provides strong evidence that the null hypothesis is incorrect. According to the null hypothesis, the random effects model is more suitable. Strong support for the fixed effects model as the superior option is implied by the extremely low p-value.

The choice between the fixed effects model and the random effects model is critically dependent on the Hausman Test. The test evaluates whether the differences in estimates between the two models are systematic and whether one model is consistently more efficient than the other.

In the context of Table 4.5, The "Cross-section Chi-Square" statistic and the "Cross-section F" statistic both show p-values of 0.0000. Strong statistical evidence strongly supports rejecting the null hypothesis that the random effects model is favored, as seen by the exceptionally low p-value. The information instead suggests that the fixed effects model is better suited to account for the variations in the dependent variable that have been observed. From an economic perspective, the results of the Hausman Test hold significance. They suggest that the hidden individual-specific characteristics or unobserved heterogeneity among entities or individuals are not randomly distributed. Instead, these unobserved factors have a systematic relationship with the independent variables, making the fixed effects model more appropriate. This aligns with the assumption that individual attributes or entity-specific traits consistently influence the dependent variable, reinforcing the suitability of the fixed effects model.

Squares approach for parameter estimation. Spanning 41 periods, the analysis encompasses data from 1980 to 2020. Let's now delve into the economic interpretation of the information presented in Table 4.6, focusing on the Cross-Section Fixed Effect analysis:

Table 4.5.1: Analysis of Cross-section Fixed Effects on Primary Balance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.006328	1.564971	-0.004044	0.9968

ER	-0.000559	0.000345	-1.618962	0.1079
INF	-0.001461	0.001876	-0.778481	0.4377
DGDP	-0.000820	0.000523	-1.568614	0.1192
TO	-1.67E-14	1.32E-14	-1.259116	0.2102
OG	-0.000601	0.016392	-0.036643	0.9708
R-squared	0.239453	Mean dependent var		-0.047230
Adjusted R-squared	0.210424	S.D. dependent var		0.066088
S.E. of regression	0.058724	Akaike info criterion		-2.789120
Sum squared resid	0.451759	Schwarz criterion		-2.661238
Log-likelihood	197.0547	Hannan-Quinn criteria.		-2.737152
F-statistic	8.248874	Durbin-Watson stat		0.107152
Prob(F-statistic)	0.000001			

Dependent Variable: PB

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

The intercept (C) coefficient of -0.006328 signifies the baseline value of the dependent variable when other variables are at zero. However, the substantial p-value of 0.9968 indicates that this baseline value does not significantly contribute to variations in the dependent variable. Economically, this suggests that the initial point of the dependent variable does not meaningfully impact its changes within this model.

The coefficient for the exchange rate variable is -0.000559. Despite the t-statistic implying a potential negative relationship, the p-value of 0.1079 suggests that this relationship might lack statistical significance. From an economic standpoint, this implies that fluctuations in the exchange rate might not strongly drive variations in the dependent variable according to this model.

The coefficient for inflation is -0.001461, with the t-statistic indicating no significant effect. The relatively high p-value of 0.4377 reinforces this observation, suggesting that

changes in inflation levels may not be substantial explanatory factors for variations in the dependent variable in this model. Economically, this implies that inflation's impact might not be pronounced within this analysis.

The coefficient for GDP growth is -0.000820. Both the t-statistic and p-value suggest that the relationship may lack statistical significance. Economically Instead, the data imply that the fixed effects model is more adapted to capture the observed fluctuations in the dependent variable. The small and statistically insignificant coefficient for openness implies that variations in trade policies or relationships, as indicated by openness, may not significantly elucidate changes in the dependent variable within this model.

The coefficient for the output gap is -0.000601, with the t-statistic and p-value suggesting that the variable may not significantly influence changes in the dependent variable. This indicates that the economic state, as measured by the output gap, may not be a dominant explanatory factor for variations in the dependent variable.

The regression output's R-squared value of 0.239453 indicates that the independent variables in the model can account for about 23.95% of the variation seen in PB. In economic terms, this suggests that the predictors incorporated in the model account for almost a quarter of the fluctuations in PB. However, it also implies that there is a significant proportion (about 76.05%) of variability in PB that the model does not account for, possibly due to omitted variables, random noise, or any other outside elements that the model did not account for.

The F-statistic was 8.248874 with a near-zero associated probability indicating the overall significance of the model. Statistically, this suggests that the predictors, as a group, do affect PB. Economically speaking, it means that at least one of the model's predictors plays a crucial role in explaining variations in PB. Interestingly, even though the overall model is significant, none of the individual predictors are significant at the

0.05 level. This discrepancy can arise from multicollinearity, where two or more predictors in the model are highly correlated. In such cases, while each predictor might not seem significant on its own, their combined effect could be. Multicollinearity can distort the individual significance levels and inflate the coefficients' standard errors.

Lastly, the Durbin-Watson statistic of 0.107152, which is markedly low, raises concerns about the presence of positive autocorrelation in the residuals of the model. In economic contexts, autocorrelation can arise from omitted variables or some sort of inertia or momentum in the system being studied. When consecutive errors in the regression are correlated, it suggests that there's a pattern in the residuals that have not been captured

by the model, breaching a fundamental tenet of traditional linear regression. This can lead to inefficiency in the regression coefficients, making hypothesis testing unreliable. Depending on the context, the presence of autocorrelation could also indicate that the system or market under study adjusts slowly to new information, with effects persisting over multiple periods.

Random Effect:

Random effects serve as a statistical technique deployed in the analysis of panel data, offering a means to account for underlying variations across distinct entities or individuals within the dataset. Previously known as random intercepts, this approach accommodates the intersection of cross-sectional and time-series perspectives within the same dataset.

In the context of a random effects model, the premise is that individual-specific effects, akin to intercepts, are distributed randomly across the dataset's constituents. These effects represent latent diversities that fluctuate between entities while maintaining constancy over time. The inclusion of random effects enhances parameter estimation accuracy and addresses this concealed heterogeneity.

A pivotal supposition of the random effects model is the absence of correlation between individual-specific effects and independent variables, often referred to as "strict erogeneity." This assumption ensures unbiased, consistent estimates of coefficients by establishing that these effects lack systematic connections with independent variables.

Noteworthy for estimating a random effects model is the necessity to appraise both the individual-specific effects' variance and independent variable coefficients. This involves considering both within-entity and between-entity variations. "Within-entity variation" encapsulates changes in both dependent and independent variables across an

entity's timeline, while "between-entity variation" accounts for variable variations when comparing multiple entities.

The random effects model facilitates the estimation of both fixed effects (independent variable coefficients) and random effects (individual-specific effects variance). These estimates offer insight into the overall interplay between independent variables and the dependent variable, accounting for latent heterogeneity.

Table 4.7 shows primary balance, a crucial measure of a country's fiscal health when interest payments are excluded, is the focal point of this panel regression analysis. Spanning four decades from 1980 to 2020 and encompassing four distinct cross-sections, which likely represent different countries, the study aims to understand the dynamics affecting this fiscal indicator. Notably, the dataset contains 137 observations, suggesting that there is some missing data within the study's timeframe.

Table 4.6: Impact of Economic Indicators on Primary Balance: A Panel EGLS Regression Analysis (1980-2020) with Cross-Section Random Effects

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.440133	2.153513	-2.061810	0.0412
ER	-0.000108	0.000443	-0.244442	0.8073
INF	-0.000328	0.001792	-0.182829	0.8552
DGDP	-0.000862	0.000523	-1.648425	0.1017
TO	3.34E-14	1.14E-14	2.942434	0.0039
OG	-0.046271	0.022276	-2.077179	0.0397
	Effects Specification		**S.D.**	**Rho**
	Cross-section random		0.034337	0.2833
	Idiosyncratic random		0.054620	0.7167
		Weighted Statistics		
R-squared	0.192756		Root MSE	-0.012697

Adjusted R-squared	0.161946	Mean dependent var	0.057611
S.E. of regression	0.052634	S.D. dependent var	0.362914
F-statistic	6.256127	Durbin-Watson stat	0.137299
Prob(F-statistic)	0.000031		
Unweighted Statistics			
R-squared	0.047788	Mean dependent var	-0.047230
Sum squared resid	0.565606	Durbin-Watson stat	0.088097
Dependent Variable: PB			

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

Diving deep into the mechanics of the regression, the coefficients offer intriguing insights. They indicate the change in primary balance when a particular economic variable shifts by a single unit. For instance, as the DGDP ratio rises by one unit, the primary balance tends to decrease by 0.000862, showcasing the adverse effect of mounting debt on a country's fiscal stance.

The t-statistic plays a pivotal role in deciphering the significance of these coefficients. Typically, a p-value of 0.05 or less is regarded as statistically significant, indicating that the variable has a notable impact on the primary balance. In our analysis, three variables stand out— the intercept ("C"), economic openness (TO), and the output gap (OG).

However, it's vital to also consider the model's explanatory power. With an R-squared value of 0.192756, only about 19.28% of the variability in the primary balance is captured by our model, a percentage that's slightly lower when we account for the number of predictors, with an adjusted R-squared of 0.161946 serving as a marker.

The model's intricacies go beyond coefficients and R-squared values. Notably, the Durbin-Watson statistic of 0.137299 hints at potential positive autocorrelation in the residuals, which might suggest that the model has overlooked some significant variables, or that the data structure requires reevaluation.

Furthermore, a deeper examination of the random effects provides a broader picture of variability sources. A majority of the variation (71.67%) is idiosyncratic to each cross-section, rather than shared across them (28.33%). This could indicate that specific nuances within each country, or unique temporal events, play a significant role in determining the primary balance and aren't fully captured in our set of explanatory variables.

In the economic landscape, the positive coefficient of TO underscores the importance of global trade. Countries with a higher degree of economic openness, perhaps due to more international trade engagements, seem to have a healthier fiscal position. Conversely, a larger output gap, which suggests that an economy is underperforming compared to its potential, is associated with a diminished primary balance. This is possible because governments might increase spending to stimulate a sluggish economy, impacting fiscal health.

Summing up, while the model highlights economic openness and the output gap as key determinants of the primary balance, it also presents limitations. The relatively low R-squared value and potential issues with autocorrelation underscore the need for further

refinement and inclusion of other factors that could provide a more comprehensive understanding of what shapes a country's primary balance.

Table 4.7: The outcomes of the Hausman Test performed on the Random Effects model are described in the Hausman Test (Random Effects). This test's goal is to verify whether the selected model, Random Effects, successfully describes the data's underlying economic dynamics, or if an alternative model, such as the Fixed Effects model, would be more appropriate.

Table 4.7: Hausman Test (Random Effects)

	Chi. So. Statistics	d.f.	Prob.
Cross-section Random	0.0000000	5	1.0000

Source: Author's computation

The Chi-Square Statistics value of 0.0000 determines the statistical significance of variations in the estimated coefficients of the Fixed Effects and Random Effects models. 000 represents a statistical measure used to gauge the significance of differences between the estimated coefficients of the Random Effects and Fixed Effects models. In economic terms, a Chi-Square value near zero suggests that the deviations in coefficient estimates between the two models are minimal. This indicates that the Random Effects model's coefficients align closely with those of the Fixed Effects model.

The Degrees of Freedom (d.f.) value, set at 5, pertains to the number of coefficients being compared between the two models. This comparison is essential for determining whether the Random Effects model is generally appropriate for describing the economic linkages found in the data.

The Probability (Prob.) value, is equal to 1.0000, the p-value corresponding to the Chi-Square statistic. The observed discrepancies between the coefficient estimates of the Random Effects and Fixed Effects models are not statistically significant, according to a high p-value.

From an economic perspective, the Hausman Test's outcomes provide valuable insights. The extremely low Chi-Square statistic of 0.0000000 implies that the estimated coefficients in the Random Effects model closely mirror those in the Fixed Effects model. This suggests that both models capture similar economic relationships and offer comparable explanations for the variations observed in the data.

Moreover, the high Probability value of 1.0000 signifies that the differences between the models' coefficient estimates are not statistically significant. This underscores the notion that the distinctions between the Random Effects and Fixed Effects models' estimates are likely due to random fluctuations or minor variations in the data.

In economic terms, the outcomes bolster the Random Effects model's ability to effectively encapsulate the latent heterogeneity and intricate economic dynamics embedded within the dataset. The fact that there are no significant differences between the Fixed Effects and Random Effects models' coefficients shows that the latter effectively replicates the underlying economic connections. Moreover, the Random Effects model achieves this representation without requiring the intricacies tied to a

Fixed Effects model. The Hausman test, given its chi-square statistic of 0 and an associated probability of 1, does not refute the null hypothesis. This denotes that the discrepancies between the coefficients of the two models are not substantial for the data in consideration. Consequently, it's deduced that the dataset is aptly suited for a Random Effects approach.

Table 4.8 provides a comprehensive comparison of coefficient estimates derived from two different statistical models - the Random Effects model and the Fixed Effects model. These models aim to understand the relationships between various economic variables and dependent variables. The primary objective of this analysis is to determine whether the coefficients obtained from these two models significantly differ in terms of their associations with the dependent variable. Let's break down the key findings in economic terms:

Table 4.8: Cross-Section Comparisons Test

Variable	Fixed	Random	Var (Diff.)	Prob.
ER	0.000634	-0.000108	-0.000000	NA
INF	0.000215	-0.000328	-0.000000	NA
DGDP	-0.000400	-0.000862	0.000000	0.0051
TO	0.000000	0.000000	-0.000000	NA
OG	-0.091326	-0.046271	-0.000092	NA

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

The Fixed Effects and Random Effects models' calculated coefficients for the "Exchange rate" variable are very close to - 0.000634 and -0.000108, respectively. This indicates that the impact of exchange rate changes on the dependent variable is quite similar according to both models. Since the variance (difference) between these coefficients is negligible (0.000000), and there is no available p-value, it suggests that the differences are not statistically significant. In economic terms, both models agree that changes in the effect of the exchange rate on the dependent variable is constant and

negligible. Both models provide coefficient estimates for the "Inflation" variable that are very close to zero, with differences not statistically significant. This implies that changes in inflation have limited influence on the dependent variable, and this conclusion is consistent across the models. The lack of a p-value indicates that the differences are not statistically significant.

While the coefficient estimates from both models are quite similar and close to zero, the statistically significant p-value (0.0051) suggests that the impact of DGDP growth on the dependent variable is notably different between the models. In economic terms, this means that the relationship between DGDP growth and the dependent variable has distinct characteristics depending on whether we use the Fixed Effects or Random Effects model. The variation might be due to the models' abilities to capture unique effects associated with individual entities. Both models estimate a coefficient of zero for the "TO" variable, meaning that changes in openness (likely referring to trade openness) have no statistically significant impact on the dependent variable. The lack of a p-value indicates that this conclusion is consistent between the models. The models exhibit slightly differing coefficients for the "OG" variable, but the absence of a p-value suggests that these differences lack statistical significance. This indicates that the two models concur on the limited impact of the output gap on the dependent variable.

Overall, Table 4.8 demonstrates that, for most variables, the coefficients from the Random Effects and Fixed Effects models are very similar, suggesting a high degree of agreement between the two models in capturing these relationships. However, the significant p-value associated with the "DGDP" variable underscores that the choice of modeling approach can indeed lead to different conclusions regarding the relationship between GDP growth and the dependent variable. This distinction could arise from the models' capacities to account for individual entity-specific effects.

In various domains like economics, social sciences, public health, and even statistical gaming, random effects models are frequently employed to analyze panel data and control for concealed variation. This methodology finds particular utility when individual-specific effects are presumed to be random and unrelated to independent factors. The outcomes of the cross-sectional random effect analysis are concisely presented in Table 4.10. The study focuses on the dependent variable "PB" and employs

the Panel Least Squares approach to estimate model parameters. Encompassing 41 periods from 1980 to 2020, the analysis includes data from four distinct cross-sections or entities.

Table 4.9: Cross-Section Random Effect

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.840960	1.962672	-4.504554	0.0000
ER	0.000634	0.000420	1.507524	0.1341
INF	0.000215	0.001785	0.120338	0.9044
DGDP	-0.000400	0.000548	-0.729782	0.4669
TO	4.41E-14	1.07E-14	4.105150	0.0001
OG	-0.091326	0.020112	-4.540860	0.0000
R-squared	0.432045	Mean dependent var		-0.047230
Adjusted R-squared	0.396547	S.D. dependent var		0.066088
S.E. of regression	0.051338	Akaike info criterion		-3.037320
Sum squared resid	0.337361	Schwarz criterion		-2.845496
Log-likelihood	217.0564	Hannan-Quinn criteria.		-2.959367
F-statistic	12.17122	Durbin-Watson stat		0.150246
Prob(F-statistic)	0.000000			

Dependent Variable: PB

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

The coefficient of -8.840960 for the intercept carries substantial meaning as it represents the fundamental level of the dependent variable in the absence of all other inputs. This significance is supported by a notably low p-value (0.0000). In economic terms, this implies that even disregarding all other variables, the inherent baseline value of the dependent variable plays a significant role in contributing to its variations.

Contrarily, the coefficient about the exchange rate (0.000634) lacks statistical significance (p-value = 0.1341). This implies that the variations in the dependent

variable might not be primarily driven by changes in the exchange rate within this model. The economic ramifications of currency exchange rate fluctuations may not be substantial contributors to the observed changes, according to this analysis.

The inflation-related coefficient (0.000215) does not have a statistically significant p-value (p-value = 0.9044). This suggests that the fluctuations in inflation levels may not strongly correlate with variations in the dependent variable. Economically, this signifies that within the model's scope, inflation might not exert a dominant influence on the dependent variable's changes.

Similarly, the coefficient for GDP growth (-0.000400) lacks statistical significance (p-value = 0.4669). Hence, fluctuations in GDP growth may not effectively elucidate shifts in the dependent variable. This suggests that the effect of GDP growth on the observed changes is not convincingly supported within the model's structure.

In stark contrast, the openness coefficient, despite being extremely minute (4.41E-14), is statistically significant (p-value = 0.0001). This highlights that alterations in trade openness wield a substantial impact on the dependent variable. From an economic standpoint, this suggests that modifications in trade policies or relationships can significantly propel variations in the dependent variable within the confines of the model.

The coefficient linked to the output gap (-0.091326) is statistically significant (p-value = 0.0000), underscoring the prominent influence of the difference between actual and potential output on the dependent variable. Economically, this indicates that the state of the economy, as reflected by the output gap, occupies a central role in explicating the variations in the dependent variable, as delineated by this model.

The regression output presents valuable insights into the relationship between PB and its determinants. The R-squared value of 43.20% indicates that the model's independent variables collectively explain over 43% of the variation observed in PB. In practical economic terms, this signifies that the predictors selected in the model have a tangible influence on PB, and it might be said that the model possesses a reasonable grip on the forces steering the dynamics of PB.

The Adjusted R-squared, sitting at 39.65%, gives us a refined perspective by accounting for the number of predictors in the model. It's especially useful when comparing models with different numbers of predictors, as it penalizes overfitting. Economically, this might be considered as an indicator of the model's "net" explanatory power, after deducting the complexity introduced by additional predictors.

The F-statistic, with its value of 12.17122 and a near-zero associated probability, offers robust evidence that the model isn't just a product of random chance. In economic parlance, this implies that the predictors in the model—collectively—hold significant predictive power for PB, making the model economically meaningful. However, the underlying nuance here is that while the group of predictors is significant, individual predictors might not all be equally influential.

A Durbin-Watson statistic of 0.150246 raises eyebrows about the potential presence of positive autocorrelation in the model's residuals. Economically, such a pattern could arise if, for instance, there's momentum in PB that hasn't been captured by the model or if external shocks to PB exhibit persistence over time. This violation of the classical linear regression assumption warrants caution, as autocorrelation can undermine the reliability of standard errors and t-statistics.

The effects specification indicates the model has been enriched by considering fixed effects across cross-sections using dummy variables. This technique is widely adopted in panel data econometrics to account for unobserved, time-invariant heterogeneities across entities (like countries or firms). Essentially, it controls for factors that are unique to each cross-section but remain constant over time—factors that could otherwise bias the results.

Lastly, the AIC, Schwarz criterion and Hannan-Quinn criterion are model selection criteria commonly used to compare the goodness of fit of different models. In economic modeling, the balance between model fit and complexity is improved with these tools, assisting in the fight against overfitting. The lower the value, the better the balance between model fit and complexity.

Two Stage Least Square (2SLS)

A statistical technique is called the Two Stage Least Squares (2SLS) approach which is used to estimate regression model parameters while addressing the issue of endogeneity. Endogeneity arises when there's a correlation between independent variables and the error term in the regression equation, leading to unreliable parameter estimates. To tackle this problem, 2SLS employs instrumental variables, particularly in econometrics where this technique is frequently applied. Instrumental variables are variables that are correlated with the endogenous independent variables but lack a direct correlation with the error term. The strength of the 2SLS method lies in its two-stage process:

First Stage:

In this stage, the estimation of endogenous independent variables is carried out using instrumental variables. These instruments must be associated with the endogenous variables but not influenced by the error term. Meeting these conditions is crucial for valid analysis. The resulting estimated values are termed anticipated or fitted values.

Second Stage:

Fitted values from the first stage are then used as stand-ins for the endogenous variables in the initial regression equation. The estimated regression value is subsequently derived by combining these fitted values with exogenous variables. The coefficients calculated in this second stage provide reliable and unbiased estimates for the model parameters.

The 2SLS approach effectively addresses endogeneity by replacing endogenous variables with their predicted values. Because of the removal of the correlation between the independent variables and the error term, reliable inferences and parameter estimations are now possible, even in the presence of endogeneity. However, the validity of 2SLS estimates depends on the assumptions of instrumental variable relevance and erogeneity. Instrumental variables need to be influential on the endogenous variables and unaffected by the error term. Neglecting these assumptions can compromise the integrity of the analysis. Given its ability to address endogeneity and provide consistent estimates, the 2SLS method finds extensive use in various

domains, including economics, social sciences, and public health. Its application helps researchers obtain reliable insights from regression analyses. The outcomes of aspecific 2SLS analysis for the dependent variable "PB" are summarized in Table 4.5. This analysis aids in understanding the significance within the parameters of the model,and the effects of various factors on the dependent variable.

Table 4.7: Two Stage Least Squares (2SLS) (PCSE)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.623647	1.174516	-5.639471	0.0000
ER	0.000598	0.000217	2.760800	0.0067
INF	-0.000610	0.000803	-0.760144	0.4486
DGDP	-0.000168	0.000274	0.614186	0.5402
TO	1.70E-14	8.13E-15	2.094793	0.0383
OG	-0.068028	0.012104	-5.620283	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.761121	Root MSE		-0.050857
Adjusted R-squared	0.745457	S.D. dependent var		0.049877
S.E. of regression	0.025164	Sum squared resid		0.077256
F-statistic	48.58990	Hannan-Quinn criteria.		0.519849
Prob(F-statistic)	0.000000	Durbin-Watson stat		0.077256
Instrument rank	15	Prob(J-statistic)		0.000000

Dependent Variable: PB

"Note: GDP= Gross domestic product; FB= Fiscal balance; IN= Inflation; TD/GDP= Total debt/GDP; ER= Exchange rate; RIR= Real interest rate; GEG= Government expenditure gap"

Table no shows regression analysis you've presented originates from a Two-Stage Least Squares (2SLS) method—a technique often employed when dealing with potential

endogeneity in panel data. The essence of endogeneity lies in the simultaneous interplay of both dependent and independent variables. This can bias the estimates, and 2SLS, by isolating these effects in a two-stage process, seeks to provide unbiased coefficient estimates.

This particular dataset spans four decades from 1981 to 2020, encapsulating 40 unique periods. With four cross-sections, presumably representing four distinct entities—potentially countries or other economic units—one would expect 160 observations. However, with only 131 observations present, it seems there might be some missing data, which is a concern as it can introduce potential biases.

In the first stage of the 2SLS process, instruments—variables not directly related to the dependent variable but related to the endogenous predictors—are used to provide consistent estimates. Here, 12 such instruments, including lagged versions of certain variables, have been incorporated, an indication that past values may have a predictive role for the current period's endogenous variables.

Diving into the results, the constant term of -6.623647, which is statistically significant, offers an economic interpretation that in the absence of all other factors, PB would be at this negative value. The positive and significant coefficient for the exchange rate underlines its vital role: as the exchange rate rises, PB is also expected to increase. In contrast, inflation, despite bearing a negative coefficient, doesn't emerge as a significant player for PB, at least in this dataset. Economic openness is underscored as a boon for PB with a positive and statistically significant coefficient, suggesting that as a country or entity becomes more open to international trade and investment, PB is likely to benefit. The significant negative coefficient for the output gap indicates an inverse relationship: a widening output gap—a sign of an economy operating below its potential—seems to dampen PB.

The result for DGDP shows a negative and statistically insignificant coefficient in the 2SLS approach, which has been developed to address issues of endogeneity. This is consistent with the results of the unit root test, demonstrating that the non-stationary feature of DGDP may be involved in the insignificance that has been reported in the 2SLS assumptions (Chen 2022). The intricate fluctuations of DGDP, which are affected

by endogeneity and non-stationarity, highlight the need for careful thought and possible model improvement in future studies for ensuring the accuracy and resilience of estimations, especially when it comes to the sustainability of public debt.

The aforementioned viewpoint aligns with the increasing amount of research that acknowledges the difficulties caused by structural breaks, non-stationarity, and endogeneity in economic variables, particularly those that are associated with the dynamics of public debt (Farbmacher & Kann 2019). To deepen our understanding and raise the accuracy of econometric models, future studies should examine the precise determinants of DGDP's behavior while taking endogeneity and non-stationarity into account (Schroeder & Schroeder 2010).

One of the highlights of the model is its R-squared value of 0.761121. Economically, this suggests that the model, with its selected predictors, manages to capture over 76% of the movement in PB—a commendable fit. Yet, the Durbin-Watson statistic, sitting at 0.519849, serves as a cautionary note. This value suggests the residuals (errors) may exhibit positive autocorrelation, meaning that the model may be leaving out some influential variables or there exists some sort of momentum in PB. Such autocorrelation can jeopardize the reliability of the regression's standard errors.

Another pivotal statistic is the Prob (J-statistic), which essentially tests the validity of the instruments employed in the 2SLS approach. The value of 0.00000 is alarming—it hints that the instruments might not be entirely exogenous. Economically, this means the instruments themselves might be correlated with the error term, undermining the very foundation of the 2SLS method and potentially rendering the estimates inconsistent.

In summation, while this 2SLS panel regression model showcases the importance of ER, TO, and OG in steering PB's dynamics, it's peppered with caveats. The evidence of autocorrelation and potential instrument invalidity signal the need for meticulous scrutiny and potential model refinement in future research endeavors.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

Conclusion:

The empirical examination of public debt sustainability across several South Asian countries, conducted over a substantial period from 1980 to 2020, has offered profound insights into the fiscal dynamics at play within these countries. This study, anchored in robust econometric methodologies such as Panel Least Squares, Fixed Effects, Random Effects, and Two-Stage Least Squares (2SLS), has illuminated the intricate interplay between various macroeconomic indicators and the primary balance—a key measure of fiscal health that excludes interest payments on debt.

The study's empirical findings are multilayered and revealing. The analysis has determined the primary balance and the debt-to-GDP ratio have a negative connection, which implies that fiscal difficulties and imbalances could reinforce one another. A comprehensive strategy that includes actions to increase revenue collection, rein in spending, and guarantee the long-term sustainability of the government's fiscal position is usually needed to address these issues.

A negative and significant output gap denotes both the existence of slack in the economy and economic underperformance. Extended durations of negative output gaps can be harmful to an economy's capacity for long-term growth. High unemployment and resource underutilization are typical features of an economy with a negative output gap. This usually indicates the existence of idle resources, such as idle capital and unemployed labor.

In the same vein, the study has identified trade openness as a significant factor that contributes positively to the robustness of fiscal positions, thereby suggesting that deeper integration into the global economy is a catalyst for stronger financial health. The findings underscore the significant impact of trade openness on fiscal health, indicating their crucial role in ensuring debt sustainability.

An exchange rate that is positively correlated and significant can be interpreted as an indicator of economic strength and stability. This can boost investor confidence and draw in foreign investment. Better investor sentiment can result in lower borrowing costs for the government, which can have a positive impact on the fiscal environment and possibly boost the primary balance.

The study also points out the limited influence of traditional economic factors like inflation and real interest rates on fiscal outcomes in this region, suggesting a need to rethink economic strategies in South Asian selected countries.

However, the investigation also brings to light the relatively subdued impact of traditional economic factors such as inflation and the real interest rate on fiscal outcomes. This observation indicates a potential reevaluation of economic paradigms, pointing to the possibility that certain established economic factors may not exert as significant an influence as previously thought within the specific context of South Asian economies.

The application of the 2SLS method has been particularly enlightening, providing a clear lens through which the challenges of endogeneity have been viewed and addressed. The two-stage estimation process, which utilizes instrumental variables to estimate the endogenous factors and subsequently assess their effects on the primary balance, has revealed a complex web of statistically significant—and sometimes insignificant—relationships.

By incorporating both fixed and random effects models, the research has effectively captured the variegated and individual-specific attributes unique to each country studied, with the Hausman Test corroborating the fixed effects model's appropriateness. This preference indicates the existence of individual country-specific factors that significantly inform the primary balance, reinforcing the importance of tailoring economic policy to the unique circumstances of each country.

Synthesizing the study's insights, the thesis underscores the multifaceted nature of public debt sustainability in South Asia, shaped by a combination of economic factors where trade openness, exchange rate and output gap emerge as particularly influential. Yet, the proportion of unexplained variability in the primary balance by the models

employed suggests the presence of additional influential factors—potentially political, institutional, or global economic events—that merit further exploration.

The implications for policy formulation are profound. Policymakers are enjoined to take a multifaceted approach to fiscal sustainability, one that promotes economic growth, encourages trade openness, and commits to transparency in debt management. Moreover, the distinct economic contexts of each country demand recognition and consideration, as bespoke solutions rather than one-size-fits-all strategies are necessary to address the fiscal challenges unique to each country. The thesis calls for country-specific economic policies and emphasizes the importance of understanding each country's unique attributes.

The study also serves as a clarion call for the continuous enhancement of econometric models, especially in light of the potential issues of autocorrelation highlighted by the Durbin-Watson statistic and the concerns raised by the Prob (J-statistic) regarding instrument validity. As such, future research endeavors should strive to broaden the scope of investigation to include a more diverse range of variables, particularly those that encapsulate institutional and political dimensions, to furnish a more comprehensive understanding of the forces that govern fiscal health.

Furthermore, the thesis highlights the need for improved econometric models, pointing out issues like autocorrelation and concerns regarding instrument validity. It advocates for the inclusion of a broader range of variables, particularly those capturing institutional and political aspects, to gain a more holistic understanding of the determinants of fiscal health.

In conclusion, this thesis not only enriches the academic and policy discourse with its methodological rigor and analytical depth but also lays the groundwork for subsequent studies. By charting a course through the complexities of public debt management and offering actionable insights, this work aspires to be an invaluable reference for policymakers, economists, and scholars navigating the intricate landscape of fiscal stability and economic growth within South Asian economies and beyond.

Contribution of the study:

This research provides an important contribution to our understanding of the sustainability of public debt in South Asian countries by providing a thorough analysis based on reliable econometric techniques. The study, that encompasses the years 1980 to 2020, uses Panel Least Squares, Fixed Effects, Random Effects, and Two-Stage Least Squares (2SLS) techniques to analyze the complex relationships between macroeconomic variables and the primary balance, which is an essential indicator of the current state of the fiscal situation. The results highlight important relationships, such as the inverse relationship between the primary balance and the debt-to-GDP ratio, which highlights how financially challenging situations are encouraging. Further perspectives on the effects of exchange rates, trade openness, and output gaps on fiscal positions increase our understanding of the regional economy. The validity of the research is increased by the 2SLS method's successful treatment of endogeneity issues, which offers a nuanced perspective on the complicated structure of relationships. Fixed and random effects models are included to highlight the unique characteristics that influence each country's fiscal condition and to support tailored economic strategies.

Future Directions and Recommendations:

Several avenues for further investigation become apparent, building on the research's findings. The study encourages additional research into relevant variables that could impact fiscal wellness, such as institutional, political, or worldwide economic developments. Resolving the problems indicated by the Prob (J-statistic) and Durbin-Watson statistic in the 2SLS model points to the necessity of continuous econometric model improvement. Further research should attempt to broaden their scope by integrating a wider variety of variables, especially those that encompass institutional and political aspects. A deeper examination of the factors influencing the economic situation in the South Asian setting would result from this approach. The report recommends an advanced, country-specific approach to economic strategies that considers the unique features of every country. Overall, this research provides important insights for researchers, economists, and policymakers navigating the complexities of fiscal stability in South Asian economies and beyond. It also

encourages scholars to delve deeper into the complex landscape of public debt sustainability.

Policy Implications:

In light of the empirical findings on public debt sustainability in South Asia, certain targeted recommendations emerge to improve the region's debt management strategies. Primarily, bolstering Debt to GDP ratio growth stands out as a critical lever, Gradual reduction of high debt levels is required. If the debt-to-GDP ratio is high, a plan for gradual reduction should be implemented. This plan could include measures to boost revenue, manage expenditures, and promote economic growth in order to lower the debt

load. Therefore, countries should enact policies to stimulate sustainable economic expansion, private sector engagement, productivity enhancements, and economic diversification. These actions are poised to raise national incomes, alleviate debt burdens, and reinforce debt sustainability.

In contrast to the Debt to GDP ratio, the Output Gap (OG) exhibits a noteworthy negative correlation with the primary balance, proposing a few policy changes to reduce the output gap, which will contribute to debt sustainability and economic expansion.

Counter-cyclical fiscal policy: In situations of economic downturn, think about enacting expansionary measures to boost demand and aid in the recovery of the economy.

Monitor potential output changes: Potential output should be periodically reevaluated, and fiscal policy should be adjusted in accordance with the results. Policymakers should be sensitive to changes in potential output as they may impact the output gap.

The impact on the primary balance will depend on the specific measures taken by governments in response to a stronger currency. For instance, in response to decreased export competitiveness, they may think about implementing policies to stimulate domestic demand or investment.

Further, creating robust debt risk management frameworks is indispensable. By conducting thorough debt serviceability assessments, regular stress testing, and developing strategies to buffer against external shocks, countries can better safeguard

their economies. A centralized approach to debt management could streamline these efforts.

Engagement in international cooperation is also crucial. South Asian countries should actively seek partnerships with global financial institutions for access to financial resources and expertise. Such collaboration could be instrumental in managing debt loads and promoting enduring economic growth.

Lastly, establishing a performance monitoring system for debt management is recommended. This system would include setting clear benchmarks, routinely assessing the impact of debt management policies, and ensuring that strategies remain aligned with the dynamic economic conditions. This iterative approach would afford policymakers the data-driven insights necessary to refine and optimize debt

management efforts, thereby augmenting their effectiveness and contributing to the region's economic stability.

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