AN ASSESSMENT OF THE HEALTHCARE EXPENDITURE AND HEALTH OUTCOMES IN NEPAL

A Dissertation Submitted to:

Faculty of Humanities and Social Sciences

of Tribhuvan University, Kirtipur, Kathmandu

in Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

in

Economics

Submitted by:

Khem Raj Subedi

TU Regd. No.: 59276/88

PhD Roll No.: 13/2017

Faculty of Humanities and Social Sciences

Tribhuvan University, Kirtipur

Kathmandu, Nepal

January 2026

DECLARATION

I hereby declare that the dissertationentitled **An Assessment of the Healthcare Expenditure and Health Outcomes in Nepal** is my original work under the supervision of Prof. Shiva Raj Adhikari, PhD and Prof. Ram Khelawan Shah, PhD. The dissertation has not been submitted for any other degree or professional qualification. I confirm that appropriate credit has been given within this dissertation where references have been made to the work of others.

……………………..

Khem Raj Subedi
PhD Roll No.: 13/2017
TU Regd. No.: 59276/88
Faculty of Humanities and Social Sciences
Office of Dean,
Tribhuvan University, Nepal

LETTER OF RECOMMENDATION

We certify that the dissertation submitted by Mr. Khem Raj Subedi entitled **An Assessment of the Healthcare Expenditure and Health Outcomes in Nepal** has been prepared as per the format prescribed and approved by the Faculty of Humanities and Social Sciences, Tribhuvan University. He completed his research for the degree of PhD under our supervision and guidance. This is his original research work. We are fully satisfied with the languages and substances of this dissertation. We hereby recommend this dissertation for final examination by the Research Committee of the Faculty of Humanities and Social Sciences, Tribhuvan University, fulfilling the requirements for Doctor of Philosophy in Economics.

Date:

Tribhuvan University

Faculty of Humanities and Social Sciences

Office of the Dean

Kirtipur, Kathmandu, Nepal

APPROVAL LETTER

This dissertation entitled **An Assessment of the Healthcare Expenditure and Health Outcomes in Nepal**was submitted by Mr. Khem Raj Subedi to the Faculty of Humanities and Social Sciences, Tribhuvan University, Kirtipur, Kathmandu, in fulfilment of the requirements for the degree of Doctor of Philosophy (PhD) in Economics, has been evaluated and approved.On the recommendation of the Research Committee, and in accordance with the rules and regulations of the Faculty of Humanities and Social Sciences, Tribhuvan University, approval is hereby granted for the award of the degree of Doctor of Philosophy in Economics to Mr. Khem Raj Subedi.

……………………………………

Associate Professor, Bam Dev Adhikari, PhD

Acting Dean and Chairperson

Research Committee

Date:

ACKNOWLEDGEMENTS

The dissertation entitled **An Assessment of the Healthcare Expenditure and Health Outcomes in Nepal** has been completed with the sustained and unwavering support of various academic dignitaries and individuals to whom I am indebted. First and foremost, I extend my profound gratitude to my supervisor, Prof. Dr. Shiva Raj Adhikari, Central Department of Economics, whose valuable suggestions, continued inspiration and feedback, patience, and mentorship have been the lighthouse that has guided me through to complete this dissertation. His unwavering belief in my abilities and insightful guidance has been instrumental in shaping my intellectual growth and nurturing my passion for scientific inquiry. My profound gratitude also goes to my co-supervisor Prof. Dr. Ram Khelawan Shah for his efforts and encouragement during my study period. Similarly, I express my sincere gratitude to Prof. Dr. Dubi Nanda Dhakal, Dean, Dr. Bam Dev Adhikari, Acting Dean of the Faculty of Humanities and Social Sciences, and Dr. Khom Raj Kharel, Assistant Dean of the Faculty of Humanities and Social Sciences, Tribhuvan University. I am also deeply grateful to Prof. Dr. Ram Prasad Gyawali, Prof. Dr. Tara Prasad Bhusal, Dr. Ramesh Chandra Paudel, and Dr. Resham Bahadur Thapa of the Central Department of Economics, Tribhuvan University, for theirconstructive feedback and academic support.I would like to acknowledge Dr. Hem Lal Pandey, Central Department of English, TribhuvanUniversity for his valuable time and meticulous effort in the language editing. This endeavor has also been made possible by the generous moral support of former campus chief Dr. Keshar Bahadur Kunwar, Tikapur Multiple Campus. I am also grateful to the entire team of the then Campus Management Committee of Tikapur Multiple Campus for their moral, and managerial supportto dedicate myself fully to my research.I also thank my friends and coworkers atTikapur Multiple Campus and attached in the professional life for their support and encouragement to go through the journey of PhD study journey.

I am deeply obliged to my late father Devi Prasad Subedi for his inspiration at the very beginning of my higher education. I also owe my mother Tikamaya Subedi for her love and encouragement in completing this dissertation. I would like to thank my beloved wife Ms. Shanta Subedi, for her constant help and support in completing this dissertation. I am equally thankful to my youngest brother Jhalak Raj Subedi for his timely encouragement to complete the doctoral study journey. Likewise, I thank my beloved sons Aayushman Subedi and Aayaam Subedi for bearing and enduring pain during my absence on account of this doctoral degree study.

Finally, I extend my sincere thanks to all those friend, family members and colleagues who have contributed to my journey, even if not named here. As I reach this milestone, I'm humbled to recognize that this achievement is a tapestry woven by many. I'm deeply grateful for their support, without which this path would have been far more challenging.

Khem Raj Subedi

PhD Roll No.: 13/2017

TU Regd. No.: 59276/88

ABSTRACT

Healthcare expenditure optimization is essential for improving access to quality healthcare services for the general population. It requires strengthening and optimizing government healthcare financing and reducing the high burden of out-of-pocket (OOP) payment faced by households. This dissertation assesses the government health expenditure and health outcomes of Nepal.

This dissertation has three objectives. First, to identify the factors associated with the per capita government health expenditure in Nepal. Second, to examine the macroeconomic factors influencing out-of-pocket (OOP) payments for healthcare in Nepal. Third, to evaluate the extent to which macroeconomic, socio-demographic, and institutional factors influence variations in population health outcomes, particularly life expectancy and infant mortality in Nepal. The study uses annual longitudinal data covering the data from 1994 to 2022 focusing on the research questions and objectives. The study employs ARDL framework of analysis to estimate both the short-run dynamics and the long-run causal relationship focusing objectives of the dissertation.Likewise, the dissertation uses the 2SLS model to analyze the relationship between health outcomes with selected macroeconomic, government health expenditure, demographic, social, and institutional variables.

The findings indicate that GDP per capita, population health-seeking behavior measured by OPD visit frequency, and health human resource density are key drivers of government health expenditure. Aggregate government health expenditure grows faster than the GDP growth, indicating rising income elasticity. Government health expenditure is significantly driven by government sector health workforce density and OPD healthcare service utilization, underscoring the role of service demand and system capacity. Moreover, institutional and policy reforms also exert a substantial influence on health financing. Likewise, OOP payments for health are significantly influenced by GDP per capita, remittance inflow, and inflation rate, while unemployment shows no persistent long-run effect except during specific shocks periods.

The findings also indicate that GDP per capita increases life expectancy at birth, but the negative squared income term indicates diminishing returns, suggesting a

threshold effect. The positive interaction between per capita health workforce density highlights the importance of efficient resource deployment for increasing life expectancy. In addition, rising life expectancy at birth is associated with falling fertility rates, indicating theoretically consistent outcomes. This implies improved efficiency in the production of health, reflecting long-term structural and institutional progress rather than short-term demographic coincidence. Finally, the per capita GDP growth significantly lowers infant mortality rate, indicating that economic growth can lead to improvement in nutrition intake, and sanitation, followed by better healthcare delivery which collectively contribute to infant survival rates. Though the squared GDP term has positive relation with infant mortality, implying diminishing marginal benefits of income growth on infant survival at higher income level. Result also shows that increase in life expectancy is associated with fall in infant mortality. Fertility rate and mean years of schooling is also negatively associated with infant mortality rate. The interaction term of per capita government health expenditure and health workforce density also shows a threshold effect, indicating that higher expenditure becomes effective only after a threshold.

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ACRONYMS AND ABBREVIATIONS

ADF	:	Augmented Dickey Fuller Test
AIC	:	Akaike Information Criteria
AIDS	:	Acquired Immune Deficiency Virus
ANM	:	Assistant Nurse Mid-wife
ARDL	:	Autoregressive Distributive Lag Model
ASEAN	:	Association of South East Asian Nations
CF	:	Capital Formation
CBHI	:	Community Based Health Insurance
CHE	:	Current Health Expenditure
CMR	:	Child Mortality Rate
DALYs	:	Disability Adjusted Life Years
DoHS	:	Department of Health Service
EBA	:	External Bound Analysis
EC	:	European Commission
EU	:	European Union
FMoHP	:	Federal Ministry of Health and Population
FY	:	Fiscal Year
GDP	:	Gross Domestic Product
GDPpc	:	Gross Domestic Product Per Capita
GGE	:	General Government Expenditure
GGHE-D	:	Domestic General Health Expenditure
GNIpc	:	Gross National Income Per Capita
GoN	:	Government of Nepal
HA	:	Health Assistant
HCE	:	Health Care Expenditure
HDI	:	Human Development Index
HFS	:	Healthcare Financing Strategy
HIV	:	Human Immune Virus
HK	:	Health Capital Formation

HR	:	Health Human Resource Density
IMR	:	Infant Mortality Rate
LDCs	:	Least-developed Countries
LEB	:	Life Expectancy at Birth
LGs	:	Local Governments
LICs	:	Low Income countries
MDGs	:	Millennium Development Goals
MoF	:	Ministry of Finance
MoHP	:	Ministry of Health and Population
NNHA	:	Nepal National Health Account
NPR	:	Nepali Rupees
NRB	:	Nepal Rastra Bank
ODA	:	Overseas Development Assistant
OECD	:	Organization of Economic Cooperation and Development
OOP	:	Out-of-Pocket
PCHE	:	Per Capita Government Health Expenditure
PGs	:	Provincial Governments
PHCC	:	Primary Health Care Centre
PHI	:	Private Health Insurance
PHCORC	:	Primary Health Care Out Reach Centre
PPP	:	Purchasing Power Parity
QALYs	:	Quality Adjusted Life Years
SAR	:	South Asian Region
SD	:	Standard Deviation
SAARC	:	South Asian Association for Regional Cooperation
SDGs	:	Sustainable Development Goals
SES	:	Socio-Economic Section
SHI	:	Social Health Insurance
SLTHP	:	Second Long-Term Health Plan

TCHE	:	Total Current Healthcare Expenditure
THE	:	Total Healthcare Expenditure
UHC	:	Universal Healthcare Coverage
UNDP	:	United Nations Development Programme
USD	:	United States Dollar
WH	:	World Bank
WHO	:	World Health Organization
2SLS	:	Two-Stage Least Square

CHAPTER I
INTRODUCTION

1.1 Background of the Study

Healthcare expenditure and population health outcomes are pivotal indicators of a nation’s socio-economic progress and overall development. Within this broader framework, Nepal’s economic vulnerability, limited resource mobilization, and stark economic disparities require a clear understanding of the factors that drive government and private health expenditure and health outcomes to inform effective policymaking. Against this backdrop, this dissertation examines macroeconomic, institutional, and demographic factors associated with the government healthcare expenditure and out-of-pocket (OOP) healthcare payments. In addition, it also assesses the socio-economic and demographic factors associated with the population health outcome metrics particularly longevity and status of infant death.

The causal relationship between the government health expenditure and improvement in population health outcome is overwhelmingly acknowledged in both theoretical and empirical literature, with government healthcare expenditure identified as a key determinant of quality of life and broader economic performance (Rahman et al., 2018; Karimi & Brazier, 2016). Healthcare expenditure constitutes to a vital investment in a nation’s human capital, exerting a long-term profound influence on the health well-being, health status, and productivity of its workforce (Llena-Nozal et al., 2019; Roy et al., 2018). Government provision of healthcare serves not merely as a social service but as a foundational pillar for national development that contribute to enhanced human development indices, improved population health status, and sustained socio-economic advancement (Ranjbari et al., 2021; WHO, 2019).

Adequate allocation of resources and their optimal utilization to the health sector enables countries to pursue dual objectives. First, it reduces the disease burden and increases the stock of a healthier, more capable, and productive workforce, which is essential for economic growth. Second, it stimulates economic performance directly by increasing labor market participation and indirectly, through long-term gains in human capital formation (Raghupati & Raghupati, 2020; Magnusson, 2009). However, understanding the healthcare expenditure and health outcomes are complex and multidimensional, shaped by a confluence of economic conditions, social structures, institutional capacities, and demographic profiles. Therefore, a better understanding of these determinants is crucial for formulating effective health policies and improving health outcomes. In other words, Nepal's resource constraints require a comprehensive understanding of these factors for effective health policies and investment for evidence-based health sector planning and financing.

Substantial resource allocation for public healthcare leads to improved health outcomes of a country (Bein, 2020). Moreover, increased income of the people leads to better health, which in turn contributes to a healthier workforce, which is crucial for increased productivity in the labor force (Raghupati & Raghupati, 2020). The improvement in population health outcomes is an essential condition for preparing productive labor forces (Alhassan et al., 2021; Benach et al., 2014). Therefore, within the realm of health economics, healthcare expenditure and the impact that it has to the economic performance are important considerations in the economy of the country (Wei et al., 2022; Abbas, 2010).

Nepal, being a resource-stricken country, faces significant challenges in allocating adequate resources to the healthcare sector (Mannava et al., 2015).The country continues to grapple with various obstacles, such as inadequate healthcare infrastructure, geographical and socio-economic disparities, and insufficient healthcare financing (Adhikari et al., 2022; Sapakota et al., 2021). In this context, Nepal's health expenditure share of GDP is 2.4 percent but the higher proportion of it is caused by the OOP payments for healthcare (Ministry of Health & Population, 2022). Moreover, existing evidence indicates that Nepal's healthcare financing system remains heavily reliant on OOP payment for healthcare, which account for more than 57per cent of total healthcare expenditure (WHO, 2019).

Public health expenditure is essential for better health outcomes, longevity, reduced mortality rates, and improved quality of life (Guzel et al., 2021; Rahman et al., 2018). Intuitively, sustained availability of public financial resources within the healthcare sector underpins the capacity of the health system to achieve improved performance of healthcare system followed by the better health outcome (Onofrei et al., 2021) which is comparatively low in Nepal. In a nutshell, better health outcome is a result of a better healthcare system maintained by the government of a country (Kruk et al., 2018). Therefore, government healthcare financing is a major challenge in low-income countries like Nepal for achieving Universal Health Coverage (UHC) (Behera

& Dash, 2019). In other words, healthcare expenditure optimization has become a crucial matter to ensure people's health improvement (Turner et al., 2021).

The improvement of population health outcomes is a significant priority for every single government globally, owing to its influence on workforce effectiveness, productivity, and overall quality of life of people (Wu et al., 2021). Therefore, theresource optimization to the public healthcare sector and their efficient utilization are essential for preparing and achieving better health outcomes (WHO, 2019). Insufficient public healthcare delivery increase reliance on OOP payments for healthcare, thereby intensifying the risk of financial hardship low-income households (Sirag & Mohamed, 2021). Moreover, the rising trend in OOP payments for health, relative to public health expenditure, further exacerbates this financial burden, forcing households to trade-off between healthcare costs and other basic necessities (Sriram & Khan, 2020), thereby increasing the incidence of poverty in the society. Aregbeshola and Khan (2021), Aregbeshola and Khan (2018), Imlak and Shabda (2016) studies have consistently demonstrated that OOP payments for healthcare become terrible for low-income households when they surpass a specified threshold of household consumption and income. Thus, the growing trend of OOP health expenditures becomes a serious welfare problem globally (Al-Hanawi, 2021). Consistent with these global empirical findings, Nepal as a low-income country is not free from this pressing issue.

Nepal has adopted a mixed type of healthcare financing system for public healthcare delivery service (Government of Nepal, Ministry of Health and Population, 2019). There is government-funded healthcare service, insurance-based tertiary services, and private health services through OOP payments for healthcare (Khanal, et al., 2023). Evidently, it has also experienced a positive correlation between increasing economic growth and rising contribution of public healthcare expenditure to the total health expenditure. It has high proportions of OOP payments for healthcare and low proportions of public health funding in its total health expenditures, though Nepal is in a better position than other South Asian countries.

Historical evidence shows that government expenditure on the health sector in Nepal was low until the 1990s (Dulal et al., 2014). However, a clear shift occurred after the restoration of democracy in 1990, when the public health sector began to receivegreater priority in successive annual government budget (Mishra et al., 2015). In particular, the newly elected government placed strong emphasis on strengthening the primary health care system as a central pillar of health sector reform (Adhikari & Maskey, 2004).

Despite this increased public commitment, a substantial share of healthcare has continued to fall on households (Acharya & Dahal, 2016). The financial burden arising from illness is commonly assessed through the concept of catastrophic when OOP payments during a given period exceed a specified, typically 40 per cent of a household's non-food expenditure in the same period (Xu et al., 2003). The study of Thapa and Pandey (2021) found the catastrophe of healthcare expenditure 11.10 per cent at the national level and varied from 9.40 per cent in Madhesh Province to 13.40 per cent in Sudurpaschim Province. Similarly, the study of Saito et al. (2014) claimed that Nepal’s health system is heavily dependent on OOP payments on healthcare which is nearly 70 per cent of health expenditure. All these contexts suggest that healthcare financing is crucial in transforming Nepal’s healthcare system into an efficient and effective one for the poor and vulnerable (Adhikari, 2010).

Evidence indicates that 242.7 million individuals face catastrophic health expenditure at the 10per cent threshold, and 56.4 million at 25per cent threshold. Furthermore, OOP payments for healthcare have been shown to push around 58.2 million individuals below the extreme poverty line of USD 1.90 and additional 64.2 million below USD 3.10 per day, with spending on medicines constituting the largest share of such expenditure in most countries (Wang et al.,2018). This scenario clearly indicates that optimization of public healthcare financing is instrumental for poverty reduction and improving labour productivity. In addition, it should be noted that increasing public expenditure is not sufficient condition for the correction of catastrophic healthcare expenditure, if efficiency is ignored. In this regard, Adhikari’s (2013) asserted that merely increase in government health expenditure would not guarantee the allocative efficiency and technical efficiency. The stakeholders, policy makers and decision making authority should know this fact and improve know how in this regard to optimize resources for public healthcare delivery.

This study is about Nepal’s evolving health system, where limited resources and macroeconomic instability pose significant challenges on government healthcare finance. The Constitution of Nepal (2015) transformed the country's governance structure from a centralized unitary system to a decentralized federal republic system (Thapa & Singla, 2019). This transformation seriously demands substantial reforms in government healthcare delivery system to realize the constitutional right to free basic healthcare services and non-denial of emergency care as envisioned by the constitution. To realize this, government need to address the financial constraints issue that arise due to the increasing demand healthcare service in changing scenario. Therefore, analyzing the growth and trends of healthcare expenditure due to increased healthcare demand and examining its intricate causal links with financial and non-financial factors can help to develop effective policies and models to achieve affordable healthcare (Mishra et al., 2015).By analyzing socio-economic, demographic, and institutional factors, this study seeks to uncover the complexities hat have shaped the healthcare financing trend in the country. Previous studies adopting this approach are sparse, leaving knowledge gap in understanding the significant factors associated with the government and private health expenditure. Likewise, there is a lack of longitudinal studies to assess the socio-economic and demographic factors associated with the key population health outcomemeasurements, particularly life expectancy at birth and infant mortality rate. Therefore, the findings aim to bridge gap in existing literature and provide actionable insights for policymakers to optimize resource allocation and improve health outcomes.

1.2 Global and Regional Comparison

It is pertinent to present the global and regional scenario of government healthcare financing and health outcome status in Nepal to strengthen the analysis and make the study focused. In this regard, Table 1.1 presents a comparisonacross the global context, lower-income countries context, South-Asian countries context and Nepalese context based on the five-year averages for the period 2001–2005, 2006-2010, 2011-2015, 2016-2020, and the year 2022. The comparative analysis has focused on GDP per capita in USD, OOP payments for healthcare per cent as a total share of Current Health Expenditure (CHE), CHE share from the General Government Health Expenditure(GGHE-D), and key health outcomes such as longevity and infant death rate.

Table 1.1 shows that global GDP per capita steadily increased from USD 6,113 during the period 2001–2005 to USD 12,737 in the year 2022. Lower-income countries (LICs) remain far below the average but have doubled from USD 338 (in 2001–2005) to USD 763 (in 2022). South Asia has shown remarkable growth from USD 543 to USD 2,239, led by large economies like India. Nepal’s GDP per capita grew significantly from USD 246 to USD 1,386, indicating rapid economic progress, though still below South Asia's average. To sum up, Nepal's figure is far below global average, and higher than lower-income countries (Table 1.1).

Table 1.1

Comparative status of Health Expenditure and Health Outcome

Parameters	Regions	Average Figure (2001-2022)				
		2001-2005	2006-2010	2011-2015	2016-2020	As of 2022
GDP per capita (USD)	World	6112.92	8793.14	10718.52	11288.88	12737.32
	LICs	338.28	673.13	703.23	654.35	763.32
	South-Asia	543.22	1033.69	1370.09	1907.38	2239.52
	Nepal	246.43	473.08	803.27	1179.20	1385.91
OOP payments for health % CHE	World	18.57	18.87	18.74	18.12	17.23
	LICs	51.72	52.84	49.23	49.31	44.44
	South-Asia	70.81	68.39	62.81	63.17	48.64
	Nepal	53.81	61.63	56.08	63.17	55.79
GGHE-D % of CHE	World	57.35	58.69	60.37	60.35	62.11
	LICs	34.41	27.46	20.43	19.73	20.66
	South-Asia	21.40	21.25	23.50	32.90	35.87
	Nepal	15.32	18.47	16.34	23.57	31.64
Life Expectancy at birth(in Year)	World	68.77	70.00	71.26	72.18	72.97
	LICs	56.15	58.78	60.61	61.89	64.06
	South-Asia	64.32	66.04	67.74	69.30	71.30
	Nepal	64.74	66.375	67.45	68.93	70.09
IMR per 1000 live birth	World	44.6	38.5	34.5	30.8	28
	LICs	74	64.4	57.8	53	45.8
	South-Asia	59.6	52.6	47.1	39.7	31.3
	Nepal	50.9	43.4	38.7	32.6	25.1

Note: Table 1.1 above presents data on GDP per capita, health financing indicators, and health outcomes are presented for the World, Low-Income Countries (LICs), South Asia, and Nepal covering the period 2001–2022. *Source:* World Bank (2023)

Nepal and South Asia have improved economically, but their per capita income remains much lower than the global average. Global OOP payments for healthcare share declined slightly from 18.57 per cent for the period 2001-2005 to 17.23 per cent in the year 2022. This figure suggests that the progress toward pooled financing is improving marginally. LICs have reduced OOP from 51.7 per cent during the period 2001-2005 to 44.4 per cent for the year 2022, which indicate that the figure is still persistently high. South Asia had extremely high OOP payments for healthcare (>70%) during the period 2001-2005. The figure has decreased significantly to 48.64 per cent in the year 2022. As far as Nepal's concerned, the OOP payments for healthcare share was 53.81 percent during the period 2001-2005 and the figure increased to 63.17 per cent during the period 2016-2020. In the year 2022 the figure is decreased to 55.79 per cent. However, in global comparison, the figure is still high (55.79 %), suggesting continued financial burden on households for their healthcare. Despite improvements, OOP payments for healthcare in Nepal and South Asia remains high, reflecting potential risks of catastrophic health expenditure. To sum up, Nepal's status is very poor in terms of financial protection in healthcare as measured by OOP payments for healthcare parameters (Table 1.1).

Table 1.1 shows that in the global context, there is a rise in CHE as a share of GGHE-D from 57.35 per cent to 62.11 per cent, improving health system financing. In LICs context, the share decreased from 34.4 per cent during the period 2001-2005 to 20.7 per cent in the year 2022, which suggest reduced government role. However, the South Asian figure improved from 21.4 per cent during the period 2001-2005 to 35.9 per cent in the year 2022. In Nepal's context, the CHE as percentage of GGHE-D of Nepal increased markedly from 15.3 per cent to 31.6 per cent during the study period. that shows a strong commitment to public health financing. It can be inferred that the Government of Nepal has significantly increased its health expenditure share and reduces reliance on private expenditure but still trails the global average.

Moreover, global life expectancy rose steadily from 68.8 years during the period 2001-2005 to 73 years in the year 2022. LICs improved greatly from 56 years during the period 2001-2005 to 64 years in the year 2022. South Asian figures also increased 64.32 years during the period 2001-2005, reaching 71.3 in the year 2022. Nepal's life expectancy rose from 64.7 years during the period 2001-2005 to 70.1 years in the year 2022, close to the South Asian average. This comparison shows that Nepal's figure is higher than lower-income countries and lower than global average.

Global IMR per 1000 live births dropped from 44.6 during the period 2001-2005 to 28 in the years 2022, showing worldwide progress. Low LICs reduced IMR per 1000 live births substantially from 74 during the period 2001-2005 to 45.8 in the year 2022, but remain worse than global levels. South Asia's IMR decreased from 59.6 per 1000 live births during the period 2001-2005 to 31.3 per 1000 live births in the year

2022. Nepal’s IMR per 1000 live births fell dramatically from 50.9 during the period 2001-2005 to 25.1 in the year 2022, outperforming the South Asian average in recent years. Therefore, Nepal has successfully reduced infant mortality faster than its regional peers which indicates effective maternal and child health programs (Table 1.1).

GDP per capita of Nepal has increased 5.6 times which demonstrates a significant economic growth. However, it remains below the SAARC average and lower than the global average. OOP payments for healthcare as a percentage of current health expenditure (CHE) remains high at approximately 56 per cent which is worse than the average figure SAARC region(48 %) and significantly higher than the global average (17%). In other words, economic growth of Nepal is steady, but health financing remains heavily relying on OOP payment for health, indicating persistently high figure for Nepal in comparison to the rest of the world. This suggests a heavy financial burden on individuals for healthcare in Nepal. The government health expenditure has increased notably over time, reaching levels comparable to the SAARC average. However, it is still below the global average of 62 per cent which indicates potential for further public investment in the health sector. Clearly, Nepal faces persistent challenges related to high OOP payments and delayed implementation of health policies, such as the National Health Insurance Program introduced only in 2016 (Table 1.1).

The government’s share in health financing is improving, yet not enough to comfort household OOP payment for health burden substantially. The key health outcome, life expectancy and infant mortality in Nepal shows the closing health gap with South Asia and global context. Further, reducing OOP payments for health and increasing public investment are crucial for future improvements in health outcomes. The studies underscore that there is a feedback effect showing a strong bidirectional relationship between population health status and national economic development (Acci & samut, 2021; Adams et al., 2003). It implies that improved health outcomes contribute to economic growth through enhanced productivity, and economic progress in turn influences the quality of health services and population health status (Ahangar et al., 2018; Davidson et al., 2006).

Nepal's longevity is significantly increased from average figure of 2001-2005 as 64.70 years to 70.10 years as of the years 2022, reflecting substantial improvement.

This is now on par with the South Asian average but remains below the global life expectancy. Nepal has achieved a remarkable reduction in IMR, now performing better than the SAARC average and also lower than the global average, signifying satisfactory progress in child health outcomes. Overall, while Nepal has made significant strides in health indicators and economic growth, challenges remain in reducing OOP expenditure and increasing government health spending to match global standards. These figures and findings rationalize the policy for stronger financial risk protection and sustainable financial management for investment in public healthcare so as to improve population health outcomes (Chalise, 2023).

Studies examining the determinants of health expenditure and health outcomes are well-documented in the global literature (Anwar et al., 2023; Kaur, 2023; Bokhari et al., 2007). However, the study in the Nepalese context remains underexplored in several important respects. At the international level, research on government health expenditure and population health outcomes has largely relied on either single-country longitudinal analyses or multi-country panel data approaches (Anyanwu & Erhijakpor, 2009). While these approaches provide broad empirical insights, they do not adequately reflect Nepal's distinctive macroeconomic conditions, health financing structure, and socio-demographic characteristics. Consequently, in developing countries like Nepal, a clear understanding of the trajectory and determinants of government healthcare expenditure is essential to identify the causal relationships with key macroeconomic, demand-side, and supply-side factors, which can inform more effective policy interventions. Similarly, empirical evidence on the socio-economic determinants of population health outcomes in Nepal remains limited, underscoring a critical gap in the existing literature.

Nepal has made significant efforts to improve its population health outcomes by expanding its healthcare infrastructure and increasing health expenditure. However, the determinants of government healthcare expenditure and health outcomes remain complex. The macroeconomic factors, fiscal space, health infrastructure factors, health seeking behavior factors, demographic factors, and social factors play crucial roles to determine healthcare and health outcomes. Yet, these types of studies are not carried out. This study fulfilled this knowledge gap by examining the determinants of government healthcare expenditure, OOP payments for health, and health outcomes in Nepal. The findings are expected to guide evidence-based decision-making processes and foster policies that optimize healthcare expenditure and enhance the health and well-being of the Nepalese population.

Over the past decades**,** Nepal has made significant efforts to improve population health outcomes through the expansion of healthcare infrastructure and increased health expenditure. Despite these advances**,** the determinants of per capita government healthcare expenditure, per capita OOP health payments, and factors associated with the health outcomes remain complex and insufficiently understood.In particular, macroeconomic conditions, healthcare infrastructure, health-seeking behavior, demographic characteristics, and broader social factors interact in ways that shape both healthcare spending and health outcomes. However**,** empirical studies that examine these interrelationships in the Nepalese context are limited. Against this backdrop, the present study addresses this gap by examining the determinants of government healthcare expenditure, OOP payments for health, and key health outcomes in Nepal. Consequently**,** the findings support evidence-based decision-making and inform policies aimed at optimizing healthcare expenditure to improve the overall health and well-being of the Nepalese population.

1.3 Statement of the Problem

Despite the government's efforts to improve healthcare access and quality, Nepal's healthcare system continues to experience several challenges associated with the resource optimization. In this context, government healthcare expenditure is associated with multiple factors such as macroeconomic capabilities, health seeking behavior of people, demographic pressures, and government policies. Better understanding of the factors that drive government healthcare expenditure and private health expenditure or OOP payments for healthcare is essential to forecast their trend and pattern. It is essential to formulate a practical strategy to optimize government health expenditure and provide financial protection to low-income households. Moreover, it is essential to formulate actionable government policy to achieve the target of better health outcome among the people mobilizing effective limited resources and ensuring equitable healthcare delivery across diverse geographic and socio-economic settings. Since the implementation of National Health Policy 1991, Nepal has been allocating a large portion of its national budget to improve public healthcare. In this context, ensuring that these government expenditures are adequately justified and strategically allocated requires a deep understanding of its driving factors. Likewise, a better understanding of determinants of private health expenditure as reflected by OOP payments for healthcare is also essential (Misra et al, 2015).

Empirical study on the specific factors that influence healthcare expenditure in Nepal is limited. The limitation has constrained the policymakers' ability to design effective and sustainable health financing strategies. At the same time, population health outcomes in Nepal are shaped by a complex interplay of macroeconomic conditions, healthcare policies, socio-economic and demographic characteristics, and levels of public awareness. Despite this complexity, systematic empirical examination of these relationships in Nepal remains to be understudied area. Existing studies have not sufficiently explored interconnectedness of the determinants of government healthcare expenditure and OOP payments for health using macro-level time-series data. Similarly, the determinants of key health outcomes, particularly in terms of longevity and infant death, have not been adequately examined within Nepal's distinct socio-economic, institutional, and policy environment using longitudinal data point. As a result, limited empirical guidance on how healthcare financing and broader macroeconomic forces have collectively influenced population health outcomes over time.

This research is motivated by the need to identify the key determinants of both government and private health expenditure, alongside the determinants of population health outcomes in Nepal. The study adopts a dual focus by analyzing government healthcare financing and examines the factors associated with the health outcomes separately. Such an integrated approach is essential for developing a comprehensive understanding of how macroeconomic, and socio-demographic factors interact and shape health outcomes in a resource-constrained country.

The relevance of this inquiry is heightened by Nepal's constitutional commitment to health. The Constitution of Nepal (2015) recognizes healthcare as a fundamental right and obligates the state to provide preventive and curative health services to all citizens. These constitutional provisions have contributed to increased public health spending. However, despite rising expenditure, comprehensive empirical studies that examine the determinants of government health expenditure, OOP payments, and health outcomes in Nepal is limited. Moreover, persistent fiscal constraints raise concerns regarding the sustainability and effectiveness of health financing, posing challenges to realizing the constitutional vision of health coverage.

Evidence from high-income countries indicates a positive relationship between government health expenditure with the GDP growth, health seeking tendency of population, health human resource density. Moreover, the study also shows a positive association between GDP growth, per capita government health expenditure and health outcomes, although diminishing marginal returns are often observed beyond certain spending thresholds (Getzen, 2000). In contrast, empirical findings from low-income and middle-income countries (LMICs), including Nepal, remain mixed, reflecting differences in institutional capacity, financing structures, and socio-economic conditions (Anyanwu & Erhijakpor, 2009; Rana et al., 2018). These findings indicate the importance of country-specific analysis. While health economics theory, particularly the Grossman model (1972), has regarded healthcare as both a consumption and an investment good, with the health outcomes jointly determined by the public and private healthcare expenditure (Grossman, 1972). Nepal-specific empirical applications of this framework are limited. Although some regional studies include Nepal within broader panel analyses, they fail to capture the country's unique structural, demographic, and policy characteristics (Rana et al., 2019). Furthermore, much of the existing literature in Nepal relies on micro-level household survey data that offer limited insights for macroeconomic policy and its analysis.

A notable gap in studies creates a need of macro-level time-series models to identify the significant drivers of per capita government health expenditure, private health expenditure in terms of per capita OOP health payments. In addition, macroeconomic, and socio-demographic factors including policy reforms associated with the health outcomes. Macro-level analyses with variables such as GDP per capita, outpatient department (OPD) visits as a proxy for healthcare demand, healthcare human resource density, remittance inflows, inflation, and unemployment remain understudied. To address these gaps, this study useslongitudinal data and employs time-series modelling econometric techniques and examines the macroeconomic, socio-demographic, and institutional factors associated with the government healthcare expenditure, OOP payments for healthcare, and key health outcomes in Nepal. By identifying these relationships, the study aims to provide a better understanding of efficient resource allocation, reduce the burden of OOP payments, and support evidence-based policy reforms. Ultimately, this research seeks to make contribution not only for academic discussion but also provide policy insights for better and evidence based policymaking by providing actionable insights to strengthen Nepal's healthcare system and improve population health outcomes.

1.4 Research Questions

This study is to assess the factors associated with the per capita government healthcare expenditure, private health expenditure. It also assesses the key economic, demographic, social and institutional factors influencing health outcomes in Nepal. In light of these issues, the following research questions are formulated to guide the direction and scope of the analysis:

a. What are the factors associated with the per capita government healthcare expenditure in Nepal?

b. How do the macroeconomic factors influence out-of-pocket (OOP) payments for healthcare in Nepal?

c. To what extent do macroeconomic, socio-demographic, and institutional factors explain variations in health outcomes particularly, longevity and infant death?

1.5 Research Objectives

The primary objective of this study is to assess the healthcare expenditure and population health outcomes of Nepal. The specific objectives are:

a. To identify the factors associated with the per capita government healthcare expenditure in Nepal.

b. To examine the macroeconomic factors influencing out-of-pocket (OOP) payments for healthcare in Nepal.

c. To evaluate the extent to which macroeconomic, socio-demographic, and institutional factors influence variations in population health outcomes, particularly life expectancy and infant mortality in Nepal.

1.6Rationale of the Study

Healthcare expenditure is a complex and policy-sensitive issue that attracts attention from policymakers, politicians, planners, service providers, and users because the users' share in health payments is central to concerns of equity and fairness. As countries progress economically, they face growing pressure to mobilize and efficiently manage domestic resources to ensure affordable healthcare for their populations (Cali et al., 2018). In this context, a clearer understanding of the determinants of government healthcare expenditure, private health expenditure, and factors associated with health outcomes become essential for informed policy design.

In Nepal, healthcare financing remains a persistent development challenge, especially in achieving equitable access to basic healthcare services and improving population health outcomes. Available evidence indicates that the growth rate of per capita public healthcare expenditure has lagged behind the rise in per capita OOP payments for healthcare. Consequently, there is persistent rise in the OOP health payment share in total health expenditure share. This pattern signals a limited financial protection for households and highlights the constrained role of public financing in shielding citizens from healthcare costs. Recognizing these concerns, the Government of Nepal introduced a free essential medicines program in 2008 (Acharya & Dahal, 2016), followed by the launch of the national free delivery and maternity care policy in January 2009 (Witter et al., 2011). These policy interventions contributed to a subsequent rise in annual government healthcare expenditure. Nevertheless, a systematic assessment of the underlying drivers of healthcare expenditure and health outcomes remains necessary (Khanal et al., 2023).

Broadly, healthcare financing plays a central role in transforming Nepal’s healthcare system into one that delivers efficient and effective services, particularly for poor and vulnerable populations (Adhikari, 2010). Understanding of the shaping factors of the health expenditure can support policymakers in improving resource allocation and long-term planning. Against this backdrop, the present investigation seeks to develop a comprehensive understanding of the determinants of per capita government healthcare expenditure, OOP healthcare payments, and health outcomes in Nepal. Specifically, the study examines both macroeconomic, population healthcare seeking factors, and institutional factors for determining per capita health expenditure. It also examines the macroeconomic, socio-demographic factors influencing the population health outcomes in terms key indicators longevity and infant death rate. By doing so, the analysis critically evaluates current expenditure trends and identifies potential weaknesses in the existing healthcare financing framework.

1.7 Limitations of the Study

The dissertation has gained valuable insights regarding assessment of the health expenditure and health outcomes. Nevertheless,it is pertinent to acknowledge certain limitations that may have influenced the findings and interpretation of the result. Therefore, the key limitations of the dissertation are discussed subsequently.

The dissertation findings are based on the annual time series data of 28 years starting from FY1994/95. The application of the results other than this time period should be done with caution, as the context and dynamics of the data may differ and the results may also different.

This study is based mainly on selected financial and non-financial variables. There may be influence of unobserved and confounding variables in the analysis results. Therefore, the influence of all unobserved and confounding variables cannot be fully ruled out. The selection and operationalization of variables used in this investigation may have limitations. Although efforts have been made to include a comprehensive set of determinants, it is possible that certain relevant variables are not included or that the chosen measures may not fully capture their complexities.

This study has utilizedlongitudinal data and quantitative research design based on the secondary time series data. While this approach provides valuable insights regarding the macroeconomic, and institutional factors associated with the government healthcare expenditure, OOP payments for healthcare, followed by the macroeconomic, socio-demographic and institutional factors associated with population health outcomes in Nepalese context. The researcher has made best effort to remain free from bias. Despite this, latent bias might have existed in the selection of variables and interpretation, data analysis and conclusion drawn.

1.8 Organizations of the Dissertation

This dissertation is structured in seven chapters altogether. The first chapter is Introduction that provides background information on the issue with global and regional comparison, highlights the statement of the problem and lists research questions, and research objectives. It also includes objectives, rationale, followed by acknowledgement of limitations.

The second chapter is titled as the Review of Literature that reviews relevant theoretical as well as empirical literature published in national and international contexts. The third chapter is Research Methodology that discusses the various part of methodology including the research process and design, nature and sources of data, data analysis tools and techniques, and specification of the model.

The fourth, fifth, and sixth chapters are Analysis chapters. The fourth chapter presents factors associated with the per capita government healthcare expenditure followed by the discussion based on the comparison and contrast with the previous studies carried out around the world. Similarly, the fifth chapter presents the macroeconomic determinants of OOP payments for healthcare in Nepal with the discussion based on the comparisons and contrasts with the previous studies carried out around the world. Likewise, the sixth chapter analyzes the macroeconomic, socio-demographic factors associated with the key health outcome in terms of longevity and infant deaths in Nepal respectively. It also discusses comparisons and contrasts with the previous studies carried out around the world.

Finally, the seventh chapter is Summary of Findings, Conclusion and Recommendation that presents a summary of the dissertation, major findings, general conclusion. It also contains with statement of contribution to the existing body of knowledge, and recommendation for future study.

CHAPTER II
REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter presents theoretical foundations and empirical evidence relevant to the issues addressed in this dissertation. It critically reviews existing scholarship to map the current state of knowledge and to identify key gaps. The review of literature is streamlined into three sections. The first section reviews the literature on the macroeconomic, population health seeking factors and government healthcare institutional factors associated with the government health expenditure. The second section reviews the literature on the macroeconomic and social actors associated with the OOP health payments. The third section reviews the literature on the factors influencing health outcomes in Nepal. By integrating insights from these strands of research, the chapter synthesizes existing knowledge while highlighting areas that remain underexplored. Overall, this review provides a foundation for the subsequent empirical analysis. As it links healthcare financing mechanisms with health outcomes, it contributes to the broader academic discourse and informs for the development of more effective and equitable health policy in Nepal. In doing so, the study addresses important gaps in the existing literature.

2.2 Review on Factors Associated with Government Healthcare Expenditure

This section reviews the macroeconomic foundations of government healthcare expenditure by integrating relevant public policy theories with empirical evidence. It begins by synthesizing aggregate-level studies on the determinants of healthcare expenditure over time, with particular attention to per capita government healthcare expenditure and its key macroeconomic, health seeking tendency of people, and health human resource density, and institutional drivers. Building on this, the section critically examines empirical findings that explain variations in government healthcare expenditure across different contexts. It then assesses prevailing perspectives in the literature and highlights unresolved issues and research gaps. Globally, the evidence consistently shows that economic growth, urbanization, and industrialization are associated with rising welfare expenditure, including public healthcare expenses. In this context, a systematic examination of the determinants of healthcare expenditure is essential, and this section provides that foundation by consolidating and evaluating the scholarship on the subject.

2.2.1 Theoretical Review

The study of public expenditure in healthcare has gained intensive attention and concern since the 1960s. Health economists have shown concern about the growing proportion of GDP devoted to healthcare expenditure (Folland et al., 2024). Essentially, the determinants of government healthcare expenditure are based on macroeconomic and microeconomic foundations.

The study of public healthcare expenditure has attracted scholarly attention since the 1960s as health economists began to examine the rising share of gross domestic product allocated to healthcare (Folland et al., 2024). In this domain, the existing scholarship has increasingly focused on identifying the forces that drive government healthcare spending. These determinants are generally understood to rest on both macroeconomic factors, such as GDP growth and population health seeking behaviour, and institutional characteristics of health systems.

Wagner (1883) contributed to the theoretical literature on the logic of government welfare expenditure. This analogy can be used in government healthcare expenditure as welfare expenditure (Musgrave & Musgrave, 1989). Wagner proposed three reasons to support the public welfare expenditure. Subsequently, modified versions of Wagner's Law study was developed on determinants of public expenditure and proposed the growth of public expenditure for public welfare as the function of GDP per capita. Gupta (1967) asserted that per capita government expenditure is the function of GDP per capita as a measure of public welfare expenditure.

Healthcare expenditure is not only a social investment but also crucial economic inputs that influences economic growth through human capital accumulation (Savvides & Stengos, 2008). In this regard, New Growth Theory explains human capital as a fundamental determinant for long-run economic growth (Teixeira & Queirós, 2016; Savvides & Stengos, 2008; Ranis, 2004). In health economics, New Growth Theory is underpinned and relevant because human health is treated as the basis for human capital that enhances workforce productivity and long-term economic growth rationalizing the substantial investment in public healthcare system.

The endogenous growth theory provides strong theoretical foundation for optimizing healthcare expenditure by treating human health as a core component of human capital and human capital as the crucial instrument of the economic growth of nations (Lucas, 1988; Romer, 1986).Moreover, healthcare expenditure improves cognitive and physical capacity, and extends working life of population, thereby raising the effective stock of capital. In this regard, the work of Barro (1991) asserted that economic growth of country is a function of available amount of physical and human capital including environmental factors.Moreover, Barrow (1996) argued that good health of the population was an engine of economic growth and productive asset associated with human beings. Health is a fundamental determinant of the living standards and overall well-being of a population (WHO, 2015). Thus, as a key component to accelerate human capital formation, several studies have shown that the health of the population directly influences economic growth and the overall development of a country.

Public Finance Theory

Public finance theory analyzes the role of government in resource allocation and income distribution with the objective of maximizing social welfare. Within health economics, this theory offers a framework for understanding how public intervention shapes healthcare financing, service delivery, and population health outcomes. Central to this framework are the three core functions of government identified by Musgrave and Musgrave (1989): allocation, distribution, and stabilization. Public healthcare services, often treated as public or merit goods, are designed to ensure broad and equitable access to healthcare for the general population. However, healthcare markets often fail to achieve efficient outcomes due to market imperfections such as externalities and information asymmetry which calls forth and justifies the government intervention.

From a public finance perspective, government health expenditure is influenced by fiscal capacity, societal demand for healthcare, and the costs of service provision, including investments in healthcare infrastructure and human resources. Guided by this factors, the present study specifies per capita government health expenditure as a function of per capita GDP, outpatient visits as an indicator of healthcare demand, and health workforce density as a supply-side and cost-related factor. In this sense, the theoretical grounding of the study is the broader public finance principles articulated by classical economists and subsequently refined by modern health economists (Musgrave & Musgrave, 1989).

The analytical relevance of this framework is further strengthened by complementary theoretical contributions. Musgrave and Musgrave's (1989) concepts of the allocation, distribution, and stabilization functions remain fundamental to assessing government involvement in healthcare financing. Pigou's theory (1920) of externalities provides an additional justification for public expenditure on health, given the positive spillover effects of improved population health (Caldari & Masini, 2011). Moreover, Grossman's (1972) conceptualization of health as both a consumption and an investment highlights the long-term economic returns to health expenditure. Building on these foundations, later contributions of Wagstaff and Van Doorslaer (2000) extend public finance theory into applied health economics by examining equity and progress in health financing using empirical tools such as concentration indices and benefit incidence analysis. Collectively, these strands of literature underpin the application of public finance theory in evaluating and guiding government health expenditure decisions.

Theoretical framework can be expressed as per capita government health expenditure is determined by GDP per capita, health seeking behavior population, government capacity healthcare delivery and other control variables such as policy reforms, internal and external shocks. Essentially, this is also consistent with the GDP-lead-health theory that argues GDP growth enhances government health expenditure and increased health expenditure improves population health quality (Newhouse, 1977; Grossman, 1972; Gerdtham & Jonseeon, 2000). It implies that wealthier people are healthier. The GDP-Lead-Health Theory emphasizes the significant role of health status, particularly life expectancy, in driving economic growth (Barro, 1996; Saha & Gerdtham, 2013). It implies that healthier people are wealthier. But,the Feedback Theory asserts bi-directional causality between population health and national wealth (Folland et al., 2024).

By reviewing above theoretical literature, it makes clarifies that expenditure on healthcare is a function of income (Okunade, 1985; Newhose, 1977; Grossman 1972). The factor that has been identified as the most influential is real GDP (Haider, 2007). In this regard, we can argue that with the advancement of the economy, the role of government expands including public healthcare management for public welfare and also suffer from market failure in context healthcare delivery. This makes pressure to increase share of healthcare expenditure from total public expenditure and rationalizes regulatory mechanism for public healthcare management (Lamartina & Zaghini, 2011). Growth of health care expenditure improves healthcare provision, upgrades quality of life people and increase productivity, thereby contribute to economic development (Khan et al., 2015). Thus, the demand for healthcare expenditure is determined by GDP growth, as rising income level enable higher level of expenditure on healthcare services, which in turn is expected to improve the population's health status.

2.2.2 Empirical Review

This section summarizes the empirical literature review based on the research worked across the countries. The empirical review is further categorically divided into two: international review and national review.

International Review

The empirical research findings have discovered that there is strong correlation among the variables healthcare expenditure and health outcomes and economic growth (Amiri et al., 2021). In this regard, Khan and Mahumud (2015) argued that public healthcare expenditure is neither a luxury in the twenty-first century nor a consumer good but a universal right of the people. So access to health care services should not be a privilege for just a few. Similarly, Vogeli (2007) asserted that identifying macroeconomic, demographic, social, and healthcare infrastructure determinants of government healthcare expenditure is critical for building a sustainable, effective, and equitable health system. Empirical studies have indicated great variation in the explanatory efficacy of GDP per capita to the per capita government health expenditure (Furuoka et al., 2012; Wu et al., 2021; Gerdtham & Jonsson, 2000). Nevertheless, the GDP per capita is significantly associated with the per capita government health expenditure (Parkin et al., 1987; Newhouse, 1977). This empirical review is focused on exploring the principal determinants of government healthcare expenditure such as GDP per capita, annual frequency of OPD visits in government healthcare system, and health human resource density in government healthcare system.

Human health constitutes a key dimension of human capital (Fahad et al., 2023) and serves as a primary driver of economic growth and workforce productivity (Cole & Neumayer, 2006). Improved public healthcare delivery system is instrumental for human capital and in turn it enhances workforce productivity of a nation (Amiri et al., 201; Khan et al., 2016). In this context, a healthy and creative population is a result of better public healthcare management (Shadmi et al., 2020). Thus, the adequate allocation and efficient utilization of public health resources are critical for delivering quality healthcare services and achieving better health outcome (Nicola et al., 2020). Obviously, good health of population upgrades the level of human capital and increases labour productivity (Becker et al., 1990) which ultimately accelerates the pace of economic growth (Szirmai, 2015; World Health Organization, 2006). Likewise, good health of an individual creates better opportunity for him to find high-paid work. The individual with high-income is expected to improve quality of his/her learning and earning further, thereby further improvement in productivity and earning (Mirowsky, 2017).Therefore, socioeconomic development of a nation is underpinned on the population good health (Grossman, 2000).

Effect of Income on Healthcare Expenditure

Empirical research indicated that income rise increases healthcare expenditure which reflects greater financial capacity to afford healthcare services. Becker (1962) analyzed the public expenditure of all developing economies since the 1960s. The result of this indicated that the increasing proportion of GDP devoted to healthcare expenditure. As a result, healthcare expenditure and health capital treated healthcare expenditure as an investment in human beings for human capital formation that is expected to increase yields to the economy. Abel-Smith (1967) approximated the model for healthcare expenditure as the ratio of total health expenditure to national income which is the function of per capita national income in USD.

Newhouse's (1977) study explored national income growth as a significant predictor health expenditure with income elasticity greater than unity (1.35). The study estimated 92 percent explanatory power to explain as health expenditure as function of GDP per capita. Parkin et al. (1987) examined the relationship between aggregate government health expenditure and national income to estimate income elasticity for healthcare expenditure. The findings revealed that the income elasticity to healthcare expenditure is greater than unity indicating that increase health expenditure is faster than national income.These findings have influenced subsequent health economics literature by highlighting the gravity of income effects in explaining variations in government and private health expenditure providing rationale of policy discussions on health care resource allocation.

Gerdtham and Jonsson (2000) found the variations in the determinants of per capita healthcare expenditure around the world based on differences in economic status. Okunade (2005) study found that the economic and other determinants, capturing 74 per cent of the variations in health expenditures, include per-capita GDP. Likewise, Dreger and Reimers’ (2005) study indicated income elasticity of healthcare expenditures equal to equals unity. Abbas and Hiemenz (2011) estimated income elasticity of healthcare expenditure of Pakistan as 0.23. This value is less than unity which suggested healthcare as a necessity in Pakistan.

Haider's (2007) study found income as significant driver of health expenditure including other social, demographic factor and technological factors. Likewise, Rahaman (2008) used panel data models to identify major factor associated with public health expenditure using the data spanning from 1971 to 1991. The estimated result indicated that real per capita income as main driver of health expenditure with income elasticity health expenditure as 0.47 and the coefficient indicated health as essential good.

Eik et al. (2009) study estimated health expenditure is increasing at faster rate than national income in most of the countries. This rapid growth brings an improvement in life expectancy and quality of life but also jeopardizes the sustainability of public budget. Nguyen et al.’s (2009) study focused on the key determinants of per capita total health expenditure and measured the income elasticity small (0.045 and 0.020), thereby indicating that public health care is a major necessity.

Xu et al. (2003) examined the trend and growth of government health care expenditure and OOP payments for healthcare in developing countries to understand the trajectory of health expenditure. The result was based on panel data analysis from 143 countries between the period 1995 to 2008. Their results showed health expenditure generally did not grow faster than GDP, with estimated income elasticity to health expenditure ranging between 0.75-0.95, indicatingthe pace of health expenditure growth varies for different economic levels.

Pan and Liu (2012) found provincial government health expenditures of China to be positively correlated with provincial GDP per capita increase reflecting a prioritization of healthcare expenditure as a response to income levels rise. Similarly, the study showed relatively low elasticities of income implying government healthcare expenditures is an essential good instead of a luxury good.

Furuokaet a. (2012) analyzed data of selected east Asian countries using data spanning for the period 1995-2008. The estimated result indicates GDP growth including other variables as a significant driver of government health expenditure.Likewise, Samadi and Rad's (2013) study also found a long run causal relationship between the government health expenditure and GDP growth including other variables. In addition, Angko (2013) estimated the coefficient of per capita GDP to government health expenditure for short and long-run for Ghana. The estimated coefficient is less than unity for long-run and greater than unity for short-run, indicating that for long-run healthcare as essential goods and for short as luxury in Ghana.

Hartwig and Sturm (2014) utilized the Extreme Bounds Analysis (EBA) to identify robust explanatory variables for healthcare expenditure growth based on the panel data spanning from 1970-2010 for OECD countries. This study finding also confirmed their previous empirical evidence that GDP growthas and indicators capturing are robust and statistically significant determinants of healthcare expenditure growth as indicated by Baumol's cost disease (1967). Khan et al. (2015) study claimed that at national level healthcare demand is the function of GDP growth, indicating increase in income growth is correlated with the increase in health expenditure and improvement in health status.

Ngheim and Connelly (2017) examined the trend and determinants of health expenditures in Organization of Economic Cooperation and Development (OECD) countries spanning the period between 1975-2004. Their findings indicated that healthcare is a necessity not a luxury. Akca et al. (2017) explored GDP, number of physicians, aging population, government revenue as key determinants of healthcare expenditure.Similarly, Barkat et al. (2019) analyzed the major driver of health expenditure for 18 Arab World countries using data covering the period 1995-2015. The study findings also indicated healthcare expenditure as a necessity not a luxury. Notable, the result showed evidence of bidirectional causality between health expenditure and economic growth. Rana et al. (2020) study found variation in per capita health expenditure by economic growth, showing income elasticity of health expenditure less than unity with coefficient variation 43 per cent.

Raghupathi and Raghupathi (2020) identified the real GDP as the most influential factors contributing to increased healthcare expenditure. In other words, a positive relationship between GDP and healthcare spending can be attributed to increased income, better health status, and higher population income. The study asserted that healthy workers are more productive, accelerating income growth and implying a causal relationship between health expenditure and GDP growth in either direction.

Moayedfard et al. (2020) examined health expenditure and human capital determinants in Iran and findings suggested that including others, GDP growth exerted significant impact on health expenditure with 99 per cent explanatory power. Similarly, Qehaja et al. (2023) concluded that increasing health expenditure can positively impact economic growth in the region. Kaur (2023) explored a unidirectional causal relationship between health expenditure and GDP suggesting that policymakers and the government should focus on health to achieve economic growth.

Annual OPD Visit Frequency and Government Healthcare Expenditure

The outpatient department (OPD) frequency per unit of time is regarded as an important proxy for demand for healthcare. The relationship between OPD visit frequency and government healthcare expenditure shows an intricate relation that is influenced by various economic and social factors. Intuitively, increased government expenditure on public healthcare is expected to correlate with improved health outcomes and higher OPD visit rates per unit of time.

Hidayat and Pokhrel (2010) explored correlation between OPD visit frequency and government healthcare expenditure based on the study in Indonesia. Wang et al. (2016) examined the relationship between OPD visit frequency and government healthcare expenditure in the context of China. The study argued that frequent OPD visits frequency, driven by the rising prevalence of chronic conditions, have significantly contributed to the increase in government healthcare expenditure. Phelps (2017) also argues that government expenditure on healthcare is influenced by the public healthcare demand and OPD visits frequency is a proxy of it. Therefore, increased demand for outpatient healthcare often leads to higher healthcare expenditures of the government.

Health Human Resources Density and Government Health Expenditure

Health human resource density in government healthcare systems and its effect on healthcare expenditure are critical measurements for estimating government healthcare expenditure. Therefore, the interplay between the number of physicians including other supplementary health workforce in government healthcare systems and government healthcare expenditure is crucial for ensuring adequate health services. Obviously, the accountable government tries to increase physicians including other supplementary health workforce in the healthcare system that causes increased government expenditure. Therefore, its optimization is desirable to improve healthcare access and quality.

Rahaman (2008) examined trend of public health expenditure in India using data spanning from the period 1971-1991 and income growth and doctor to people ratio as significant driver of health expenditure. Similarly, Samadi and Rad (2013) study found a long-run causal relation between health expenditure and GDP growth including other variables. Moayedfard et al. (2020) showed health expenditure and human capital determinants in Iran using time series model to examine causal relationship between income growth, health expenditure, and human capital formation.The research findings indicated GDP growth as main driver of health expenditure, indicating that economic growth are associated with increased expenditure on health. Conversely, the Gender Parity Index (GPI) has a significant negative effect.But, the variables representing physician density and hospital beds do not show any significant linkage with health expenditure. Bayar et al. (2021) conducted study to identify the major drivers of health expenditure in 27 EU member states using the panel data spanning the period 2000-2008. The study used causality and co-integration analysis and result showed that the health expenditure is significantly determined by GDP growth with unidirectional causality from GDP growth to health expenditure.

National Review

Historical documents on the government healthcare sector show that there were only a handful of doctors until the 1950s in Nepali healthcare system (Adams, 1998). Since the introduction of the General Health Plan in 1956marked progress has been made in the health sector with the aim of providing basic health services to every Nepali citizen (Rai et al., 2001). Moreover, public healthcare system of Nepal undergone massive change after the political change in 1990s. In addition, several other factors are responsible for the change such as increase in urbanization, the remittance inflow growth, reduced poverty level, improvement in information and communication, followed by the drastic growth of medical schools, and collages.

David et al. (1998) study asserted that the Government of Nepal launched an ambitious primary healthcare service in rural areas after 1990s. As a result, the number of health posts increasedto 2597units in 1996 AD as compared 200 units in 1990, which is abouttwelve-fold growth. This clearly indicates that the public healthcare system of Nepal got less priority before the 1990s in terms of resource allocation in the annual government budget. This can be claimed in terms of basic healthcare provision parameters and healthcare financing plans of the governments before the 1990s. Likewise, government strengthened healthcare financing mechanism with multiple stream to address the issue of household healthcare expenditure. This is clear and concrete evidence that the government healthcare system has changed by political and socio-economic forces.

Adhikari and Maskay (2004) asserted that Government of Nepal began to prioritize public healthcare expenditure significantly after political regime shift in 1990 from the partyless Panchyat system to the multiparty democracy. This fact is explicitly by the Nepal National Health Policy 1991 and subsequent periodic plans. Adhikari (2010) underscored that the government contributes less than a quarter of total health expenditure. He also argued that public healthcare financing strategy plays vital role to transform overall healthcare system and address the poor and vulnerable people of Nepal. Therefore, designing the risk pooling mechanism is essential for optimizing healthcare resources and ensuring sustainable healthcare system.

The Ministry of Health and Population (2010) study report emphasized to improve public healthcare system to ensure health aces to poor people at affordable price. In this regard, the choice of financing is crucial as the risk polling mechanism and cost sharing play pivotal role (Dahal, 2016).National Health Policy of Nepal (2014) was drafted and implemented to resolve the issues of the health sector of Nepal. Moreover, National Health Policy of Nepal (2014). Moreover, the policy also focused to the mobilization of all necessary resources through public financing system to address the exiting issue (Mishra et al., 2014).

Ghimire et al. (2018) asserted the necessity risk pooling mechanism to ensure universal health coverage by 2030 and also to address the healthcare access and utilization. Moreover, this effort is essential to address the issue of high proportion of OOP payments for health and financial protection. The Ministry of Health and Population (2023) report stated that total health expenditure in FY 2018/19 was NPR 183.8 billion and was increased in FY 2019/20 to NPR 223.4 billion. The estimated per capita health expenditure was NPR 6,188.4 for FY 2018/19 which increased to NPR 7,418.8, for the FY 2019/20. Evidently, during the decade, health expenditure has increased significantly, with current market prices increasing over threefold surpassing the GDP growth rate.

By reviewing the theoretical and empirical literature from global and literature, the researcher has gained world view to have better insight to estimate per capita government healthcare expenditure. Moreover, synthesizing findings from the literature review, the researcher has identified some key factors associated with the per capita government healthcare expenditure in the international context. They are GDP per capita, annual out-patient visits frequency in the government healthcare system, and health human resources density in the government healthcare system. Methodologically, previous research has predominantly relied on microeconomic and cross-sectional data, which may not fully account for the dynamic nature of macroeconomic determinants and their effects on health expenditure over time.

There is a need for longitudinal studies that can provide deeper insights into the temporal relationships and potential causal mechanisms underlying these determinants in Nepal. In other words, a critical review of the literature indicates that government healthcare expenditure in Nepal is largely driven by fiscal capacity as displayed by GDP growth. A few studies rigorously examine the roles of healthcare demand and system capacity. The existing review clearly indicates that most analyses rely on cross-sectional or descriptive statistics, offering limited causal insights. Therefore, the current study proposed the per capita government health expenditure as function of macroeconomic condition, healthcare demand trend from the side of population, healthcare system capacity of government, policy reforms and other control variables.

From a methodological perspective, the application of ARDL model, a robust method in time series analysis significantly strengthens this analysis. Despite small data points, ARDL is well-suited for time series analysis, when data series are mixed order integration. Moreover, this approach is suitable when data series are level stationary I(0) and first-differenced stationary I(1). This is particularly important in health economics, where longitudinal data on macroeconomic variables and service delivery indicators often evolve at different rates (Pesaran et al., 2001).

Moreover, ARDL allows us to distinguish between short-run fluctuations and long-run equilibrium relationships between government health expenditure and its determinants (Murthy & Okunade, 2016). In fact, this dual perspective offers richer policy insights to immediate budgetary adjustments or only influences long-term allocations. The model also incorporates structural dummies to capture the effect of policy responses. Overall, the current study advances the methodological rigor in Nepali health financing research and enhances understanding of how government expenditure responds to dynamic changes in economic capacity, service utilization, and workforce availability in the government healthcare system.

2.3 Review on Factors Associated with OOP Payment for Healthcare

This section reviews the existing literature on the factors associated with the OOP health payments. OOP payments for health implies the payments made by private individual or households to access healthcare disposing their private resources (Ruggeri et al., 2020; WHO, 2011; Wagner et al., 2011. The review focuses on identifying the macro-level determinants of OOP payment for healthcare and examines how these factors influence financial protection within the health system. It also critically assesses the extent to which Nepal's health financing structure aligns with the objectives of universal health coverage (UHC). Accordingly, this review provides a conceptual foundation for analyzing Nepal's health financing system in relation to UHC targets. The section is organized into three parts: a theoretical review, an empirical review, and a discussion of the identified knowledge gaps.

2.3.1 Theoretical Review

The level and magnitude of OOP payments for healthcare influence the demand for healthcare services. It is relevant to mention the law of demand and higher prices (including OOP payments) lead to a decrease in quantity demand of healthcare goods and services. This framework suggests that patients may delay or forego necessary healthcare services due to cost considerations of healthcare goods and service (Morris et al., 2012). In this regard, Grossman (1972) model is regarded as baseline model for the analysis of demand function for healthcare. This model, healthcare expenditure is both investment and consumption. Moreover, individual with high income tend to spend more on high quality healthcare. Likewise, there is positive but indirect relation between demand for health and income given the price of health service. In addition, age is positively correlated with quantity demand of health services, implying that with the increase in the age people struggle with their health issues.

Behavioral economics examines how psychological factors affect economic decisions of economic agents including healthcare financing. In this context, increase in the OOP payments for healthcare can lead to adverse outcomes such as financial distress where patients experience personal stress and financial strain due to unexpected sudden medical costs. Therefore, this theory helps in explaining why individuals may avoid healthcare service utilization even though it is necessary (Chandra et al., 2019) and lead a life with health poverty. So, people experience financial hardship when they fall in the compulsion of OOP payments for health.

This is a macroeconomic study considering the health financing perspective to examine the determinants of OOP payments for health expenditure in Nepal. Obviously, at the macro level, health expenditure patterns are heavily influenced by the broader economic variables that shape demand for healthcare services. Essentially, the health demand modelof Getzen (2000) posits that national income and external income sources like remittances increase household purchasing power, thereby influencing the capacity to pay for healthcare services directly. Likewise, inflation, captured through the Consumer Price Index (CPI), affects the real value of income and the cost of healthcare, while the unemployment rate reflects income insecurity and income constraint.

Welfare economics theory emphasizes the equity and efficiency implications of high OOP payments for healthcare, which often indicates inadequate financial risk protection and regressive health financing systems (Wagstaff & Van Doorslaer, 2003; Xu et al., 2003). Essentially, high OOP payments for health result in catastrophic health expenditure that pushes the larger population below the poverty line. Therefore, these theoretical lenses provide a holistic macroeconomic framework for analyzing how economic factors affect the burden of OOP health payments in low-income and middle-income countries like Nepal. Under public finance theory, Musgrove (1996) laid out strong theoretical and empirical insights into how countries finance healthcare system, including the role of OOP payments for healthcare, government expenditure, and insurance. Therefore, the theoretical model that posits demand for healthcare as reflected by OOP payments healthcare is a function of national income, where people make choice between the health goods and other necessities given the resource constraints. In this regard, the generalized form of theoretical framework may be stated as the OOP payments for healthcare is determined by per capita GDP, remittance inflow, inflation rate, unemployment rate and vector other control variables such as policy reforms, internal and external shocks and so on.

2.3.2 Empirical Review

This section discusses entire empirical literature as international review and national review. The findings of empirical study underscore the complex interplay between macroeconomic factors, social factors, demographic factors, inflation rate and OOP payments for healthcare which emphasizes the need for tailored policy interventions to mitigate financial barriers in accessing healthcare services (Aregbeshola, et al.,2018; Ke et al., 2011). The empirical literatures are summarized subsequently.

International Review

In health economics literature, the high level of OOP payments for healthcare to total health expenditure (THE)has always been the major concern within the realm of health economicsacross the globe. The World Health Organization (WHO) defined catastrophic health expenditure, if OOP payments for healthcare exceeds 40 percent of household incomes, then it indicates to vicious circle of poverty. The affected households are forced to reduce other necessities including child education.

GDP per capita and OOP Payments for Health

The effect of GDP per capita on OOP payments for health is significant, particularly in developing countries. Previous empirical studies have indicated that as GDP per capita increases, OOP payments tend to rise, implying greater healthcare access but also financial burdens on households.Musgrove et al. (2002) findings showed GDP growth as significant driver of OOP payments for heal. In addition, Clement et al. (2004) explored the GDP growth responsive to private health expenditure using the time series data spanning from 1960-1997 for 22 OECD countries. The study estimated elasticity greater than unity, implying that private health expenditure as a luxury.Yildirim et al.(2011) and Muhammad andSyed (2012) findings indicated OOP payments for health is the function of income, age, level of education of economic units including other control variables.

Muhammad and Azam (2012) examined socio-economic determinants of household OOP payment for healthcare in Pakistan andconcluded that economic status including other variables are significant positive predictors of OOP payments for healthcare. Savedoff et al. (2012) concluded that OOP payments share from total health expenditure is influenced by country's fiscal capacity.

Keegan et al. (2013) study found contrasting results than others. They tested the responsiveness of OOP payments for healthcare to related macroeconomic variables and found contrasting result and concluded that OOP payments for healthcare is insignificantly related GDP growth and unemployment rate. Imlak and Shabda (2016) examined the OOP payments for healthcare expenditure in the south Asian countries by comparing per capita health expenditure differences for the period of 19 years from 1995 to 2013 for South Asian Countries and found the final household expenditures as the percentage of GDP as the key determinant of OOP payments for healthcare.

World Health Organization (2019) survey estimated healthcare expenditure of 51 Lower Middle Income Countries (LMIC). The study estimated 13-32 per cent share of healthcare expenditure of total monthly income. Similarly, Łyszczarz and Abdi (2021) found disposable income positively associated with OOP health expenditure including other variables. Additionally, Bedado et al. (2022) explored the OOP health payments as function of level of income including other variables.

Remittance Inflow and OOP Health Payments

The effect of remittance inflows is significant on OOP payments for health, particularly in developing countries. Empirical literature indicates that remittances can enhance OOP payments for healthcare. Acosta et al. (2007) examined several effects of remittance on household expenditure including healthcare expenditure. They asserted that remittance relaxes the credit constraints of households that creates space in healthcare expenditure and concluded positive effects on healthcare and education expenditure.

Jorge (2008) concluded that the absence of financial protection, households are significantly to suffer from catastrophic healthcare expenditure. Kalaj (2015) conducted a study on impact of remittance on household health expenditure in Albania. The study found a significant positive impact of remittances on household health care expenditures. In other words, there is a positive correlation between remittance received by households and health care expenditure.

Al Kabir et al. (2018) investigated remittance and healthcare utilization patterns in Bangladesh. Their study found mixed effects of remittance in long-run and short-run in Bangladesh. The findings concluded that remittance inflow and health indicator have positive and significantrelation in the long-run but the relation is insignificant in the short run. Similarly, Khan et al. (2021) examined the effect of remittances on healthcare expenditure in Pakistan and concluded that remittance inflow contribute to health expenditure and better health outcomes in Pakistan.

Effect of Inflation on OOP Payments for Health

The effect of inflation on OOP payments for healthcare is significant, particularly in developing countries where households often rely heavily on OOP payments for health. Obviously, inflation exacerbates the financial burden of health care to individuals. In this regard, Newhouse (1992) and Newhouse (1993) discussed the effect of inflation on healthcare service access cost and postulated that medical CPIs that are commonly associated with price indexes and have effect on healthcare utilization. Intuitively, inflation is associated with the higher OOP payments for healthcare. In addition, Reichert and Cebula (1999) examined the effect of inflation on private health expenditure and empirical verification and increased private healthcare access cost. Smith et al. (2009) also discussed medical price inflation and its effect on healthcare access cost.

Effect of Unemployment on OOP Payments for Healthcare

The relationship between level of unemployment and OOP payments for healthcare is complex and influenced by macroeconomic conditions. Intuitively, unemployment reduces disposable income, which in turn can constrain their ability to afford healthcare services. In this regard, Grossman (1972) postulated that health is both a consumption and an investment good, and maintaining or improving health requires resources. Obviously, the capacity to spend on health for unemployed people will be reduced given the income constraint. However, this reduction in health expenditure may not necessarily reflect a lower need for care; rather it leads to a forced reduction in utilization because of financial constraints given the preference for other survival stuff for families.

The empirical studies have indicated that rising unemployment can lead to decreased willingness to pay for OOP payment for healthcare, particularly during economic downturns. This overview of this section explores the effects of unemployment on OOP payments from various macroeconomic perspectives. The study of Hughes and Khaliq (2014) explored how various macroeconomic conditions, including unemployment, could impact healthcare decisions among employed individuals. It suggests that during economic downturns, OOP payments for healthcare may increase due to prioritizing essential healthcare over other expenses, potentially due to job loss. In other words, unemployment or the threat of job loss can heighten this effect leading to altered care decisions and possibly higher OOP payments to maintain health security amid risk of economic uncertainty.

Grigorakis et al. (2018) study indicated that higher unemployment rates tend to increase OOP payments for healthcare. It can be inferred that unemployment reduces household incomewhich limits access to employer-sponsored health insurance and forces individuals to cover healthcare costs themselves. Likewise, another study of Grigorakis et al. (2022) also found the significant impact of unemployment on OOP payments for healthcare, highlighting that higher unemployment rates could lead to an increase in OOP payments for health.

Based on their study of 60 countries' financial crisis of 20008, Zheng et al. (2020) underscore that economic recessions often reduce individuals' willingness to make OOP payments for healthcare. They also suggested that the financial crisis significantly reduced their willingness to pay for healthcare. Moreover, the study underscored that the impact of unemployment on OOP payments varied by countryinfluenced by healthcare systems and level economic development.

National Review

The aim of the review is to gain insight about the macroeconomic including other potential drivers of OOP health payments in Nepalese context. The OOP payments for healthcare services remain the primary financing source in developing countries like

Nepal, causing financial hardship for poor individuals and those needing long-term treatment. The National Health policy (2019) was implemented to harmonize the healthcare delivery system in the federal system of government. This is essential to fulfil the aspiration of people as per the Constitution of Nepal (2015) that envisioned basic healthcare as a fundamental right of its citizens. To cope with these facts, new national health policy was essential to coordinate various types and tiers of healthcare delivery management.

Rous and Hotchkiss (2003) investigated the determinants of OOP payments for healthcare using cross-sectional data of Nepal and estimated income elasticity of health as1.10. Acharya et al. (2010) explored Nepal's regulatory mechanisms for healthcare, including healthcare financing, service delivery, and quality assurance. Additionally, the paper examined initiatives to improve service delivery, such as decentralization, strengthening primary healthcare facilities, and public-private partnerships. The study emphasized the importance of effective regulatory mechanisms in ensuring equitable access to quality healthcare services and addressing systemic challenges. Further research is suggested to assess their effectiveness and identify areas for improvement.

WHO (2010) study report asserted that governments can design variety of channel for health financing and reducing OOP health payment burden. Likewise, Gupta and Chowdhaury (2014) studied OOP payments for healthcare in Nepalrevealing a sevenfold increase in nominal terms between 1995-2011. The study found that poorer households incurred catastrophic health expenses, with 13 percent of households incurring such expenditure in 2010-2011. The study also concluded that the health-financing system in Nepal has become regressive, with the share of the bottom quintiles facing catastrophic burden increasing by 14 percent between the two periods.

WHO (2015) underscored that Nepal's total expenditure on health is 5.8 percent of GDP for FY 2014/15. According to the Fifth Household Budget Survey Report of Nepal (2014/15), household health expenditure is NPR 819 which is 3.13 percent of total household expenditure (Nepal Rastra Bank, 2015). Similarly, Adhikari et al. (2016) estimated NPR 4,322 as OOP health payments which was 2.7 percent of non-food expenditure in Kaski District of Nepal and claimed that the OOP payments for health treatment isa major barrier in healthcare utilization. The study focused on calculating OOP payment for neonatal health care in Kaski district of Nepal and found that the mean OOP payment of neonatal healthcare was NPR 4,322 which was 2.7 percent of total non-food expenditure.

Pandey et al. (2016) underscores that if OOP payments for healthcare are not pooled and risk sharing is not shared among wider groups, it can create financial hardship for poor households. Therefore, UHC is crucial in resolving the OOP payments for healthcare due to financial protection unavailability.WHO (2017) asserted that Universal Health Coverage(UHC) would be far cry if the issue of OOP payment is not addressed.

World Health Organization (2019) study estimated the household OOP payments for healthcare as 57.90 percent of current health expenditure. Likewise, household OOP payments for healthcare per capita was USD 30.84.Thapa and Pandey (2021) conducted a study to explore determinants of Nepal's catastrophic health expenditure and the study revealed key determinants such as household size, literacy status, consumption quintile, urban or rural residence, illness type, and health facility type. The findings suggested that the government should implement equity-oriented strategies to prevent catastrophic health expenditure and impoverishment.

The Ministry of Population and Health (2023) mentioned that household OOP healthcare expenditure was 57.9 percent of current health expenditure (CHE) which is NPR 99,343.6 million in the FY 2018/19 and it is estimated to be 54.2 percent of CHE which is NPR 109,711.1 million in the FY 2019/20. Evidently, OOP payments for healthcare was the main fund in Nepal's health system. Moreover, per capita OOP health payment was NPR 3,642 for FY 2-18/19. The figure gives OOP payments for healthcare as a pressing matter in the Nepali context. As a remedy, the concept of UHC has been proposed as an ideal mechanism to ensure accessibility, affordability, quality, and inclusiveness in the healthcare system (Pandey, 2023; NHRC, 2022).

By critical review of the existing body of all category of literature explicitly in a macroeconomic perspective, the researcher has gained better insights regarding the factors associated with the OOP payments for health. In other words, the critical review helped to grasp world view regarding the potential factors associated with the OOP payments for healthcare. Moreover, the international empirical findings highlight complexity and sometimes contradiction in the relationship between macroeconomic variables and OOP payments for health, underscoring the need for tailored, country-specific analysis. Similarly, literature indicates that variables like GDP per capita and unemployment are significant determinants of OOP payments for healthcare.Some research suggests that the growth rate of OOP payments for healthcare is not importantly influenced by variables like GDP and the unemployment rate. This divergence emphasizes that the impact is conditional on the country's specific healthcare system and level of economic development.

Furthermore, unemployment and financial constraints are also critical aspects. The relationship between unemployment and OOP payments for healthcare is particularly complex. Intuitively, unemployment reduces disposable income, limiting the ability to afford healthcare. However, findings also indicate that higher unemployment rates are likely to increase OOP payments for healthcare. It can be inferred that job loss limits access to employer-sponsored healthcare insurance or forces individuals to prioritize essential healthcare expenditures amid economic uncertainty. The national data unequivocally demonstrates the urgency of addressing OOP payments in Nepal, where household OOP payments for healthcare constitute about 60 percent of current health expenditure (CHE). Essentially, this high reliance on OOP payments runs directly counter to the goal of Universal Health Coverage (UHC), which is asserted to be a "far cry" if the issue of OOP is not resolved.

Similarly, the critical analysis reveals that while the literature has effectively established the micro-level (household) determinants of OOP and catastrophic health expenditure in Nepal, and confirmed the detrimental magnitude of OOP payments for healthcare, there remains a gap in comprehensive macroeconomic modeling specifically for Nepal. Obviously, this demands a rigorous macro-level investigation. Hence, the study aims to employ a macroeconomic approach considering the health financing perspective to examine the determinants of OOP payments for healthcare. The conceptual framework is the function of per capita GDP, and remittances, including other control variables inflation, and unemployment, as the navigation of the study path to arrive at a logical conclusion. Obviously, this demands a rigorous macro-level investigation of the topic.

The primary research gap is the lack of robust, unified econometric modeling in the Nepali context that simultaneously assesses the complex, multi-directional influence of core macroeconomic determinants (GDP, remittances, inflation, and unemployment) on national OOP payments over time. Almost all existing national findings tend to be descriptive of trends or focus on household-level financial hardship. However, the study is inherently a macroeconomic study considering the health financing perspective to examine the determinants of OOP payments for health expenditure in Nepal. The central theoretical framework posits thatOOP payments for healthcare is a function of GDP per capita including a vector of other variables of interest. These control variables which include remittances, inflation (CPI), and the unemployment rate are variables that operate and evolve over time, requiring a modeling approach that accounts for their historical influence and lagged effects.

Moreover, the literature also acknowledges that the level of OOP payments is influenced by dynamic macroeconomic conditions such as GDP, inflation, unemployment, remittance inflow, and so on. Intuitively, macroeconomic factors like recessions which reduce individuals' willingness to make OOP payments for healthcare, while unemployment can paradoxically increase OOP payments over time due to limited access to employer-sponsored insurance, suggest that the full impact of these variables involves complex adjustment periods and lags. Therefore, a time-series model, particularly ARDL framework is essential for capturing such trends and providing insight into whether current changes in macroeconomic conditions like GDP growth or inflation will have only a temporary impact on OOP payments healthcare or will lead to a permanent, long-run change in the health financing structure.

2.4 Review of Literature on Health Outcomes

In health economics, health outcomes are critical indicators used to measure the impact of health expenditure. In this regard, Ahangar et al. (2018)argued health outcome is the function of economic growth and development both.Moreover, substantial allocation resources in healthcare sector and its better utilization are central to ensuring the optimal use of limited resources to achieve desirable health outcomes (WHO, 2020). Therefore, health encompasses not only mental and physical well-being but also physical metrics measured in terms of key health outcomes such as life expectancy at birth and IMR per 1000 live births reflecting overall effectiveness of the healthcare system meant for national welfare (Yanful et al., 2023).

Improved health outcomes underpin the formation of robust human capital, which is a fundamental driver of national economic growth and development (Currie, 2009; Grossman, 2000). In this context, there are different types of health outcomes. It can be discussed in multiple perspectives. These health outcomes are termed as physical health outcomes, patients reported health outcomes, mental health outcomes and so on. In this regard, physical health outcomes reflected life expectancy at birth, morbidity rates, and mortality rates (Murray & Lopez, 2017).

Patients reported health outcomes that include subjective reports of their health status and lively experience with the available healthcare service (Black, 2013). Likewise, mental health outcomes that focus on mental wellbeing have received growing attention in recent years (Lund et al., 2018). Moreover, clinical outcomes include recovery rates, the effectiveness of specific treatment and health status of patients after hospital discharge (Black, 2013). These outcomes reflect various aspects of the health status of individuals based on micro perspectives. Addressing this context, the current study has adopted a macroeconomic perspective to analyze the determinants of population health outcomes.

Moreover, analysis of the impact of healthcare expenditure on population health outcomes, the selection of appropriate and representative indicatoris crucial to capture both the quantity and quality of life within a population. Among the many available health indicators, longevity and infant death are two of the most widely accepted and policy-relevant measures (Murray & Lopez, 2017). Essentially, the current study is also focused on physical health outcomes particularly, LEB and IMR per 1000 live births from macro perspectives.

Nepal has made substantial investments in maternal and child health, including free delivery services and expansion of immunization coverage, which are directly and simultaneously captured by the changes in LEB and IMR per 1000 live births. In other words, improvements in LEB reflect broader health system strengthening, economic development, and public health interventions over time. Therefore, the focus of review of related literature is physical health outcomes particularly, LEB and IMR per 1000 live births. Therefore, effective health system management requires substantial healthcare investment, as better health outcomes contribute to the formation of productive human capital, which is essential for sustained economic development (Kruk et al., 2018; Coovadia, 2009). In nutshell, understanding the determinants of healthcare expenditure patterns and health outcomes is vital for resource optimization and evidence-based policymaking.

2.4.1 Review on Factors Influencing Life Expectancy at Birth

This section summarizes literature on socioeconomic determinants of LEB based on the study carried out across the world including Nepal. The central thrust of the literature review is to get answers on macroeconomic, social, and demographic determinants of LEB in Nepal. Therefore, the main variables of interest are GDP per capita, per capita government health expenditure, health human resource density in the government healthcare system, and level of education as the possible determinants of life expectancy at birth. The summary of the review presented as theoretical review is categorically presented under national and international review respectively. In this regard, scholars such as Wirayuda et al. (2022) and Balkhi et al. (2021) argue that population health status and life expectancy are influenced by the combination of socioeconomic, demographic, and political factors.

2.4.1.1 Theoretical Review

In health economics, LEB is a crucial indicator to analyze the productivity of the labour force in a country and gauge overall quality of life. Essentially, LEB is considered as one of key health outcomes and a major indicator of human development as well. In this regard, longevity is regarded as the ultimate objective of human beings based on the research (Colantonio et al., 2010; Ali, 2015). Theoretical literature asserts that bi-directional relationship lies between population health outcome and economic development. It implies that longevity as health outcome is central component of overall development and human beings thrives for longer,and high quality life. Therefore, living longer and having healthier conditions have become a common aspiration of human society (Lei et al., 2009).

Health capital theory postulates that human health is to be regarded as human capital goods (Teixeira &Queiros, 2016). Its stock increases with healthy life style choice and medical treatment and depreciates with age (Schneider-Kamp, 2021). Moreover, economic resources significantly influence access to healthcare services, preventive measures, and nutritious food, which directly impact life expectancy at birth. Similarly, positive externalities, such as education and individual income flow, further enhance health capital. This perspective underscores the importance of economic resources and investments in shaping health outcomes and improving life expectancy at birth (Schneider-Kamp, 2021). In fact, Grossman (1972) model is regarded as the root of this theory which posits that treating human health is capital that can depreciate over time but can be maintained or improved through investment in medical care, lifestyle choices, and healthy behaviors.

Preston’s (1975) work is a seminal contribution to health economics in showing income-health relationships. The work identified a positive, non-linear relationship between national income per capita and LEB. Moreover, thepopulation health status improves as a country's income increases, and these gains are most substantial for low-income countries and flatten out significantly at higher income levels. Therefore, health outcomes including life expectancy at birth is influenced by the macroeconomic, socio-demographic, healthcare institutional capacity, policy variables and other control variables. In nutshell, this shows a relationship between economic development and health outcomes, showing that life expectancy improvements can occur independently of economic growth due to advancements in medicine and public health.

The endogenous growth theory postulates that healthier populations can contribute to more robust and sustained economic progress by integrating health improvements and increased life expectancy into models of economic growth (Romer, 1986; Lucas, 1988; Leung & Wang, 2010).This theory emphasizes the effect of political institutions and governance on life expectancy through shaping healthcare policies, economic stability, and social services. This theory argues that the countries with inclusive institutions tend to provide better healthcare services and thus have higher life expectancy (Acemoglu & Robinson, 2012).

Theoretical literature underscores that the economic, social, and policy factors affect life expectancy at birth. Evidently, economic growth emerges as a critical determinant, with higher GDP per capita generally associated with increased life expectancy through improved living standards, healthcare access, and nutrition intake. Similarly, public health expenditure and better public healthcare infrastructure are instrumental for enhancing population health outcomes. macroeconomicconditions are also crucial to adopt healthier behaviors and utilize healthcare services more effectively which together contribute to longer lifespans. Thus, the relationship between macroeconomic factors and life expectancy is multifaceted emphasizing the need for holistic policies formulation and implementation that can balance economic growth with equitable access to education and healthcare, enhanced longevity. To sum up, this study adopts Grossman’s model of human capital production framework (1972) to analyse the determinants of LEB. Likewise, it also adopts Preston's(1975) curve hypothesis to observe nonlinear relation of national income with life expectancy at birth. To sum up, health outcomes (e.g. life expectancy at birth), in any country is influenced by vectors of macroeconomic variables, vectors of demographic and social variables and vectors of other control variables respectively. Moreover, vectors of macroeconomic variables may be GDP growth, government health expenditure and so on.

2.4.1.2 Empirical Review

The empirical literature review aimed to have insight on the macro determinants of LEB is based on recent research work of scholars around the world. Several research works have been conducted around the world to identify economic, social and demographic determinants of LEB. They have been presented in the following section.

International Review

This section summarizes the empirical literatures within themes on the determinants of LEB as function of GDP per capita, per capita government healthcare expenditure, health human resources density in government healthcare system, infant mortality rate, and fertility behavior.

GDP Per Capita and Life Expectancy at Birth

The relationship between GDP per capita and LEB is a critical area of study. It reveals how economic factors influence health outcomes of any country. Empirical research indicates that higher GDP per capita correlates with increased life expectancy, but this relationship is nuanced by several factors. The Preston Curve shows the empirical relationship between a country's income level particularly GDP per capita and LEB (Jetter et al., 2019). Pritchett and Summers (1996) highlighted the significant role of economic resource endowment influencing health outcomes, with wealthier nations experiencing better health and longer life expectancy. In other words, higher income levels lead to significant improvements in health outcomes, such as better access to healthcare, improved nutrition, higher living standards, and better sanitation and education which are key determinants to longevity.

Strauss and Thomas (1998) explored feedback effect between health expenditure and economic growth asserted that investing in health and nutrition is crucial for long-term economic growth that can enhance human capital and address health inequalities contributing to longevity. Deaton (2003) found a strong correlation between higher income levels and better health outcomes, particularly in reducing mortality rates and increasing life expectancy. However, this relationship is complex and may be influenced by social policies and public health interventions.

Cutler and Lleras-Muney (2006) underscored that the high income countries including USA observed unprecedented decline in infant death and upsurge in longevity argued, reflecting that income growth is instrumental for better health outcomes via different channel. Lei et al. (2009) asserted that quality health is end goals overall development of human society and income is key to pursue healthcare and longevity. Similarly, empirical studies have also demonstrated that healthcare expenditure influences health indicators including life expectancy (Baltagi & Moscone, 2010; Anyanwu & Erhijakpor, 2009).

Lin et al. (2012) findings revealed that longevity in least developed countries over a time is associated with economic, social and political actors. In other words, socioeconomic and political determinants contributed 54.74 percent to 98.16 percent of the life expectancy gains. Bilas et al. (2014) conducted a study to explore the determinants of life expectancy at birth and estimated the income growth as a major contributor of longevity.

Sede and Ohemeng (2015) found per capita income including other variables as determinants of life expectancy.Delavari et al. (2016) conducted a study to estimate the factors affecting Life Expectancy at Birth using time series data of Iran from 1985 to 2013. Their findings indicated that GDP per capita including other variables have positive and significant statistical effects on LEB. Jetter et al. (2019) found GDP per capita growth as a major factor contributing life expectancy at birth with more than 64 percent explanatory power. Their study are align with Preston Curve hypothesis.

Miladinov (2020) examined the effects of the socioeconomic development on life expectancy at birth or longevity in five EU accession candidate countries; Macedonia, Serbia, Bosnia and Herzegovina, Montenegro, and Albania. The study findings suggested that higher the GDP per capita and lower the infant mortality rate and this lead to higher life expectancy at birth. Likewise, Wirayuda and Chan (2021) conducted systematic review and the findings revealed GDP of the countries including other variables contribute to life expectancy. Jafrin et al. (2021) employed panel data estimation methods for selected SAARC countries to identify the determinants of longevity and found GDP growth, gross fixed capital formation, information and communication tool access and penetration as contributor for longevity.

Wirayuda et al. (2022) examined the macroeconomic, social, demographic and health status and resources factors associated with longevity in Oman using data spanning from 1978 to 2028. The findings indicated that the selected variables such as macroeconomic, social, demographic and health status and resources factors are significantly and directly associated with longevity in Oman for the study period. Additionally, Wirayuda et al. (2023) conducted the study of the effect of macroeconomic, social, demographic and health status and resources factorson longevity in Bahrain using the data spanning from 1971 to 2020 of Bahrain. Their results showed that macroeconomic factors and health status factors and resources factors have significant direct effects on life expectancy of Bahrain.Kaur (2023) explored long-run causal relationship between health expenditure and health status using the data spanning from 1981-2026. The findings indicated the long-run relationship between health expenditure and health outcomes including longevity. Additionally, the study explored causality from health expenditure and GDP growth to infant death and longevity.

Government Healthcare Expenditure and Life Expectancy at Birth

The relationship between government health expenditure and LEB is significant, as evidenced by various empirical studies across different countries. Essentially, increased government healthcare expenditure is associated with improved health outcomes, including higher life expectancy. Sede and Ohemeng (2015) examined the socio-economic determinants of life expectancy in Nigeria using data from 1980-2011. They used government expenditure on health, per capita income, secondary school enrolment, unemployment rate and the Naira foreign exchange rate as a socio-economic variables proxy. They found that government expenditure on health was highly effective in determining life expectancy of developing countries which were not significant in the case of Nigeria.

Shahbaz et al. (2016) investigated the determinants of life expectancy in the presence of economic misery using Pakistan’s time series data over the period of 1972-2012 using ARDL bound test approach for time series analysis. Their times series analysis findings confirmed co-integration between government health expenditure and food supply directly contributed to life expectancy. Similarly, Istihak et al. (2019) conducted a study to estimate the health production function for the south Asian countries based on balanced panel data of seven South Asian countries for the period of 1995-2015 using data of World Development Indicator 2017. The empirical results revealed that health expenditure per capita, education, access to improved water sources and urbanization had statistically significant positive impacts on life expectancy.

Balkhi et al. (2021) study assessed impact of health expenditure on health outcome and claimed the significant positive relationship between health expenditure and longevity in MENA region. Kaur (2023) explored the causal link between government health expenditure, health status, and economic growth in India and found a unidirectional causality between government health expenditure and health outcome such as LEB and infant mortality rate. Similarly, Roffia et al. (2023) showed the influence of per capita health-care expenditure on LEB including other variables. Moreover, the study also confirmed overall government healthcare system and government health expenditure for longevity.

Health Human Resources and Life Expectancy at Birth

The provision of health human resources in the government healthcare system with respect to a certain ratio of population is called government health human resource density. The healthcare human resource provision in the government healthcare system plays a critical role to improve health outcomes including LEB as revealed by various studies. In other words, effective mobilization of healthcare resources, particularly human capital, is crucial for improving health outcomes and longevity. Nguyen et al. (2016) underscore the importance of a robust health workforce as a determinant of health outcomes including LEB which advocates for better workforce strategies to achieve improved public health outcomes. Jaiyesimi et al. (2021) also postulate that the effective healthcare human resource provision significantly contributes to increased LEB by enhancing healthcare delivery systems.

Anwar et al. (2023) investigated government health expenditure and health outcome nexus in OECD countries. The study revealed that health expenditures negatively impacted infant mortality, while income, doctor number, and air pollution positively affect life expectancy. It suggested that proper utilization of health expenditures, policy improvements, and economic and environmental measures were crucial for long-lasting health outcomes. Likewise, Roffia et al.'s (2023) study showed the positive influence of physician density, hospital bed density on LEB. In addition, Anand and Bärnighausen (2004) postulated that health human resources ensure proper vaccination there by fall in IMR and in turn it contributes to increase in LEB.

Infant Mortality and Life Expectancy at Birth

The influence of IMR per 1000 live births on LEB is critical for understanding population health outcome dynamics. Empirical research indicated that lower IMR is associated with the higher LEB which reflects overall improvements of health outcomes. In this context, Rabbi (2013) concluded that a high IMR results in lower life expectancy at birth, compared to age one, indicating an inverse correlation between infant mortality and life expectancy at age one.

Miladinov (2020) examined the relationship between status of socioeconomic development and life expectancy at birth using cross-country empirical data for European Union Accession countries. The findings show that higher income levels, and better institutional quality including other factors are strongly associated with longer life expectancy at birth. Moreover, the findings also highlight that economic growth alone is insufficient to improve health outcomes unless accompanied by broader socioeconomic development, thereby supporting the standpoint that health outcomes are closely linked to the overall development process rather than being merely a byproduct of national income growth.Wirayuda and Chan (2021) study findings revealed sociodemographic factors, infant mortality rate, literacy rate, education level, that all have a significant impact on life expectancy based on the time series analysis using data spanning 2004-2019.

Anwar et al. (2023) investigated government health expenditure and health outcome nexus in OECD countries. Their study revealed that health expenditures negatively impact infant mortality, while income, doctor number, and air pollution positively affect life expectancy. It suggests that proper utilization of health expenditures, policy improvements, and economic and environmental measures are crucial for long-lasting health outcomes. Similarly, Roffia et al. (2023) study confirms the importance of health care expenditure and system metrics in determining life expectancy while highlighting the mutual influence of social factors. The study advised policymakers to consider these relationships when allocating public funds, especially in light of the COVID-19 pandemic.

Relation between Total Fertility Rate and Life Expectancy at Birth

Tehsin et al. (2017) study examined the macro-economic factors affecting fertility rates in Pakistan utilizing the data spanning from 1971 to 2014. Based on the VECM model and ARDL technique to analyze short-run and long-run associations, they emphasized that the government should increase secondary school enrollment to reduce fertility and improve life expectancy. Chen (2015) analyzed global trends in TFR and its association with national wealth, life expectancy, and female education, highlighting the significant interconnectedness of these factors.

Poot and Siegers (2001) discussed that the falling fertility leads to demographic shifts that favour investment in education and health, which eventually leads to indirect raising life expectancy. This analysis shows causal mechanisms from TFR to LEB through economic and policy feedback channels such as fiscal space for health. It can be inferred that lower fertility improves maternal and child health, increases health investment per child, reduces health system burden, and eventually increases adult life expectancy. The conclusive insight of the literature is that fertility and life expectancy both significantly affect economic performance. In other words, fertility decline contributes to gains in life expectancy via better resource allocation and contributing to educational attainment.

The central thrust of the review was to identify possible socio-economic, demographic and institutional factors associated with the LEB in macro perspectives. The researcher conducted a literature survey on life expectancy determinants, identifying GDP per capita, healthcare expenditures, demographic factors, and healthcare delivery personnel. However, there is limited research on life expectancy determinants in Nepal from a macro perspective. Empirical literature review on determinants of LEB provided researchers to identify some macroeconomic, demographic, and healthcare facility and healthcare delivery infrastructure factors as possible determinants of LEB in Nepalese context.

By reviewing the theoretical and empirical literature critically to examine the macroeconomic, socio-demographic and institutional factors associated with the life expectancy at birth in the global context, the researcher has gained valuable insight for completing the current study in Nepali context. Moreover, the review highlights a declining trend over a time associated with the improvements in the level of income, increase in government health expenditure, improvement in education and healthcare access, and fertility reduction. Moreover, institutional influences such as policy reforms and investment in health infrastructure are often ignored or treated as fixed effects. The empirical studies are found to be ignored the per capita GDP threshold effect on life expectancy at birth.In other words, factors such as macroeconomic growth, government health expenditure, reduced IMR and fertility decline are often analyzed in isolation, failing to capture their combined and dynamic effects. The current study addresses this gap by integrating macroeconomic, demographic, social, and institutional variables within a unified time series framework. This provides better reflection on the complex nature of health outcomes in terms of LEB in Nepal. Likewise, the current study employed a Two-Stage Least Squares model, which strengthens the analysis by addressing endogeneity bias that often arises when estimating the determinants of life expectancy in the presence of IMR in the model. This approach offers deeper insights into how structural, social, and institutional dynamics interact over time to influence life expectancy, filling a critical evidence gap for long-term health policy planning. It also accounts for threshold effect of per capita GDP on life expectancy at birth.

2.4.2 Review on Factors Influencing Infant Mortality

The researcher seeks insights from scholars worldwide, focusing on factors associated with the rate. While there may be contextual differences between Nepal and the rest of the world, and research philosophical guidelines are necessary to converge on the central idea. This provides an ontological, epistemological, axiological, and methodological foundation for the dissertation, identifying the knowledge gap and contributing to the existing body of knowledge.

2.4.2.1 Theoretical Review

Theoretical review is concentrated to analyze the economic conditions, social context, demographic trend, policy reforms including other control factors influencing infant deaths around the world and the use of empirical and evidence based knowledge from the existing scholarship to carry out study in Nepalese context. The infant death is regarded an important measure of population health outcome in the realm of health economics (Reidpath & Allotey, 2003). Furthermore, IMR is one of the most important components in Sustainable Development Goals as set United Nations. This is the reason why; trend of infant death is also considered as a crucial indicator for assessing the population health status. Theories have been developed and postulated that socioeconomic factors have a significant effect on infant death rate in all development levels of countries around the world. Therefore, within the realm of health economics infant death is directly linked with health human capital formation process.

Social Determinants of Health (SDH) suggests that the conditions in which people are born, grow, live, work, and age shape their health outcomes. Social Determinants of healthTheory examines how factors like income, education, and social environment impact on health including infant death rate(Williams et al., 2023). Moreover, this theory underpin that health outcomes are determined by the birth status, growth process, life styles choice, working environment, and aging of an individual as part of society. This theory postulates that income, education, occupation, age of mothers impacting mortality rates significantly at both macro and micro levels(Lee et al., 2018).

Economic determinants of IMR are multifaceted and encompass various socioeconomic factors, and national policies. Several researches have indicated that income inequality and maternal education significantly influence infant mortality rates across different contexts. Higher income is associated with lower IMR (Tang, 2019; Pabayo et al., 2019). Therefore, we can conclude that socioeconomic status and income level of parents also impacts IMR. It can be inferred that better socio-economic status lowers the IMR and vice versa.

Environmental determinants of infant mortality include a range of factors such as poor environmental quality, socioeconomic status, and available community health resources. The studies (Genowska et al., 2015; Patel et al., 2018) have indicated that both environmental and social conditions significantly influence IMR across different contexts showing the need of targeted interventions. Moreover,environmental determinants of infant mortality include lower temperatures, poor housing conditions, and exposure to pollutants, particularly in peripheral urban areas, which correlate with higher neonatal mortality rates (World Bank, 2019). Therefore, infant deaths are influenced by economic, social and demographic factors that is evolving in the society.

The human capital theory postulates that investment in the children's health as a form of prenatal, postnatal care and vaccination can contribute to the quality of human capital including lower IMR for the future productivity of any society. Human capital is driving productivity and economic growth of an economy. Investment in human capital improves living standards, enhances human capital quality, increases productivity with increased life-span and reduces IMR (Ruggeri & Yu, 2023). In fact, human capital theory adopts the production function framework of analysis and estimates relation between target variables and its determinants.

Health Production Function is rooted in the Human Capital Theory that provides a theoretical foundation for analyzing how different socioeconomic inputs influence health outcomes of population including IMR. This was originally conceptualized by Grossman (1972) that treats health as a form of capital stock depreciating with age. Moreover, the health capital stock can be augmented through investments in medical care, nutrition, and healthy behaviors. Extending Grossman's microeconomic theory to the macroeconomic level, national health production is modeled using aggregate inputs such as per capita health expenditure, health human resource density, GDP per capita, education, and other structural factors. Likewise, this approach aligns with the neoclassical production function model in economics, where multiple inputs combine to produce an output. In this case, IMR, a key indicator of population health outcome, is an outcome variable. Therefore, this analysis is based on Grossman's theory. To sum up, health outcomes (e.g. infant mortality), in any country is influenced by vectors of macroeconomic variables, vectors of demographic and social variables and vectors of other control variables respectively. Moreover, vectors of macroeconomic variables may be GDP growth, government health expenditure and so on. The vectors of demographic and social variables may be life expectancy at birth, total fertility rate, mean years of schooling and so on. Finally, control variable may health human resource density and policy reforms.

2.4.2.2 Empirical Review

This section reviews the literature relating to economic, social, demographic, institutional factors influencing the infant death rate from the body empirical literature from international and national level study.

International Review

In the health economics perspective, IMR is regarded as a crucial metric of population health outcome, reflecting broader social and health well-being conditions. This review is a summary of the presentation focusing on the effect of GDP per capita, per capita government healthcare expenditure, health human resources in the government healthcare system, life expectancy at birth, TFR and mean years of schooling on IMR.

GDP per capita and Infant Mortality Rate

Generally, countries with higher GDP per capita tend to have lower IMR per 1000 live births due to better healthcare delivery systems, improved living standard, and better access to essential healthcare services.Schell et al. (2007) study found income growth, female education including others as significant factor influencing infant death rate based on the analysis of 152 countries of the world. Osakwe (2014)study findings indicate that the income growth, growth in public health expenditure as a percentage of GDP, prevalence of HIV and the participation of adult females in the labour force significantly affect infant death rate based on the data of 53 African countries spanning from 2000 to 2009. Furthermore, amongst explanatory variables used in the analysis, fertility rate and GDP per capita had the most impact on IMR respectively.

Subramaniam et al. (2018) carried out a study to identify the determinants of infant mortality in four South East Asian countries; Malaysia, Thailand, Indonesia and Philippines using Auto Regressive Distributive Lag framework of analysis. The estimated result indicated the evidence of long-run relationship amongst the variables infant death rate, level of education, female fertility, income and access to healthcare. They also found female literacy as main determinants of IMR in Malaysia, while access to healthcare matters for IMR in Indonesia, and to a lesser extent for the Philippines. In the error correction model, the speed of adjustment of IMR was comparatively low in the countries. Likewise, Monika (2018) findings indicated income growth as significant determinant of infant death.

Abbuy (2018) investigated the macroeconomic factors affecting infant death rate in selected countries based on the data spanning from 1980-2016. The panel data model revealed that female literacy, GDP per capita, public health expenditure, and urbanization significantly impact infant mortality rates. Higher female literacy, GDP per capita, public health expenditure, and urbanization were associated with lower infant mortality rates. The study highlights the need for further research on these factors.

Onambele et al. (2019) examined the changes and trends of infant death rate in European Union member 28 using the data spanning from 1994-2015. The study asserted that there is significant fall in infant death rate from 8.3 to 3.6 per 1000 live births during the study period with the significant contribution of institutional arrangement for healthcare delivery. Additionally, Tang (2019) found income, healthcare expenditure, female education, governance quality, and technological progress as the significant negative determinants of IMR in Malaysians. The study concluded that the improvements on these factors decreases IMR. The study further suggests that government policies aimed at improving these areas are crucial for reducing IMR in Malaysia. Kiross et al. (2020) asserted that increase in government health expenditure ensures better pre-natal and post-natal care and contribute to reduce infant death rate.But private health expenditure is not associated with infant death rate.

Sari and Prasetyani (2021) study estimated negative association between GDP growth and infant death rate based on the analysis of the data of ASEAN countries, indicating that rise in income ensures better healthcare and nutrition and contribute to reduce infant deaths. Likewise, Taramsari et al. (2021) found that the IMR was higher in countries with higher economic inequalities, which determine the social class as a major factor. They found that lower household income was associated with high IMR in societies. Bugelli et al. (2021) conducted scoping review of the literature published between 2010 to 2020 and concluded that the income, education, fertility, housing pattern to be the significant determinants of falling infant death rates.

Government Healthcare Expenditure and Infant Mortality Rate

Government healthcare expenditure plays a vital role in influencing IMR per 1000 live births. In this regard, several empirical studies have indicated that increased government expenditure on health can lead to significant improvement in health outcomes including reductions in IMR. Hu and Mendoza (2013) concluded that public health expenditure improves health outcomes significantly with the reduction in IMR. Osakwe (2014) examined the economic, social, and demographic factors associated with infant deaths in 53 African countries based on the data spanning from 2000 to 2009. The study finding indicated that GDP growth and public health expenditure as percentage of GDP significantly contributed to reduce infant death rate in the study area during the period.

Kiross et al. (2020) findings showed government health expenditure and infant deaths are inversely correlated.Likewise, Boachie et al. (2020) examined the effect of government health expenditure on infant mortality in low- income and middle-income countries. The study concluded that public health expenditure improved health outcomes significantly, as did the reduction in infant mortality. Similarly, Sari and Prasetyani (2021) study claimed that the healthcare delivery system, level of education, socio-economic inequality has causal linkage with infant death rate in ASEAN countries. Moreover, the study estimated negative association between economic growth and infant death rates.

Health Human Resource in Government System and Infant Mortality Rate

Health Human Resources in the government healthcare system play a critical role in reducing IMR by ensuring adequacy of healthcare services for both mothers and infants through better prenatal and postnatal care.Ananda and Barnighausen (2004) study claimed that health workforce density in government healthcare system significantly contribute to fall in infant death rates. Nguyen et al. (2016) found statistically significant evidence of the impact of health human resources such as density of doctors, nurses, midwives, and pharmacists on the reduction of infant deaths. Krishna (2016) observed the inverse relation between provision health human resource and IMR in India. To sum up, previous studies have indicated that improving the availability and quality of health human resources within government healthcare systems can significantly influence IMR by ensuring that healthcare services are accessible, equitable, and efficient.

Longevity and Infant Death Rate

In theoretical perspective, longevity is inversely associated with infant death rates. In other words, as life expectancy increases, infant mortality tends to decrease. Therefore, an increase in life expectancy reflects broader socioeconomic and healthcare improvements directly contributing to lowering the IMR. The transmission channel from life expectancy to infant mortality involves intricate links among the factors such as improved healthcare services, enhanced maternal and infant nutrition, economic development, strengthened public health infrastructure, and improvement in life expectancy at birth and reduction in IMR (Barua et al., 2022). Furthermore, the study of Miladinov (2020), and Ray and Linden (2020) also support the evidence of the effect of life expectancy at birth on IMR.

Effect of Education and Infant Mortality Rate

Education plays a critical role in reducing the IMR. Intuitively, educated individuals, especially mothers, are more likely to have better knowledge of child care, nutrition, hygiene, and healthcare practices, leading to improved infant care. In this regard, Schell et al. (2007) assessed the economic, and social factors associated with infant death rate using data of 152 countries. The study claimed that the per capita gross national income, public expenditure on healthcare female literacy are significant contributors to reduce infant death rates.

Victora et al. (2008) stated that undernutrition in early childhood can lead to stunted growth, reduced cognitive abilities, lower educational attainment, and chronic diseases in adulthood and low level of health outcomes. Primarily, undernutrition is the result of income poverty. The study emphasizes the long-term social and economic costs of undernutrition and calls for sustained investments in maternal and child nutrition. Likewise, Barrow and Lee (2013) study also found significant contribution of level of male and female education to reduce IMR based on the national level analysis.

Kabir and Maitrot (2017) found out that youthful mothers were exposed to complications during delivery hence high IMR. The study revealed that young mothers had a high rate of IMR as compared to older mothers who had their experience in motherhood and proper feeding in Dhaka slum. These factors assisted in evaluating the causes of IMR in the study locale. Abbuy (2018) investigated the macroeconomic factors affecting infant mortality in West African Economic and Monetary Union (WAEMU) countries from 1980-2016 and the study revealed that female literacy and urbanization significantly impact IMR.

Hossain et al.(2018) demonstrated that an infant born to an illiterate mother in Bangladesh had a higher possibility of dying within the first month of birth compared to mothers who had 12 years and above level of education. Similarly, the post-neonatal death rate was also higher in illiterate mothers than those who had simple formal education.Tang (2019) analyzed the factors associated with the infant death rates in Malaysia utilizing unbalanced panel data from 2001 to 2013. The study claimed that level of income, government health expenditure, female education, governance quality significantly contributes reduce infant death rates in Malaysia.

Aldirawi et al. (2019) found higher IMR with lower level education of mothers in Gaza strip. This demonstrated that mothers with lower levels of education had a higher risk of IMR than with the higher level of education. Therefore, the mother's education level is regarded as a significant predictor of IMR. Taramsari et al. (2021) examined the relationship between socioeconomic status and infant mortality, and their results showed that education and social and economic status of parents had a significant role in the decline in IMR.

Total Fertility Rate and Infant Mortality Rate

Yamada (1983) examined the causal relationship between fertility rate and IMR using time series econometric techniques and revealed that a decrease in fertility leads to a decrease in infant mortality, suggesting that fertility and infant mortality are jointly determined. Conversely, high fertility rates can perpetuate higher infant mortality due to resource constraints for maternal healthcare utilization. The research emphasized the importance of integrated health and economic policies in facilitating demographic transitions in these sectors.

Shimouchi et al. (1996) analyzed the data from 117 countries and found that fertility reduction starts when IMR per 1000 live births are reduced to a threshold level, mainly through increased contraceptive prevalence. Bloom et al. (2003) provided cross-country empirical evidence linking demographic variables including IMR and TFR and its implication for economic development. Based on the macroeconomic level, the study shows that reducing infant mortality leads to fertility decline, enabling demographic transition and economic growth.

Lawson et al. (2012) suggest that variation in fertility is a trade-off between offspring quantity and quality, with child survival being a key factor. The analysis of the result showed that higher fertility often correlated with increased child mortality, suggesting a quality-quantity trade-off in human reproduction. This study highlighted that in the circumstances with high child mortality, parents might opt for more children to ensure some survive, whereas in safer conditions, they invested more resources in fewer children, enhancing survival rates.Osakwe (2014) examined the factorsassociated with the infant death rate of 53 African nations using data spanning from the year 2000 to 2009. The study findings claimed that the economic growth rate and fertility rate contribute to reduce infant deaths in the African nations.

National Review

Khadka et al. (2015) examined the determinants of IMR in Nepal and claimed that the social and economic factors are associated with fall in infant death rates. Likewise, the population of the Far Western Region experienced higher IMR compared to the rest of the regions of the country. Therefore, socioeconomic distal and proximate determinants are associated with infant mortality in Nepal. Infant mortality was higher in the poor and middle classes than the wealthier classes. Acharya and Khanal (2015) revealed that higher income levels, maternal education, healthcare access, sanitation, and nutritional status were all significant determinants of IMR. They underscored that educated mothers are more likely to adopt health-promoting behaviors and provide better care for their infants, leading to lower mortality rates. Access to healthcare services, including prenatal and postnatal care, also reduces infant mortality. Improved sanitation facilities and clean drinking water are also linked to reduced infant mortality. Urban areas generally have lower IMR due to better healthcare infrastructure, higher education levels, and improved living conditions. The authors suggest an integrated policy approach, focusing on these factors to effectively reduce infant mortality rates, should be implemented.Lamichhane et al. (2017) claimed healthcare delivery system, breast feeding behavior are associated with infant death rates.

The comprehensive literature presented above provides the systematic description of the IMR per 1000 live births and its various determinants such as macroeconomic, socio-demographic, and educational factors in the countries around the world. The main thrust of the literature review was to get contexts and existing scholarship related to research questions such as; what are the socio-economic and demographic determinants of IMR per 1000 live births in Nepalese context? Most of the reviewed literature is related to microeconomic household surveys. Likewise, the literature review has given strong theoretical and empirical insights on the possible determinants of IMR per 1000 live births in Nepali context. In this regard, the researcher could not find any previous substantial work done in the Nepali context from a macroeconomic point of view. Thus, there is a knowledge gap in the context of macroeconomic determinants of IMR in the Nepali context. Therefore, the researcher has proposed GDP per capita, per capita government healthcare expenditure, health human resource per 10000 populations, life expectancy at birth, mean years of schooling, and total fertility rate as explanatory variables for predicting IMR per 1000 live births.

By reviewing the theoretical and empirical literature critically to examine the macroeconomic, socio-demographic and institutional factors associated with the infant mortality rate in the global context, the researcher has gained valuable insight for completing the current study in Nepali context. Moreover, the review highlights a declining trend over a time associated with the improvements in the level of income, increase in government health expenditure, improvement in education and healthcare access, and fertility reduction. However, most studies rely on descriptive, cross-sectional analysis and multi-country panel data analysis that fail to account for the complex, potentially endogenous relationships between infant mortality rate and life expectancy at birth, due to revers causality. Moreover, institutional influences such as policy reforms and investment in health infrastructure are often ignored or treated as fixed effects. The previous literature also ignored the threshold effect of GDP per capita on infant mortality rate.

The current study addresses these limitations by integrating GDP per capita, government health expenditure, education level, health, human resource density, and total fertility rate variables into a dynamic time-series framework. Moreover, the current study also included and estimated threshold effect GDP per capita on infant mortality rate. Essentially, this holistic approach allows for a nuanced understanding of the structural and policy-level determinants of IMR in Nepal. In methodological perspectives, the use of the Two-Stage Least Squares model within a time-series context enhances the study’s rigor by addressing endogeneity and reverse causality. By combining this robust estimation technique with a comprehensive variable set, the study provides stronger empirical evidence to inform Nepal’s health policy stakeholders to reforms aimed at further reducing infant mortality.

2.5 Research Gap

Despite a growing body of global literature on healthcare expenditure and health outcomes, substantial research gaps persist in the context of Nepal due to its unique macroeconomic structure, demographic transition, healthcare financing arrangements, and institutional capacity. Most existing studies provide fragmented evidence and are limited in their applicability to Nepal’s healthcare system and policy environment.

First, the previous studies have largely adopted a narrow analytical focus only focusing on fiscal variables overlooking critical supply-side and demand side factors such as human resource density for healthcare, OPD visit frequency, and policy intervention. As a result, the interaction between economic growth, healthcare system capacity, demand side factors and government healthcare expenditure remains insufficiently examined. This led to an incomplete understanding of expenditure dynamics and policy effectiveness.

Second, the previous research on OOP payments for healthcare in Nepal has predominantly relied on household micro-level and cross-sectional household survey data. They provide insight into the household financial burden, and fail to capture the longitudinal influence of macroeconomic conditions such as per capita GDP, remittance inflow per capita, consumer price index, and unemployment rate. As a result, the macroeconomic drivers of OOP payments for health and their long-run implication for financial protection and universal health coverage remains unexplored.

Third, the previous studies examined the macroeconomic and socio-demographic factors associated with the health outcomes such as life expectancy at birth and infant mortality rate often neglecting potential endogeneity, feedback effects, and interactions with socio-demographic and institutional factors. They also examined the threshold effect of per capita GDP on health outcomes. Consequently, macro-level evidence linking healthcare financing, demographic factors, and institutional capacity to health outcomes remains sparse.

Fourth, the previous studies lack a context-specific theoretical framework capable of capturing the institutional and structural character of Nepal's healthcare infrastructure and system. This gap highlights the necessity to adopt and extend health economic theories to reflect Nepal's healthcare delivery mechanism, fiscal constraints, and evolving institutional arrangements. In the methodological perspectives, much of the existing research relies on cross-sectional and micro-level data, limiting insight into the evolving longitudinal nature of health expenditure determining factors that varies over a time. This methodological gap restricts evidence-based evolution of short-term and long-term health system performance and policy sustainability. This study addresses this gap by employing longitudinal analysis to observe both short-term and long term dynamics regarding selected models and frameworks.

To sum up, this dissertation addresses the aforementioned gaps by assessing a comprehensive macro-level analysis to examine factors associated with government health expenditure, OOP payments for health, and macroeconomic, and socio-demographic factors associated with the life expectancy at birth and infant mortality rate. By employing time series econometric techniques and incorporating macroeconomic, social, demographic, institutional variables, thereby addressing structural break, the study estimates short-run and long-run evidence to inform healthcare financing and health outcome policies that fits Nepal's specific economic and institutional context.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Design

This is a quantitative research based on the nature of the data used. This study employs a quantitative time series research design to examine the determinants of government health expenditure and OOP payments for healthcare, followed by the assessment of the determinants of key health outcomes in Nepal. Annual data from 1994 to 2022 on per capita healthcare expenditure, GDP per capita, health human resources density in the government healthcare system, life expectancy at birth, and infant mortality per 1000 live births are sourced from national and international databases. To estimate both short-run dynamics and long-run relationship, with the accommodation of the variables with mixed integration orders, Autoregressive Distributive Lag (ARDL) modelling framework is appropriate.

Diagnostic tests are conducted to ensure that the estimated ARDL modelling framework yields best, linear, unbiased and efficient (BLUE) estimators. Moreover, these test assesses the reliability and robustness of the estimated coefficients. The choice of the tests dependents on the econometric technique employed in the study. In the context of the ARDL modelling framework, the study applies the most commonly used diagnostics, which can be grouped into three broad categories: lag structure diagnostics, coefficient diagnostics, and residual diagnostics. In this regard, lag structure diagnostics ensure that the selected lag length adequately captures the dynamic relationships among variables. Likewise, coefficient diagnostics examine the stability and statistical validity of the estimated parameters over time. Likewise, Two-Stage Least Square Method was also employed to examine the factors associated with the health outcomes.

The study is descriptive and analytical based on the statistical tools used for data analysis. Firstly, it describes the trend and pattern of government health expenditure, private health expenditure and health outcomes of Nepal. In this perspective it follows descriptive study. It also involves examining the causal relationship between macroeconomic, healthcare demand variable, institutional variables, demographic variable and government health expenditure as well as private healthcare expenditure. Similarly, it also examines causal relationships between macroeconomic variables, institutional variables, social variables, demographic variables and health outcomes. Therefore, this study follows explanatory design. Nevertheless, inferential statistics are used to draw inferences after data analysis.

3.2 Research Philosophy

The philosophical root of the study guides the overall research methodology including research design, choice of methodology, selection of variables, data analysis and interpretation, and the analytical framework of the dissertation. In this context, the current study is grounded in the post-positivist research paradigm. The appropriateness of post-positivism paradigm can be rationalized as this study seeks to explain and model the real-world relationships between government healthcare expenditure with various macroeconomic, healthcare seeking demand and institutional determinants. Likewise, the current study seeks to explain casual factors associated with OOP payments for healthcare macroeconomic perspectives. It also assesses the factors associated with the key health outcomes using observable and quantitatively measurable macroeconomic, socio-demographic, and institutional variables.

Moreover, the post-positivist paradigm also provides a suitable base for the macroeconomic and longitudinal nature of the study that adopts the quantitative data analysis using econometric modeling, hypothesis testing, and robustness. In other words, post-positivist philosophy emphasizes objective and measurable realities that can explain causal relationships. In assessing determinants of health expenditure and determinants of health outcomes in Nepal, this approach relies on quantifiable macroeconomic, institutional, demographic, healthcare utilization related, health outcomes related data to identify statistically significant patterns. Moreover, the core components of research philosophy are the paradigm of research, ontological position, epistemological position, axiological position, and methodological position of the research, reflecting their alignment with the nature and objectives of this dissertation. They are discussed subsequently.

3.2.1Ontological Orientation of the Study

The ontological position of this study is grounded in the critical realism philosophy, assuming that economic and human health-related facts and phenomena exist independently of human consciousness and social constructions.The variables such as per capita government healthcare expenditure, OOP payments for healthcare, life expectancy at birth, and infant mortality rates are treated as objective realities. These can be observed, measured, and analyzed based on quantitative approaches. Moreover, the existence of these socio-economic and health facts and figures does not depend on individual beliefs but reflects an objective reality that is consistent and generalizable across time and space. Therefore, this stance is appropriate as the research seeks to uncover structural relationships among variables that influence government healthcare financing as well as health outcomes separately in Nepal.

3.2.2 Epistemological Orientation of the Study

This study adopts the objectivism epistemological position. In this context, the epistemological position of this study aligns with the objectivism tradition, where knowledge is considered to be valid when derived from the prevalent empirical observation and objective measurement. In other words, epistemological perspective of the study follows an objectivist stance, emphasizing quantifiable relationships among macroeconomic and health variables. The relationship between government health expenditure, economic growth, OOP payments for health, health human resources density, and health outcomes are investigated using formal econometric models. Essentially, the process involves statistical testing and estimation to accept or reject hypotheses derived from economic theory. Likewise, the emphasis is also on obtaining generalizable and reproducible knowledge that reflects actual causal mechanisms prevailing in the Nepalese economic and healthcare systems.

3.2.3 Axiological Orientation of the Study

This research adopts a value-neutral position, maintaining objectivity throughout the process of data analysis and interpretation. In this regard, the use of econometric methods aims to minimize researcher's subjective bias, ensuring that the findings are driven by empirical evidence rather than subjective preferences. However, it is acknowledged that the choice of research problem and issue on determinants of government healthcare expenditure and determinants of health outcomes reflects a burgeoning societal concern regarding public health wellbeing in Nepal. Despite this normative interest, the researcher has maintained an analytical process rigorously objective. Therefore, the study process has maintained objectivity and minimized researcher's personal biases throughout the completion of this dissertation.

3.2.4 Methodological Orientation of the Study

The methodological orientation of this study is quantitative, deductive, and econometric modelling. The deductive reasoning follows the pattern of theory, hypothesis, observation and confirmation (Mahootian & Eastman, 2009). In this regard, the variables included in the specified models are based on the underlying economic theories. Furthermore, methodologically, the study follows a quantitative, econometric approach using time-series models (ARDL and 2SLS) to establish causal linkages and policy-relevant inferences for Nepal's health sector.To be specific, the research employed time-series econometric techniques to examine the determinants of government healthcare expenditure, and OOP payments for healthin Nepal. ARDL approach to co-integration analysis is employed to capture the short-run dynamics and long-run equilibrium amongst the variables of interest relating to the factors associated with the per capita government health expenditure and OOP payments for health. These techniques are appropriate for addressing potential non-stationarity and co-integration issues relating to time-series data. Likewise, other models such as determinants of life expectancy at birth and IMR are estimated using the 2SLS model to address the issue of simultaneous equation bias. In this regard, secondary data are drawn from credible sources, ensuring the reliability and validity of the dataset. Moreover, statistical software such as EViews and STATA were used for model estimation.

3.3 Conceptual Framework

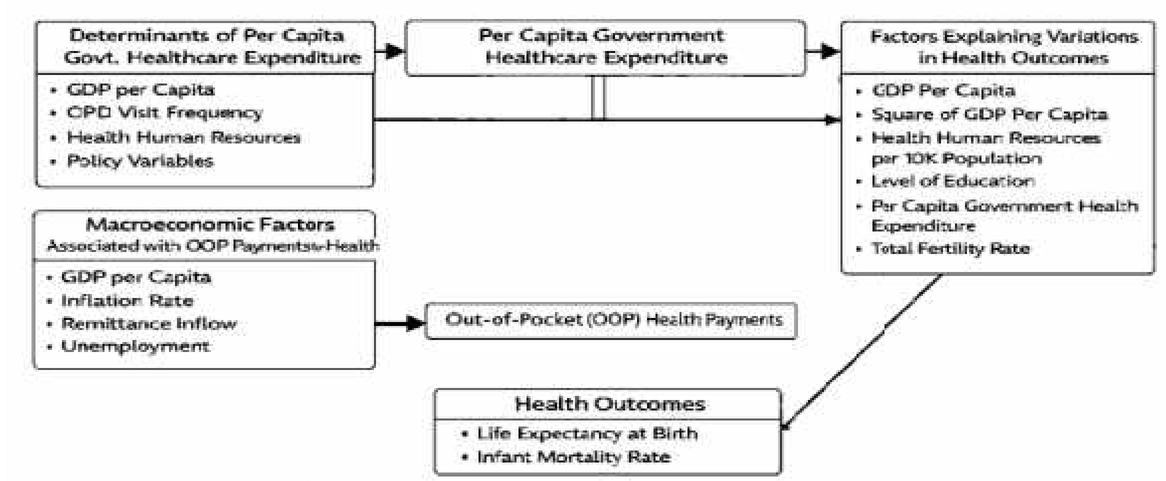
The conceptual framework of this dissertation is grounded in a comprehensive review of theoretical and empirical literature and is designed to guide the systematic analysis of three interrelated components: per capita government healthcare expenditure, OOP payments for healthcare, and population health outcomes, measured by life expectancy at birth and infant mortality rate (IMR). Empirical evidence consistently identifies GDP per capita as a core determinant of government healthcare expenditure, reflecting both fiscal capacity and demand-side pressures. Alongside income, healthcare utilization, commonly proxied by outpatient department (OPD) visits, captures health-seeking behavior and influences public expenditure patterns. Similarly, health human resource density within the government healthcare system emerges as a critical supply-side factor, shaping both service availability and expenditure levels.

OOP payments for healthcare constitute another central pillar of the framework, particularly relevant in low-income and middle-income countries such as Nepal where public financing mechanism and insurance coverage remain limited. High OOP payments for health are often associated with inadequate public provision, reliance on private services, frequency of healthcare utilization, and the burden of illness. Macroeconomic factors, including GDP per capita, remittance inflow per capita, and labor market conditions such as unemployment rate, are incorporated to explain variations in OOP spending. Moreover, health outcomes are positioned as the final link in the framework, influenced both directly and indirectly by public healthcare expenditure and OOP payments. Life expectancy at birth is treated as a key indicator of human development and productivity, shaped by income levels, government health expenditure, health human resource density, fertility behavior, and infant mortality. Likewise, IMR, another core health outcome, reflects the effectiveness of healthcare systems and broader socio-economic conditions. The framework recognizes income, government healthcare expenditure, health human resources, education, fertility rates, and life expectancy as key determinants of IMR. Overall, the conceptual framework highlights the dynamic interactions between macroeconomic conditions, healthcare financing mechanisms, service capacity, and health outcomes, providing a coherent basis for empirical investigation in the Nepalese context.

The figure 3.1 presents a general conceptual framework for analyzing the determinants of government healthcare expenditure, determinants of OOP payments for health and determinants health outcomes in Nepal. The framework incorporates a multidimensional approach grounded in macroeconomic, demographic, policy and health system variables. The framework posits that healthcare expenditure is shaped by macroeconomic conditions, structural capacity, demographic trends of the country. In Nepal, where government health financing remains limited and fragmented, these factors significantly influence the scale and equity of healthcare expenditure.

Figure 3.1

Determinants of Healthcare Expenditure and Health Outcomes in Nepal



Note. This figure proposes the determinants of healthcare expenditure and health outcomes based on the insight of the researcher based on the literature review.

In conclusion, Figure 3.1 above demonstrates hypothesized relationships among the macroeconomic variables, institutional factors, and health seeking behavior of people, as the determinants of per capita government healthcare expenditure. Likewise, it also demonstrates macroeconomic factors associated with the OOP payments for healthcare. Moreover, hypothesized relationship between, key health outcomes viz., life expectancy at birth and IMR per 1000 live births are depicted by the conceptual framework. Overall, this empirical conceptual framework reflects the complex and interrelated factors affecting healthcare expenditure and health outcomes in Nepal. This offers a comprehensive basis for empirical investigation and policy formulation aimed at improving efficiency, equity, and population health.

3.4 Specification of Model and Variables

The study has identified financial and non-financial variables as the determinants of healthcare expenditure in Nepal context. The conceptual framework given in figure 3.1 clearly states the linkage between the outcome variable and their corresponding predictors. The expected sign for the coefficientswith respect to their predictors stated hereunder (Table 3.1, 3.2, 3.3, 3.4). The expected sign for the coefficients of explanatory variables are proposed on the basis of underlying economic theory and empirical literatures.

Firstly, the study has proposed the model of per capita public healthcare expenditure as a function of GDP per capita, annual OPD visits frequency in the government healthcare system, and health human resource density in the government healthcare system. Therefore, the researcher has proposed the expected sign of the coefficients of respective explanatory variables of this model as follows:

Table 3.1

Expected Sign of the Coefficient in the Regression Analysis

Variables Codes	Description	Supporting literatures	Expected Sign of Coefficient
$PCHE_t$	Per Capita government healthcare expenditure of Nepal for the time period 't'.		Dependent Variables
$GDPpc_t$	Gross Domestic Product per capita for the time period 't'.	Kaur (2023);Moayedfard et al. (2020);Raghupathi and Raghupathi (2020);Barkat et al. (2019); Furuoka et al. (2012),Pan et al. (2012);Ku et al. (2011);Eik et al. (2009)	(+)
OPD_t	Annual out-patient visit frequency in the government healthcare system for the time period 't'.	Hidayat and Pokhrel (2010); Wang et al. (2016); Phelps (2017)	(+)
HRt	Health Human Resource per 10 population in government healthcare system for the time period 't'	Moayedfard et al. (2020);Samadi and Rad (2013);Rahaman (2008)	(+)

Most of these studies argued that income (GDP) is the main determinant of healthcare expenditure (Newhouse, 1977; Gerdtham, 1992; Hitiris & Posnett, 1992). This assertion is based on the underlying economic principle that the ability to spend of economic agent depends to a large extent on income level. Moreover, it is expected that as GDP increases, healthcare expenditure will continually increase over time at the national level. Therefore, the researcher has made a model by combining Toor and Butt (2005) and Tokita et al. (1999) to describe the model for determinants of health care expenditure in the Nepalese context. The model in functional form is as follows:

$PCHE = f(GDPpc, OPD, HR, Dum_{k+1})$ ...(3.1)

The model used annual time series data from 1994 to 2022. The researcher has converted level data natural log form to interpret the coefficients in the elasticity form. Transforming the above equation (3.1) in logarithmic form and adding with subscript t to denote time series data, equation (3.1) can be re-written as:

$LnPCHE_t = \alpha_0 + \alpha_1 LnGDPpc_t + \alpha_2 LnOPD_t + \alpha_3 LnHR_t + \alpha_4 Dum_{k+1} + \varepsilon_t$ ... (3.2)

$\alpha_0, \alpha_1, ... \alpha_4$ = Coefficient to be estimated for respective variables.

Ln = Natural Logarithm

$PCHE_t$= Per capita government health expenditure in NPR for time 't'.

$GDPpc_t$ = Gross Domestic Product per capita in time 't'.

OPD_t = Total annual out-patient visit in the government healthcare system for time 't'.

HR_t = Number of healthcare professionals in the government healthcare system per 10000 populations for the timeperiod 't'.

Dum_{K+1} = Dummy variable for interaction terms of explanatory variables based structural break dates.

ε_t = White noise disturbance term.

Secondly, the study has proposed the model as OOP payments for healthcare is a function of GDP per capita, remittance inflow per capita, consumers price index and health insurance government subsidy. Therefore, the researcher has proposed the expected sign of the coefficients of respective variables of model OOP payments for health in functional form as follows:

Table 3.2

Expected Sign of the Respective Coefficient in the Regression Analysis

Variables Codes	Description	Supporting literatures	Expected Sign of Coefficient
$OOPpc_t$	Per capita OOP payments for healthcare at the time period 't'.		Dependent Variables
$GDPpc_t$	Gross Domestic Product per capita for the time period 't'.	Deraro et al. (2022); Łyszczarz and Abdi (2021); World Health Organization (2019); Imlak and Shabda (2016); Keegan et al. (2013); Savedoff et al. (2012)	**(+)**
$RMTpc_t$	Remittance inflow per capita for the time period 't'.	Khan et al. (2021); Al Kabir et al. (2018); Kalaj (2015); Jorge (2008); Acosta et al. (2007)	(+)
CPI_t	Consumers price index for the time period 't'	Smith et al. (2009);Reichert and Cebula (1999);Newhouse (1992); Newhouse (1993)	(+)
$Unemp_t$	Percentage of unemployment for the time t.	Grigorakis et al.(2022); Zheng et al.(2020); Grigorakis et al.(2018); Hughes and Khaliq (2014)	(-)

The function model for OOP payments for healthcare is:

$OOPpc_t$ = f($GDPpc_t$, $Rmtpc_t$, CPI_t , Unemp, Dum_{k+1}) ...(3.3)

The above model in equation (3.3) in logarithmic form and adding with subscript t to interpret the coefficients in the elasticity form. The model is presented as follows:

$LnOOPpc_t = \Psi_0 + \Psi_1 Ln(GDPpc_t) + \Psi_2 Ln(Rmtpc_t) + \Psi_3 Ln(CPI_t) + \Psi_4 Ln(Unemp_t) + \Psi_5 Ln(Dumk+1) + \varepsilon_t$ ... (3.4)

$\Psi_0, \Psi_1, \Psi_2 \ldots \Psi 5$ = Coefficient to be estimated for respective variables.

Ln = Natural Logarithm

$GDPpc_t$ = Gross Domestic Product per capita for the time t.

$Rmtpc_t$ = Remittance per capita for time t.

CPI_t = Consumer price index for the time t.

$Unemp_t$ = Percentage of unemployment for the time t.

Dum_{k+1} = Dummy variable for interaction terms of explanatory variables based structural break dates.

ε_t= White noise disturbance term

Thirdly, the study has proposed the model of life expectancy at birth as a function of GDP per capita, interaction term between per capita government healthcare expenditure with health human resource density in government healthcare system, IMR, and total fertility rate. Therefore, the researcher has proposed the expected sign of the coefficients of respective variables of model estimating life expectancy at birth in functional form as follows:

Table 3.3

Expected Sign of the Respective Coefficient in the Regression Analysis

Variables Codes	Description	Supporting literatures	Expected Sign of Coefficient
LEB_t	Life Expectancy at birth of Nepal for the time period 't'.		Dependent Variable
$GDPpc_t$	Gross Domestic Product per capita for the time period 't'.	Kaur (2023); Wirayuda et al. (2022);Jafrin et al. (2021); Wirayuda and Chan (2021); Bayar et al. (2021); Miladinov (2020); Jetter et al. (2019); Delavari et al. (2016)	(+)
$PCHE_t$	Per capita government health expenditure for time period 't'.	Roffia et al. (2023); Kaur (2023); Balkhi et al. (2021); Istihak et al. (2019); Shahbaz et al. (2016);Sede and Ohemeng (2015)	(+)
HR_t	Health Human Resource in government healthcare system per 10000 population for the time period 't'	Roffia et al. (2023); Anwar et al. (2023);Jaiyesimi et al. (2021); Nguyen et al. (2016); Anand and Bärnighausen (2004)	(+)
IMR_t	Infant Mortality per 1000 live birth for the time period 't'.	Anwar et al. (2023); Wirayuda and Chan (2021);Rabbi (2013); Miladinov (2020)	(-)
TFR_t	Total Fertility rate for the time period 't'.	Poot and Siegers (2001);Cheng et al. (2022); Khan and Tehseen (2017)	(-)

The researcher has proposed model for determinants of life expectancy at birth in functional form as:

$LEB_t = f(GDPpc_t, (GDPpc_t)^2, PCHE_*HR_t, IMR_t, TFR_t, Dum_{k+1})$ ...(3.5)

The model given in equation (3.5) in logarithmic form and adding with subscript t to interpret the coefficients in the elasticity form as follows:

$LnLEB_t = \beta_0 + \beta_1 LnGDPpc_t + \beta_2 Ln\,(GDPpc_t)^2 + \beta_3 LnPCHE\_HR_t + \beta_4 Ln\,IMR_t + \beta_5 ln\,TFR_t + Dum_{K+1} + \varepsilon_t$ ...(3.6)

$\beta_{0,}\ \beta_{1,}\ \beta_2 \ldots B_5$ = Coefficient to be estimated for respective variables.

Ln = Natural Logarithm

LEBt = Life Expectancy at birth for time t.

$GDPpc_t$ = Gross Domestic Product per capita for time t.

$GDPpc_t^2$ = Squared Gross Domestic Product per capita for time t.

$PCHE\_HR_t$ = Interacting term between per capita government healthcare expenditure and health human resource per 10000 populations for time t.

PCHE_HRt= Squared per capita government healthcare expenditure for time t.

IMRt = Infant mortality rate for the time $_t$.

TFRt = Total fertility rate for time t.

Dum_{k+1} = Dummy variable for interaction terms of explanatory variables based structural break dates.

ε_t= White noise disturbance term.

Finally, the study has proposed the model as IMR per 1000 live births as a function of GDP per capita, per capita government health expenditure, health human resource density in government healthcare system, life expectancy at birth, and mean years of schooling and total fertility rate. Therefore, the researcher has proposed the expected sign of the coefficients of respective variables of model estimating life expectancy at birth in functional form as follows:

Table 3.4

Expected Sign of the Respective Coefficient in the Regression Analysis

Variables	Description	Supporting literatures	Expected Sign of Coefficient
IMR_t	Infant Mortality per 1000 live births for the time period 't'.		Dependent Variable
$GDPpc_t$	Gross Domestic Product per capita for the time period 't'.	Bugelli et al. (2021); Taramsari et al. (2021);Sari and Prasetyani (2021);Kiross et al. (2020);Tang (2019);Mallick et al. (2019);Onambele et al. (2019);Subramaniam et al. (2018); Monika (2018)	(-)
$PCHE_t$	Per capita government health expenditure for time period 't'.	Sari and Prasetyani (2021);Boachie et al. (2020);Kiross et al. (2020);Hu and Mendoza (2013); Bokhari et al. (2007)	(-)
HR_t	Health Human Resource in government healthcare system per 10000 population for the time period 't'	Krishna (2016); Nguyen et al. (2016); Ananda and Barnighausen (2004)	(-)
LEB_t	Life Expectancy at birth of Nepal for the time period 't'.	Barua et al.(2022); Ray and Linden(2020);Miladinov (2020)	(-)
MYS_t	Mean Years of Schooling of Nepal for the time period 't'.	Aldirawi et al.(2019); Tang(2019); Hossain et al. (2018); Kabir and Maitrot(2017); Barro and Lee (2013); Mazen et al.(2011)	(-)
TFRt	Total Fertility Rate for the time 't'.	Bloom et al. (2004); Yamada (1983); Lawson et al. (2012); Shimouchi et al. (1996).	(-)

Likewise, the model given in equation (3.6) in logarithmic form and adding with subscript t to interpret the coefficients in the elasticity form as follows:

$$IMRt = f(GDPpc_t, GDPpc_t^2, PCHE{*}HR_t, (PCHE\_HR_t)^2, LEB_t, MYSt, TFR_t, Dum_{k+1}) \quad ...(3.7)$$

The model given in equation (3.5) in logarithmic form and adding with subscript t to interpret the coefficients in the elasticity form as follows:

$LnIMR_t = \lambda_0 + \lambda_1 LnGDPpc_t + \lambda_2 Ln(GDPpc_t)^2 + \lambda_3 LnPCHE\_HR_t + \lambda_4 LnPCHE\_HR_t^2 + \lambda_5 Ln\ LEB_t + \lambda_6 Ln\ MYSt + \lambda_7 Ln\ TFR_t + Dum_{k+1} + \varepsilon_t$ ...(3.8)

$\lambda_{0,} \lambda_{1,} \lambda_2 \ldots \lambda_7$ = Coefficient to be estimated for respective variables.

Ln = Natural Logarithm

IMRt = Infant mortality rate for the time $_t$.

$GDPpc_t$ = Gross Domestic Product per capita for time t.

$GDPpc_t^2$ = Squared Gross Domestic Product per capita for time t.

$PCHE\_HR_t$ = Interacting term between per capita government healthcare expenditure and health human resource per 10000 populations for time t.

$PCHE\_HR_t$= Interaction term of per capita government healthcare expenditure and health human resource density for time t.

LEB_t = Life Expectancy at birth for time t.

TFRt= Total fertility rate for time t.

ε_t= White noise disturbance term.

3.5 Descriptions of Variables and Data Sources

Based on the comprehensive literature the researcher identified some key variables for the test of the hypothesis and fulfillment of the objectives of this study. Therefore, the main variables of this study and their explanations are given below:

Table 3.5

Key Variable Codes their Operation Definition and their sources

S.N.	Variable Codes	Description	Data Source
1.	$PCHE_t$	Per capita government healthcare expenditure of Nepal for the time period 't'.	NRB
2.	$GDPpc_t$	Gross Domestic Product per capita for the time period 't'.	NRB
3.	OPD_t	Annual out-patient visit frequencies in the government healthcare system for the time period 't'.	Federal Ministry of Health and Population/
4.	HR_t	Health human resource in government healthcare system per 10000 population for the time period 't'	National Statistics Office
5.	PCHE_HR	Interacting terms between per capita health expenditure and human resources density for the time t.	National Statistic Office
5.	MYS_t	Mean years of schooling of Nepal for the time period 't'.	UNDP
6.	LEB_t	Life expectancy at birth of Nepal for the time period 't'.	WB Database
7	IMR_t	Infant mortality per 1000 live births for the time period 't'.	WB database
8.	$OOPpc_t$	Per capita Out-of-pocket payments for healthcare for the time period 't'.	WHO
9.	$RMTpc_t$	Remittance inflow per capita for the time period 't'.	Federal Ministry of Finance of Nepal
10	Unempt	Percentage of unemployment for the time period 't'.	WB Database
11	TFRt	Total Fertility Rate the time t.	DB Database

Note: This tables describes the variables of this study and their sources with measurements.

3.6 Econometric Analysis

The time series econometric models are used in this study because they allow for the analysis of the annual time series data collected over time, enabling us to understand the trends and relationship between government healthcare expenditure, private healthcare expenditure and health outcomes across different time periods. In other words, this study utilizes time series econometric techniques to examine the dynamic and causal relationships among key macroeconomic, demographic, social and health outcome related indicators in Nepal. Considering the nature of the data used and theoretical underpinnings, two main econometric approaches were selected and employed for systematic analysis. ARDL bounds testing approach was employed for the estimation of the models specified in equation (3.1) and (3.3). In other words, the ARDL model is selected due to its flexibility in handling time series data with mixed order integration i.e., I(0) and I(1) and its suitability for small sample size in terms of data points, making it appropriate for this study based on annual data from 1995 to 2022.

Two-Stage Least Squares (2SLS) method was used to estimate the models specified in the equation (3.6) and (3.8). Moreover, the proposed equation relating to determinants of key health outcomes contained potential endogeneity between explanatory and dependent variables due to simultaneous equation bias. Therefore, the 2SLS method is employed to obtain consistent and unbiased parameter estimates. The standard procedures for econometric analysis are discussed subsequently.

3.6.1 Structural Break Test

In time series data, structural break occurs when the underlying data-generating process changes at a certain point in time due to policy changes, economic crises, or technological shifts. If this issue is not addressed, structural breaks can lead to spurious regression, biased estimates, and eventually misleading inference (Bai & Perron, 1998). Bai-Perron is the most powerful tool to detect multiple break points. Therefore, this study has selected Bai-Perron structural break tests taking into consideration the nature of data included in this study. This tool detects multiple structural breaks in regression models at unknown points, is flexible, widely used in economic time series analysis, and is recommended for long time series with multiple potential breaks. In order to incorporate the single structural break from the Bai-Perron test approach at specified break date into the ARDL framework for capturing a regime-switching dummy (Dt) is introduced where Dt =0 pre-break and Dt = 1 post-break was generated. For the diagnosis of the structural break relies on allowing coefficients to change at unknown break dates. The test of the dates for time-series regression can be presented as:

$$y_t = x_t'\beta + u_t, \quad t = 1,2,\ldots,T \qquad \ldots (3.9)$$

The Bai-Perron test generalizes equation (3.9) to allow foe m structural breaks (i.e. m+10):

$$y_t = x_t'\beta_j + u_t, \quad t = 1,2,\ldots,T_{j-1}+1, \ldots, T_j, \; j = 1, \ldots, m+1 \ldots (3.10)$$

In the above equation (3.10), B_j denotes the regime specific parameter vector, Tj denotes unknown break dates to be estimated. Likewise, T_{m+1}= T. The Hypothesis for structural break test result can be presented as:

Null hypothesis (no structural Break): H_0: $\beta_1 = \beta_2 = \ldots = \beta_{m+1}$

Alternative hypothesis (structural Break exists): H_1: $\beta_i \neq \beta_{i+1}$

Similarly, for a single structural break at unknown date (T_b), the diagnostic statistic is presented as:

$$supF(Tb) = \max_{T_b \in [\varepsilon T, (1-\varepsilon)T]} \frac{(S_0 - S_1(T_b))/k}{S_1(T_b)/(T-2k)} \ldots (3.11)$$

In the above equation(3.11), S_0 stands for sum of squared residuals under no break, $S_1(T_b)$ denotes sum of squared residuals with a break at T_b. Likewise, k and ε represent number of estimated parameters and trimming parameter respectively. If sup F exceeds the Bai-Perron critical value, the null of parameters stability is rejected.

Similarly, structural break tests for the variables that estimated using 2SLS were carried out using the breakpoint unit root test method. Moreover, the current study used a breakpoint unit root test with endogenous break in the trend to address the potential issues structural break in time series properties of the variables. In this regard, the diagnostic framework follows (Perron-Zivot-Andrew (1992) tradition that accounts the break date endogenously from the data. The breakpoint unit root test can be expressed as:

$$\Delta y_t = \mu + \beta t + \gamma DT_t(T_b) + \alpha y_{t-1} + \sum_{i=1}^{k} c_i y_{t-1} + \varepsilon_t \ldots (3.12)$$

In the equation (3.12) above, $y_t$is the variables of interest, t denotes deterministic times trens, and DTt(T_b) is the trend-break dummy defined as:

$$D_t(T_b) = \begin{cases} t - T_b, & t > T_b \\ 0, & t \leq T_b \end{cases} \ldots (3.13)$$

In the above equation (3.13), Tb stands for the unknown break date. Likewise, the null hypothesis (H0) is that the series contains a unit root even after allowing for a trend break (H0: α =0), whereas the alternative hypothesis(H1) implies that trend is stationary with structural break (H0: α < 0).

3.6.2 Stationarity of Data and Unit Root Test

The stationarity of data is fundamental requirement in time series econometric analysis. A time series is said to be stationary if its statistical property namely mean variance and auto covariance remain constant over time. In contrast, non-stationary series exhibits time-varying moments, which can lead to spurious regression results, misleading statistical inferences (Gujrati et al., 2012). Therefore, examining stationarity property of the variable is a necessary preliminary step before model estimation. In this regard, to test for stationarity unit root tests are employed. The most commonly used tests include the Augmented Dickey-Fuller (ADF) test and Phillips-perron(PP) test (Dicky& Fuller, 1979; Phillip & Peron, 1988). They are discussed subsequently.

3.6.2.1 Augmented Dickey Fuller Test

The ADF test extends the basic Dickey-Fuller procedure by incorporating lagged differences of the dependent variable to correct for serial correlation(Dickey & Fuller, 1981).

$\Delta Y_t = \beta + \lambda_t + \phi Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-1} + U_t$...(3.14)

In the equation (3.14) above, β represents intercept, p implies the selected lag, tdenotes a time trend variable. Likewise, Δstands for first difference operator, and ϕ, α are coefficient of regression. Finally, $U_t$stands for the error term. If null hypothesis (H_0)rejected at level, Yt is regarded stationary at level. If null hypothesis (H_0) is rejected at first difference then, Yt is stationarity after first difference. In both case, if null hypothesis(H_0) cannot be rejected then Yt has unit root (Johansen & Juselius, 1990).

3.6.2.2 Philip-Perron Test

The Philip-Perron Test (1988) was developed by Peter C. B. Phillips and Pierre Perron as a non-parametric alternative to the ADF test.It builds on the Dickey-Fuller test of the null hypothesis as p=1 in:

$\Delta y_t=(p-1)\ y_{t-1}+u_t$ ...(3.15)

In equation (3.15), Δ is the first difference operator. Like the augmented Dickey-Fuller test, the Philip-Perron test addresses the issue that the process generating data for, yt might have a higher order of autocorrelation than is admitted in the test equation making y t-1 endogenous and thus invalidating the Dickey-Fuller test. In this case, if the PP test statistic rejects null hypothesis (H_0) then it implies that the series is stationary. Conversely, if the PP test statistic fails to reject (H_0), indicating the series is non-stationary. Therefore, the test is robust with respect to unspecified autocorrelation and heteroscedasticity in the disturbance process of the test equation.

The result of unit root tests classifies variables as stationary in levels or stationary after first differencing. This classification guides model selection. For instance, the ARDL bound testing approach is applicable when variables are integrated of mixed order i.e. stationarity at level and after first differencing.

3.7 Lag Length Selection

The selection of an appropriate lag length is an essential step in time series modeling. By doing this, it ensures that the dynamic structure of the model is correctly specified. In this regard, an inadequate lag length may result in serial correlation of residuals and produce biased parameter estimates, while an excessive lag structure can reduce degree of freedom and poor estimation efficiency (Pesaran et al., 2001). Therefore, an optimal lag length balances model parsimony with adequate capture of dynamics. In this regard, generally, Akaike Information Criterion (AIC), the Schwartz Bayesian Criteria (SBC) or Hannan-Quinn Criterion (HQC) can be used in order to choose the lag order. However, the AIC criterion has been used in this study to select the optimum lag in the ARDL model. The general Akaike Information Criteria (AC) is defined as:

$AIC(p)=\frac{S\quad(p)}{T}+(p+1)\frac{2}{T}$ …(3.16)

In the above equation (3.16), AIC, SSR, T and P denote the Akaike Information Criteria, sum of squared residuals, the sample size and lag order respectively.

3.8 Autoregressive Distributive Lag (ARDL) Bound Test Approach to Co-integration

The ARDL bounds testing approach to co-integrationis to be employed to examine the long-run relationship amongst the variables of interest used in the ARDL framework of analysis. The first step of analyzing time series data is to examine the stationarity of the variables of interest used in the model. In other words, order of co-integration of the variables either in level or first difference is examined. The ARDL modeling approach was originally introduced by Pesaran and Shin (1999) and further extended by Pesaran et al. (2001) is based on the assumption that time series under investigation are integrated of order zero I (0), or integrated of order one, I (1) or mutually co-integrated. After confirming that the included variables are cointegrated of mixed order at level i.e. I(1) and after the first difference I(1) based on the stationarity test results, we should proceed to ARDL bound testing for confirming long-run relationships amongst the dependent and independent variables.

The Johansen Cointegration test can be applied directly if all the variables of interest are integrated after first differencing. Furthermore, Pesaran et al. (2001) suggested that when the data series of the variables of time series are stationary at both integrated of level I(0) and integrated at first difference I(1) then we have to use the ARDL Model (Shrestha & Bhatta, 2018). This model has several advantages over the well-known residual based approach proposed by Engle and Granger (1987) and maximum likelihood -based approach that was proposed by Johansen and Jeselius (1990), Johansen (1992), and Johansen (2002).

Pesaran and Shin (1999), and Pesaran et al. (1997, 2001) stated that a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation. In addition, the ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information and avoids problems such as spurious relationships resulting from non-stationary time series data (Shrestha &Bhatta, 2018). We can illustrate the general form of ARDL (p, q) modeling approach using following simple model:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=0}^{q} \gamma_i X_{t-j} + \varepsilon_t \ldots (3.17)$$

In equation(3.17), Y_t is the outcome variable, X_{t-j} denotesvectors of explanatory variables, $\alpha_i$andβ_j are estimated coefficients, p and q are the selected lag orders, andε_t is the error term.

Likewise, the error correction version of the ARDL (p_1, q_1,q_2) model is given by:

$$\Delta Y_t = \alpha_0 + \sum_{i=i}^{P} \beta \Delta Y_{t-1} + \sum_{i=i}^{q1} \delta \Delta X_{t-1} + \sum_{i=i}^{q2} \omega \quad _{t-i} + \lambda_1 Y_{t-1} + \lambda_2 X_{t-1} + \lambda_3 Z_{t-1} + \mu_t \ldots (3.18)$$

In equation (3.18) above, the first partof the right hand side β, δ and ωdenotes short-run dynamics of the ARDL model. Likewise, the second part of the right hand side with λ_3 reflects the existence of the long-run relationship amongst the variables used in the model. Moreover, the null hypothesis(H_0) in the equation is stated as$\lambda_1 = \lambda_2 = \lambda_3 = 0$. This statement means there is no long-run relationship. Moreover, the rejection of null hypothesis implies existence of long-run relationship amongst variables included in the model.

3.8.1 F- Bound Test for Long-Run Relationship

The F-Bound Test is used to examine whether a long-run equilibrium relationship exists among the variables included in a model within ARDL framework. The test evaluates the joint significance of the lagged level variables by comparing the computed F-statistic with the critical bounds. The presence of co-integration confirmed, if the F-statistic exceeds the upper bound, and the null hypothesis of no long-run relationship is rejected. Conversely, if the F-statistic falls below the lower bound, the null hypothesis cannot be rejected. However, a value between the bounds leads to an inconclusive result. Most notable property of ARDL model is that it can applied for small data points, having stationarity of data sets with mix order i.e. stationary at level I(0), and stationary after first difference I(1), provided none is integrated of order I(2).More importantly, the significance of the error correction term (ECT) should be taken into account to assess the convergence process and stability of the model. Therefore, it is a useful way of confirming and establishing co-integration. The generalized form of applied ARDL model is given as:

$$\Delta LnY_t = \mu + \sum_{t=0}^{p} \omega_i \Delta LnY_{t-i} + \sum_{t=0}^{q} \phi_i \Delta LnX_{t-i} + \sum_{t=0}^{r} \pi_i \Delta LnZ_{t-i} + \lambda_1 LnY_{t-1} + \lambda_2 LnX_{t-1} + \lambda_3 LnZ_{t-1} + v_t \quad ...(3.19)$$

In the equation (3.19) above, Δ denotes the first difference operator, μ represents intercept term and v denotes the usual white noise error term. Likewise, thesuper scripts p,q,r denote chosen lag of the first difference variables. Essentially, the remaining coefficients describe short-run and long-run relationships. The coefficients λ_1, λ_2 α λ_3 correspond to the long-run relationship while the short-run effects are captured by the coefficients for the first difference variables i.e. ω, ϕ and π. Essentially, equation (3.17) differs from standard distributed lag models in that it includes a linear combination of the lagged level of all variables, normally referred to as an error correction term. Therefore, the ARDL model shown in equation (3.19) integrates the short-run dynamics with the long run equilibrium without losing any information for the long run.

3.8.2 Coefficients for Error Correction Model for Short-Coefficients

In the ARDL approach to cointegration the lagged error correction term (ECMt-1) is generated out of the long-run coefficients to replace a linear combination of the lagged variables, and the model is re-estimated at the optimum lags selected by using model selection criterion (Bahamani & Ardalani, 2006). Hence, the short- run error correction version of model can be specified as the follows:

$$\Delta LnYt=\mu+\sum_{i=0}^{p} \omega_i \Delta Ln+\sum_{i=0}^{q} \phi_i \Delta Ln X_{t-i}+\sum_{i=0}^{r} \pi_i \Delta Ln Z_{t-i}+\gamma E \quad {}_{t-1} \ldots (3.20)$$

In the equation (3.20), ECM is the error correction mechanism term obtained as residual from the estimation of the long run cointegrating equation (3.19); ωi, ϕi, and πi, are the short run dynamic coefficients of the model’s convergence to equilibrium, and γ determines the speed of adjustment from short run to long run i.e. towards equilibrium.

3.9 Diagnostics Tests

Diagnostic tests are to be conducted to ensure that the estimated ARDL modelling framework yields best, linear, unbiased and efficient (BLUE) estimators. Moreover, these test assesses the reliability and robustness of the estimated coefficients. The choice of the tests dependents on the econometric technique employed in the study. In the context of the ARDL modelling framework, the study applies the most commonly used diagnostics, which can be grouped into three broad categories: lag structure diagnostics, coefficient diagnostics, and residual diagnostics. In this regard, lag structure diagnostics ensure that the selected lag length adequately captures the dynamic relationships among variables. Likewise, coefficient diagnostics examine the stability and statistical validity of the estimated parameters over time. The details of all diagnostic are discussed subsequently.

3.9.1 Regression Specification Error Test

Ramsey (1969) developed Regression Specification Error Test (RESET) to test if non-linear combinations of the fitted values can describe the explanatory variable (Ramsey, 1969). In general, this test is a general specification test for the linear regression model. Moreover, it examines whether non-linear combinations of the fitted values help explain the dependent variable. The intuition behind the RESET is that if the model is correctly specified, then adding powers of the fitted values should not provide additional explanatory power. In this context, a statistically significant result indicates potential problem of omitted variable bias or incorrect functional form. Given the baseline regression model as:

$Y_t=\beta_0+\beta_1X_{1t}+\beta_2X_{2t}+\cdots+\beta_kX_{kt}+\varepsilon_t$…(3.21)

In equation (3.21) above, Yt is the dependent variable, Xit are explanatory variables, and $\varepsilon_t$is the error term. The RESET augments for the above model by including powers of the fitted values $\widehat{Y_t}$, such as:

$$Yt= \beta_0+\sum_{i=1}^{k}\beta_iX_{it} + \gamma_1\widehat{Y_t^2}+\gamma_2\widehat{Y_t^3}+\mu_t \quad ... (3.22)$$

After estimating regression equation (3.22) we set the null hypothesis of the RESET as:

$$H_0 : \gamma_1 = \gamma_2 = \cdots = 0$$

The failure to reject the null hypothesis indicates that the model is correctly specified, where rejection indicates misspecificaton. The test is typically conducted using F-statistics.

3.9.2 Breusch-Godfrey Test for Serial Correlation

The presence of serial correlation in the residual violates the assumptions of classical linear regression and can lead to inefficient parameters estimates and produce biased standard error thereby weakening the statistical inferences. To ensure that the estimated model is free from serial correlation, the Lagrange Multiplier (LM) test for autocorrelation also known as the Breusch-Godfrey test is employed(Gujarati et al., 2012; Wooldridge, 1996). This test is particularly suitable in models that include lagged dependent variables, such as ARDL or dynamic regression frameworks, where the Durbin–Watson statistic is not reliable. TheLagrange Multiplier(LM) test evaluates the null hypothesis (H_0) that there is no serial correlation issue in the residuals. The joint significance of the lagged residual terms is then assessed using either the F-statistic or the Chi-square statistic. The rejection of null hypothesis indicates the presence of serial correlation, while failure to reject implies that the residuals are serially uncorrelated. The procedure for the LM test can be presented as follows:

Let the estimated baseline regression model be specified as:

y_t=α0+ $\sum_{i=1}^{k} \alpha_i x_{ti}$ + μ_t…(3.23)

In the above equation (3.23), y_t is the dependent variable, x_i are explanatory variables, and u_t is the disturbance term. Moreover, after estimating the above model, we obtain the residuals $\hat{\mu_t}$. The LM test for serial correlation of order p is based on the following auxiliary regression.

$\hat{\mu_t}$=β_0+ $\sum_{i=1}^{k} \beta_i x_{ti}$ + $\sum_{j=1}^{k} p_i \hat{\mu}_{i-j}$ + ε_t…(3.24)

The null and alternative hypothesis are:

If H_0: $p_1 = p_2 = \ldots = p_p = 0$. then it implies no serial correlation in the model.

If H_1: $p \neq 0$ indicates there is serial correlation in the data series used in the model.

The test statistic can be expressed a:

LM = (T-p) R2 χ² (p) …(3.25)

In the equation (3.25), T is the number of observations and R^2 is the coefficient from the auxiliary regression.

3.9.3 Test for Homoscedasticity

Homoscedasticity implies the constant variance of the error terms across the observations. This is fundamental assumption of the classical linear regression model. Moreover, it is the test to ensure that all residuals have a constant variance meaning that test of homoscedasticity. It is worth noting that in both case regular OLS estimation and ARDL framework of analysis, it is assumed that the residuals have a constant variance (homoscedasticity) over a time. It means, if the model does not have a constant variance (heteroscedasticity) in the residuals, the estimated coefficients will no longer be BLUE estimators. For the test of heteroscedasticity in this study the researcher used the Breusch–Pagan–Godfrey test for heteroscedasticity (Gujarati et al., 2012; Wooldridge, 1996).The null hypothesis of the test states that the error variance is constant, while the alternative hypothesis assumes the presence of heteroscedasticity. The test is implemented by estimating an auxiliary regression in which the squared residuals from the original model are regressed on the set of explanatory variables. The original regression model is specified as:

y_t=α$_0$+ $\sum_{i=1}^{k} \alpha_i x_{ti}$ + μ_t , μ_t □ (0, δ^2) …(3.25)

The estimation of regression equation (3.25), we obtain $\hat{\mu_t}$, the auxiliary regression is given by:

$\hat{\mu_t}$= γ_0+ $\sum_{i=1}^{k} \gamma_i x_{ti}$ + v_t…(3.26)

The null hypothesis of homoscedasticity is formally stated a:

$H_0 : \gamma_1 = \gamma_2 = \cdots = \gamma_k = 0$

The test statistic is computed as:

LM=T×R2□χ2(k)

3.9.4 Test for Normality of the Residuals

The assumption of normality of the residual distribution is also essential. In other words, non-normality may cause problems regarding statistical inference of the coefficient estimates such as significance tests and for confidence intervals that rely on the normality assumption. Therefore, the normality of the residuals is formally examined as part of the model diagnostic test.The standard test for normality is the Jarque-Bera (J-B) test.In this dissertation, the J-B test is employed to assess whether the distribution of the residuals conforms to normality. The test is based on the skewness and kurtosis of the estimated residuals and jointly evaluates whether these moments match those of a normal distribution(Gujarati et al., 2012; Wooldridge, 1996). The null hypothesis states that the residuals are normally distributed, while the alternative hypothesis indicates non-normality.

Let the estimated regression model be expressed as:

y_t=α$_0$+ $\sum_{i=1}^{k} \alpha_i x_{ti}$ + μ_t…(3.27)

In the equation (3.27), $\mu_t$denotes the disturbance term. We obtain residual term μ_t, after estimating the model. After obtaining μ_t,we further obtain their skewness (S) and kurtosis (K). The J-B test statistic is defined as:

$$J = \frac{T}{6}\left[S^2 + \frac{(K-3)^2}{4}\right] \quad \ldots(3.28)$$

In the above equation (3.28) above, T stands for the number of observations. Moreover, under the null hypothesis of normality, the J-B statistic follows a chi-square distribution with two degrees of freedom.

If H_0: Residuals are normally distributed.

If H_1: Residuals are not normally distributed.

In the context of above hypotheses, if the probability value of the J-B statistic exceeds the 5 per centsignificance level, the null hypothesis cannot be rejected. This indicates that the residuals are approximately normally distributed. On the other hand, if the p-value is below significance level, the null hypothesis is accepted.

3.9.5 Test for Stability

To assess the stability of the long-run and short-run coefficients cumulative sum of the recursive residuals (CUSUM) and the cumulative sum of squared recursive residuals (CUSUMSQ) tests proposed by Brown et al. (1975) can be used. If there is instability in the coefficients one may increase the sample size or introduce dummy variables (Naiya & Manap 2013; Fuinhas & Marques, 2012). The test results of CUSUM and CUSUMSQare of a graphical nature whereby the residuals are updated recursively and are plotted against the breakpoints for the 5 per cent significance line. The cumulative sum of recursive residuals is plotted against the upper and lower 95 per cent confidence bounds. The concept remains the same for CUSUMSQ. The long-run and short-run coefficients are stable if the plot of CUSUMSQ and CUSUM stay within the 5 per cent level of significance. In detail, both tests analyze if the residuals do not significantly deviate from its mean value by imposing parallel critical lines on a 5 per cent significance level. The CUSUM test is based on the statistic:

$W_t = \sum_{r=k+1}^{t} \omega_r / s$ ...(3.29)

In the equation (3.29) above, W_t represents a cumulative sum of standardized residuals for r = k+1, …, T, where ω is the recursive residual and s is the standard error of the regression of the recursive residual w_t. This detects parameter stability or structural breaks in the regression model. Therefore, downward or upward movement of W_t that cross the critical bounds indicate parameter instability. The statistical significance of deviation from the zero line is evaluated using a pair of 5 per cent significance boundaries, whose width increases as time t progresses. These 5 per cent significance lines are constructed by joining the following reference points:

$[\, k, \pm -0.948(T-k)^{1/2}]$ and $[\, T, \pm 3\times 0.948(T-k)^{1/2}]$

Movement of w_t outside the critical lines is suggestive of coefficient instability.

The CUSUMSQ test (Brown et al., 1975) is based on the test statistic:

$S_t = (\sum_{r=k+1}^{t} w_r^2) / (\sum_{r=k+1}^{T} w_r^2)$ ...(3.30)

In the equation (3.30), the expected value of S_t under the hypothesis of parameter constancy is:

$E(S_t)= (t-k) /(T-k)$ ... (3.31)

In equation (3.31) above, if the parameters are stable, the cumulative statistic S_t is expected to increase smoothly and linearly over time.

Therefore, at, t=k: E(St)=0

Similarly, at, t=T: E(St)=1

So, under stability, St should lie close to a straight line rising from 0 to 1. The significance of the departure of St from its expected value is assessed by reference to a pair of parallel straight lines around the expected value.

3.10 TWO-Stage Least Square Estimation Method

Two-stage least squares (2SLS) estimation method is applied to obtain consistent estimates when the proposed model includes one or more regressors as endogenous and valid instruments are available (Angrist, & Pischke, 2009; Stock & Watson, 2019). The econometric model specified as equations 3.6 and 3.8 are simultaneous equations. It is so because life expectancy at birth (LEBt) and infant mortality rate(IMRt) are regressor for each other. These types of models reflect an endogeneity bidirectional causality between life expectancy at birth (LEBt) and infant mortality rate(IMR), acknowledging their interdependence. In these specifications, IMR and life expectancy at birth are endogenous variables. In other words, life expectancy at birth (LEB) and infant mortality rate (IMR) are treated as explanatory variables in each other's equations, indicating a two-way causal relationship. It is obvious that simultaneous equation bias arises when one or more explanatory variables in a regression model are endogenous. Application of ordinary least squares (OLS) to estimate such a model would yield biased and inconsistent coefficients due to this simultaneity bias. Therefore, it is essential to address this issue, using appropriate econometric techniques such as the 2SLS method of estimation. To address this issue, the researcher has proposed the structural model due to the nature of variables included in the study (Hausman, 1978). Essentially, the two structural models are estimated using the 2SLS approach and followed by a diagnostic test. The methodological aspects of the simultaneous equations system in the context of this dissertation are discussed subsequently.

Simultaneous Equations

To account for the joint determination of health outcomes, life expectancy at birth (LEBt) and infant mortality rate (IMRt) are modeled as a system of simultaneous equations. The structural form of the model is specified as:

$LEB_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 (GDPpc_t)^2 + \alpha_3 IMR_t + \alpha_4 TFR_t + \alpha_5 PCHE\_HR_t + \varepsilon_{1t}$ …(3.32)

$IMR_t = \beta_0 + \beta_1 GDPpc_t + \beta_2 (GDPpc_t)^2 + \beta_3 LEB_t + \beta_4 TFR_t + \beta_5 MYS_t + \beta_6 PCHE\_HR_t + \varepsilon_{2t}$ …(3.33)

In the above simultaneous equation (3.32) and (3.33) life expectancy at birth (LEBt) and infant mortality rate (IMRt) are endogenous variables (each appears in both equations), and GDPpct, squared of GDPpct, TFRt, MYSt and interaction term of per capita government health expenditure and health human resource density are exogenous variables meaning that they are determined outside the system. Therefore, in this system, (LEBt) and (IMRt) are endogenous variables, as each appears as a regressor in the other equation. This simultaneity leads to correlation between the regressors and the error terms (ε_{1t}, ε_{2t}), rendering OLS estimators biased and inconsistent.However, we have to satisfy the identification conditions for valid 2SLS estimation and ensure that consistent, unbiased parameter estimates can be obtained, even in the presence of simultaneity.

First-Stage Least Squares

In the first stage of the two-stage least square (2SLS) procedure, each endogenous variable is regressed on the full set of exogenous variables in the system (Stock & Watson, 2019), which serve as instruments. The first-stage equations are specified as:

$LEB_t = \Upsilon_0 + \Upsilon_1 Z_t + \varepsilon_{1t}$ …(3.34)

$IMR_t = \delta_0 + \delta_1 Z_t + \varepsilon_{2t}$ …(3.35)

In the above equation (3.34) and (3.35), Z_t denotes the vectors of instruments. From these regressions, the fitted values of life expectancy at birth ($\widehat{L}_t$) and life infant mortality rate($\widehat{I}_t$) are obtained. These predicted values depend only on exogenous variables and are therefore uncorrelated with the structural disturbances.

Second-Stage Least Squares (2SLS) Equations

In the second stage, the predicted values of the endogenous variables from the first stage replace the actual endogenous regressors in the structural equations. Since these fitted values endogenous variables depend only on the exogenous variables in the system, they are orthogonal to the structural error terms, ensuring consistent estimation. The second-stage equations are written as:

$LEB_t = \alpha_0 + \alpha_1 GDPpc_t + \alpha_2 (GDPpc_t)^2 + \alpha_3 \widehat{I}_t + \alpha_4 TFR_t + \alpha_5 PCHE\_HR_t + v_{1t}$…(3.36)

$IMR_t = \beta_0 + \beta_1 GDPpc_t + \beta_2 (GDPpc_t)^2 + \beta_3 \widehat{L}_t + \beta_4 TFR_t + \beta_5 MYS_t + \beta_6 PCHE\_HR_t + v_{2t}$…(3.37)

In equation (3.36), the contemporaneous infant mortality rate, which is endogenous in the original structural form, is replaced by its instrumented value . Similarly, in equation (3.37), life expectancy at birth is replaced by its predicted value. Moreover, the estimation of these equations using ordinary least squares provides the 2SLS estimators of the structural parameters α_i and β_i. Finally, it ensures that the instruments are exogenous and relevant provided that the identification conditions are satisfied. This implies that the resulting 2SLS estimates are consistent and asymptotically unbiased, indicating that they are able to effectively address the simultaneity bias present in the original system.

3.11 Diagnostic Test

After 2SLS estimation in econometrics, it is essential to conduct diagnostic tests to ensure the validity, consistency, and efficiency of the estimated results. These tests help verify whether the necessary assumptions of the estimation techniques are satisfied, and whether the instruments and model specifications are appropriate. Therefore, endogeneity tests and normality tests are also done.

CHAPTER IV
ANALYSIS OF GOVERNMENT HEALTH EXPENDITURE IN NEPAL

4.1 Introduction

This chapter presents a descriptive analysis of determinants of per capita government healthcare expenditure based on their trend and pattern. It also presents and discusses the results of the ARDL model estimated to assess the long-run and short-run determinants of per capita health expenditure in Nepal. The model includes key socio-economic, demographic, and institutional variables, namely GDP per capita, outpatient visits, health human resources per 10,000 populations, and interacting terms of respective dummy variables for structural break solution. The analysis is based on annual time series data spanning from the FY 1994/95 to 2021/22. The ARDL bounds testing approach to co-integration confirms the existence of a stable long-run relationship among the included variables in the model. Essentially, both the F-statistic and t-statistic strongly reject the null hypothesis of no level relationship, indicating that changes in economic, institutional, and health system variables have both immediate and persistent impacts on health expenditure in Nepal.

4.2 Trend and Pattern of Government Health Expenditure of Nepal

Government health expenditure has increased substantially in Nepal after restoration of democracy in the 1990s. Prior to this, it was very low. In other words, it was the period when the then government formed based on democratic system after restoration of democracy meaning that the government showed accountability towards healthcare of people (Adams, 1998). This description is based on the data placed in Annex A of this dissertation. During the period FY 1994/95, per capita government healthcare expenditure on average was NPR 71. This figure has increased up to NPR 4096 in FY 2021/22 which is increase more than 57 times growth as compared to the NPR 71 for FY 1994/95(Ministry of Finance/Government of Nepal, 2023). However, GDP per capita increased from NPR 10850 in the FY 1994/95 to NPR 169030 in the FY 2021/22 which is just more than 15 times growth. In this context, taking the GDP per capita as a reference for the analysis, there is rapid growth in government healthcare expenditure per capita in Nepal.

It is pertinent to examine the trend of healthcare expenditure with respect to GDP per capita, OPD visit frequency and health human resource density. This empirical dataset given provides an insightful overview of the evolution of Nepal's healthcare expenditure and key health sector performance indicators over nearly three decades. The variables examined in terms of Per Capita Health Expenditure (PCHE), GDP per capita (GDPpc), OPD visits, and Health Human Resources (HR) collectively capture the interplay between economic growth, public health investment, and healthcare utilization in Nepal for the current study period (Appendix A).

Trend and Patter in Per Capita Government Health Expenditure

Per capita government health expenditure (PCHE) in Nepal shows a clear upward trend during the study period. In FY 1994/95, PCHE was merely NPR 71 per person, and rose sharply by FY 2021/22, to NPR 4,096 which is more than 57-fold increase. Based on the trend of growth, the rise has not been linear; instead, two distinct phases. During the Phase I (FY 1994/95–2004/05), slow growth characterized this phase. PCHE increased from NPR 71 to NPR 181 in a decade which is a modest growth considering inflation and demographic pressures. This reflects the underfunding of Nepal's health sector during the years of political instability and the armed conflict (1996–2006), which diverted government priorities toward security rather than social development.

The second phase, spanning FY 2005/06 to FY 2021/22, witnessed a significant acceleration in healthcare expenditure, especially in the period following the 2006 Comprehensive Peace Agreement and the subsequent federal restructuring. This phase marked a turning point in Nepal's public health investment, driven by improved political stability, increased donor support, and a greater emphasis on decentralizing health services under the new federal government. Evidently, by FY 2008/09, PCHE nearly doubled to NPR 490, and after FY 2010/11, growth became steeper. The introduction of health insurance programs, free basic healthcare packages, and donor-supported programs may explain this rise. Interestingly, in FY 2020/21 and FY 2021/22, the COVID-19 pandemic likely prompted additional health spending, pushing PCHE to unprecedented levels above NPR 4,000 per capita (Appendix A).

Trend and Pattern of GDP Per Capita

Nepal's GDP per capita also reflects steady economic growth over the same period. In FY 1994/95, GDP per capita was NPR 10,850 and reached NPR 169,038 in FY 2021/22, which is a more than 15-fold increase. Evidently, GDP per capita growth was relatively slow until the early 2000s marked by the country's political unrest and economic stagnation. From FY2005/06 onward, GDP per capita showed sustained growth, reflecting post-conflict recovery, remittance inflows, tourism revival, and the expansion of the services sector. Despite this growth, the rate of increase in per capita government healthcare expenditure outpaces that of GDP per capita, indicating a possible rise in the priority given to health expenditure by both government and households relative to economic output. This could suggest the investment in health sector has become more essential in Nepal's development agenda or that the cost of healthcare provision has risen substantially (Appendix A).

OPD Visits as Utilization of Health Services

The number of OPD visits (annual outpatient department consultations frequency) grew significantly between FY 1994/95 and FY 2021/22, though this trend also not without certain fluctuations. In 1994/95, total OPD visits stood at around 4.17 million. This rose continuously, reaching a peak of 33 million in FY 2021/22, showing an eightfold increase. Evidently, the most rapid growth occurred between FY 2007/08 and FY 2009/10, when visits rose from 12 million to over 20 million, likely reflecting the expansion of public health facilities, introduction of free essential health services, and improved geographic access in rural areas after the conflict. After FY 2013/14, OPD visits surprisingly declined slightly despite economic growth and rising health expenditure. This fall (from 24 million in FY 2012/13 to 18.7 million in FY 2015/16) might reflect either improved preventive care reducing illness incidence or systemic inefficiencies in health service delivery. Another explanation could be shifting disease burden patterns (from communicable to non-communicable diseases)or the increasing role of private-sector services which is not captured in public OPD data. After the dip, OPD visits recovered significantly post-2017/18, possibly due to expanded coverage of community health programs and post-earthquake health reconstruction efforts (Appendix A).

Health Human Resources Density

Health Human Resources per 10,000 population (HR) also reflects important dynamics. HR rose from 13.84 per 10,000 in FY 1994/95 to a peak of 37.23 in FY 2004/05. After that, HR declined gradually, reaching 27.46 by FY 2014/15, before again rising moderately to 31.0 in FY 2021/22. The early sharp rise until FY 2004/05 can be attributed to government efforts to train and deploy health workers to rural and underserved regions, with donor and development partner assistance. The post-2005/06 decline in HR may result from outmigration of health professionals' underinvestment in medical education, or an expansion in population outpacing HR growth. Despite substantial GDP and health expenditure growth, HR availability has not kept pace which indicates a potential bottleneck in healthcare delivery capacity, especially in remote areas (Appendix A).

Based on the nature of interrelationship among indicators, PCHE and GDP per capita show a positive correlation, consistent with health economics theory: higher income allows higher health spending both publicly and privately.However, HR's inconsistent trend raises concerns; while economic and health expenditure indicators improve, the stagnant or declining HR ratio suggests supply-side constraints, potentially affecting service quality and availability.In addition, OPD visits surged along with PCHE and GDP per capita which suggests that improved access or demand for health services as incomes rose and government health programs expanded. Yet, its fluctuation also hints at changing disease patterns or service delivery issues.In this context, several contextual factors likely contribute to shape these trends.

The armed Political Conflict (1996–2006) period is characterized by limited economic growth and healthcare investments during the Maoist insurgency years. Similarly, Federal Restructuring (Post-2015)characterized by devolution of health responsibilities and fiscal authority to local governments explain the renewed rise in PCHE and OPD use. The 2015 earthquake caused temporary disruptions in health service utilization and HR deployment. The COVID-19 Pandemic (FY 2020/21–FY 2021/22)period increased PCHE due to emergency expenditure; fluctuations in OPD visits due to lockdowns, fear of infection, and service disruptions (Appendix A).

This gives some insights for policy implications as well Despite impressive economic and PCHE growth, health human resources remain a weak point requiring focused policies to expand and retain skilled professionals. Fluctuating OPD visits hint at the need to assess service delivery quality and accessibility, particularly in rural and marginalized areas. The consistent rise in PCHE suggests increasing public and possibly private commitment to health, but the efficiency and equity of this expenditure need evaluation. To sum up, this 28-year data review highlights Nepal's substantial progress in healthcare financing and service utilization, underpinned by economic growth and post-conflict reconstruction. Yet, critical gaps remain visible particularly in human resources and equitable service delivery that demand urgent strategic policy attention. Therefore, future reforms must align financial investments with capacity-building and health workforce development to sustain health outcome improvements for the Nepalese population.

4.3 Econometric Analysis of the Data

The econometric analysis is based on annual time series data from1994 to 2022. The econometric analysis concentrated to analyze the ARDL model specified as per capita government health expenditure as function of GDP per capita, health seeking behavior of people and health workforce density including policy variables, followed by the co-integration analysis. Moreover, test of long-run relationship and short run dynamics, diagnostic test and stability test are conducted side by side.

4.4 Unit Root Test Results

The unit root test is a statistical approach used to determine whether a time series variable is non-stationary and possesses a unit root. In time series analysis, the concept of stationarity is crucial because many statistical models rely on the assumption that the properties of the time series, such as its mean and variance, do not change over time. In the process of unit root test, the null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationarity, trend stationary or explosive root, depending on the test used (Shrestha, 2018). The result of unit root is presented in Table 4.1 and Table 4.2.

4.4.1 Augmented Dickey Fuller Unit Root Test

The Augmented Dickey Fuller (ADF) test determines whether variables are stationary, a crucial assumption for valid time-series modeling. Therefore, the Augmented Dickey Fuller Test is carried out to test the stationarity of the data series. Table 4.1 presents the results of the Augmented Dickey-Fuller (ADF) unit root test for various variables used in a time-series analysis of healthcare expenditure in Nepal. The ADF unit root test confirmed the stationarity of the data series in mixed form i.e., at level and first difference. The result is presented below.

Table 4.1

Augmented Dicky Fuller Unit Root Test Results

Variables	ADF-statistics	P-value	Critical values at 1%	5%	10%	Order of integration
LnPCHE	1.202	0.9971	-3.809	-3.021	-2.650	
ΔLnPCHE	-4.153	0.0206	-4.533	-3.674	-3.277	I(1)
LnGDPpc	0.244	0.9702	-3.711	-2.981	-2.630	
ΔLnGDPpc)	-3.352	0.0231	-3.724	-2.986	-2.633	I(1)
LnHR	-4.624	0.001	-3.699	-2.276	-2.627	I(0)
ΔLnHR	-4.544	0.001	-3.737	-2.991	-2.635	I(0)
LnOPD	-1.214	0.651	-3.738	-2.992	-2.636	
ΔLnOPD	-4.275	0.002	-3.738	-2.992	-2.636	I(1)

Note. Table 4.1 above demonstrates the Augmented Dickey Fuller Test result as computed by author based on the data given in the Appendix A.

Table 4.1 above shows thatthe variableΔLnPCHE, is stationary after first difference at the 5 percent level, indicating that LnPCHE is integrated of order one. The variableLnGDPpc, is non-stationary at level and stationary at the first difference, indicating that LnGDPpc is also I(1). The variableLnHR, is stationary at level and I(0), indicating that LnHR is integrated of order zero. The variableLnOPD, is non-stationary at level but becomes stationary after first differencing, implying that LnOPD is I(1). These findings indicate a mixed order of integration, suggesting that the ARDL model would be appropriate for further econometric analysis, as they can handle variables integrated of different orders I (0) and I(1).

4.4.2 Philip-Perron Unit Root Test

The Philip-Perron unit root test is widely used procedure for examining the stationarity property of time series data. Table 4.2 below presents the Philip-Perron unit root test result.

Table 4.2

Phillip-Perron Unit Root Test Results

Variables	PP-statistic	P-value	Critical values at			Order of integration
			1%	5%	10%	
LnPCHE	0.700	0.989	-3.711	-2.981	-2.630	
ΔLnPCHE	-3.787	0.008	-3.724	-2.986	-2.633	I(1)
LnGDPpc	-0.320	0.908	-3.711	-2.981	-2.630	
ΔLnGDPpc	-6.020	0.001	-3.724	-2.986	-2.632	I(1)
LnHR	-5.259	0.000	-3.699	-2.976	-2.627	I(0)
ΔLnHR	-4.599	0.001	-3.711	-2.981	-2.629	I(0)
LnOPD	-1.588	0.474	-3.711	-2.981	-2.630	
ΔLnOPD	-3.157	0.035	-3.724	-2.9862	-2.633	I(1)

Note. Table 4.2 demonstrates the Phillip-Perron Test result as computed by author based on the data given in the Appendix A.

Table 4.2 presents the PP test results for four key log-transformed variables used in the healthcare expenditure model in Nepal. The Phillips-Perron test results show that LnPCHE, LnGDPpc, and LnOPD are non-stationary at level but stationary after first differencing I(1), while LnHR is stationary at level I(0). This mix of integration orders I(0) and I(1) suggests that an ARDL modeling approach is suitable for analyzing long-run relationships among these variables. The LnPCHE variable is non-stationary at level but stationary after first differencing I(1), while the LnGDPpc variable is non-stationary at level but stationary after first differencing I(0). The results suggest that an ARDL modeling approach is suitable for analyzing the long-run relationships among these variables, as it accommodates such a mixture without requiring all series to be I(1).

In conclusion, the Table 4.1 and 4.2 showing unit root test results in ADF test and Phillip-Perron test indicate that all the variables are integrated of I(0) and I(1). All the variables having mixture of order integration i.e. I(0) and I(1), which is suitable and desirable condition for ARDL approach to analysis.

4.5Descriptive Statistics

Descriptive statistics of the variable set provide insight about data used in the study. Table 4.3 below presents the descriptive statistics for the selected data set for this analysis. In this regard, each variable has 28 data points as annual time series data from FY 1994/95 to FY 2021/22. The variables were expressed in natural log form to interpret the coefficient elasticity in percentage term.Evidently, the average natural logarithm of per capita government health expenditure (LnPCHE) is 6.00 with standard deviation of 1.15. The average of the natural logarithm GDP per capita (LnGDPpc) is 10.56 with standard deviation of 0.855. Likewise, the natural logarithm of the health human resource provision per 10000 populations in the government healthcare system (LnHR) is 3.35on an average with standard deviation 0.24. Finally, the natural logarithm value for annual out-patient visit in government health system (LnOPD) is 3.93 on an average with standard deviation of 0.47 (Table 4.3).

Table 4.3

Descriptive Statistic of the Variables

Parameters	LnPCHE	LnGDPpc	LnHR	LnOPD_
Mean	6.00	10.56	3.35	3.93
Median	5.91	10.38	3.54	3.87
Maximum	8.14	11.89	3.61	4.62
Minimum	4.26	9.29	2.62	3.03
Std. Dev.	1.15	0.85	0.24	0.47
Observations	28	28	28	28

Note. This table demonstrates descriptive statistical results of variables as computed by the author based on the data given in Appendix A.

4.6 Structural Break Test

In time series data, a structural break occurs when the underlying data-generating process changes at a certain point in time due to policy changes, economic crises, or technological shifts. If this issue is not addressed, structural breaks can lead to spurious regression, biased estimates, and eventually misleading inference (Bai & Perron, 1998). Bai-Perron is the most powerful tool to detect multiple breakpoints. Therefore, this study has selected Bai-Perron'sMultiple Break Tests, taking into consideration the nature of the data included in this study. This tool detects multiple structural breaks in regression models at unknown points, is flexible, widely used in economic time series analysis, and is recommended for long time series with multiple potential breaks.Table 4.4, given below, presents the Bai-Perron breakpoint test result. The Bai-Perron breakpoint test indicates statistically significant structural breaks in the model's variables at the 5 percent level of significance.

Table 4.4

Bai-Perron Breakpoint Test Result

Variable	Sequential F-Statistic	Scaled F-Statistic	Critical Value (5%)	Significant 5%	Break Date	Comments
LnGDPpc	12.0503	24.100	11.47	Yes	2013	Evidence of break
LnOPD	22.733	45.466	11.47	Yes	2013	Evidence of break
LnHR	63.331	126.66	11.47	Yes	2008	Evidence of break

Note. Table 4.4 above demonstrates the Bai-Perron break point test result for ensuring the detection of breaks of the data used in the proposed regression model computed by the author.

Table 4.4 above shows structural break for the both all three variables LnGDPpc, LnOPD, and LnHR. For the variables LnGDPpc, LnOPD, both structural break date is the year 2013**,** possibly due to policy shift. Moreover, LnHRshows a significant break earlier, in the year 2008**,** indicating a structural change in health human resources in the government healthcare system, potentially linked to reforms and investments in the workforce. The test provides strong evidence of a structural break in the data series, which should be accounted for in further time series modelling and analysis. In this regard, creating dummy variables and generating interacting terms with the respective variables corresponding to the break date points is a standard option.The researcher has pointed to creating an additional dummy variable and including it as an explanatory variable as a policy dummy free of cost medicine and maternity as a remedy of structural break.

4.7ARDL Cointegration Test Results

The ARDL integration analysis is usually started from lag length selection criteria and followed by bound test, long-run and short-run coefficient estimation.

4.7.1 Lag Length Selection

The study used Akaike Information Criterion (AIC) to choose the optimal lag length. The decision was based on the results from the HQIC, AIC and FPE. Table 4.5 below presents the lag length selection test result.

Table 4.5

Optimal Lag Length Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	49.1496	NA	0.0000	-3.0481	-2.6642	-2.9340
1	284.2007	313.4014*	2.55e-17*	-15.71857*	-12.26300*	-14.69105*

Note. This table demonstrates optimal lag length criteria results for the model as computed by the author based on the data given in the Appendix A.

The optimal lag length selection results indicate that lag 1 is preferred based on all selection criteria. Moreover, based on Akaike Information Criterion (AIC) selected, having smallest coefficient. Likelihood Ratio(LR), Schwarz Criterion (SC), Final Prediction Error(FPE), Akaike Information Criterion (AIC), and Hannan-Quinn (HQ).The asterisks (*) mark the minimum values for each criterion at lag 1, suggesting that including one lag in the model provides the best balance between model fit and parsimony (Table 4.5).

4.7.2 F- Bound Test Result

F-Bound Test is to be conducted for co-integration analysis in ARDL framework. Moreover, the ARDL model bound test was conducted to examine the long run and short run relationship amongst the variables such as per capita government healthcare expenditure, GDP per capita, government revenue per capita, health human resource provision per 10000 populations in government healthcare system (HR), and annual OPD visit frequency in government healthcare system. Likewise, interaction terms with dummy variables are included to address the issue of structural break and to capture the government policy regime. The bound test result given below in Table 4.6 indicates that the computed F-statistics of value 5.347 is obviously higher than lower bound I(0) and upper bound I(1) critical values at the given level of significance (5.347>3.91 > 3.18 > 2.83 > 2.54). Based on the result, we reject the null hypothesis that there is no long-run relationship amongst the variables included in the estimated model.

Table 4.6

Bound Test for Co-Integration Analysis

Null Hypothesis: No long-run relationship exists		
Test Statistics	Values	K(Explanatory Variables)
F-statistic	5.347	7
	Critical Value Bounds	
Significance	I(0) Bounds	I(1) Bounds
10 %	1.70	2.83
5%	1.97	3.18
1%	2.54	3.91

Note. Table 4.6 demonstrates a bound test for cointegration analysis results for the model as computed by the author based on the data given in Appendix A.

In other words, per capita government healthcare expenditure is co-integrated with GDP per capita, annual OPD visit frequency in government healthcare system, health human resource provision per 10000 populations in government healthcare system, and policy dummy variables (Table 4.6). After confirming a co-integration relationship between the series, the ARDL model can be established to determine long run and short run relationships. Therefore, we conclude that there exists a long run relationship between dependent and independent variables included in the model.

4.7.3 Long-Run Relationship

ARDL bounds testing approach ensures long-run relationship between the dependent and its determinants. The long-run coefficients capture the equilibrium relationship amongst the variables, indicating magnitude and direction of the impact of each explanatory variables on the outcome variable in the long-run. The estimated long-run coefficients of the current study are shown in Table 4.7. The result is compliance with the economic theories and previous empirical studies. The value of coefficient of determination and adjusted coefficient of determination are 0.997 and 0.995 respectively. This implies that more than 99 percent of the variation in the dependent variable per capita government healthcare expenditure can be defined by the explanatory variables included in the model.

Table 4.7

Estimated Long run Coefficients using ARDL model

Dependent variable: Per Capita Government Health Expenditure (LnPCHE)			
Explanatory Variables	Coefficient(S.E.)	t-Statistic	Prob.
LnGDPpc	1.16***(0.16)	7.19	0.00
LnOPD	0.48***(0.09)	4.87	0.00
LnHR	0.55**(0.16)	3.52	0.01
LnGDPpc*Dum2013	0.84**(0.38)	2.16	0.04
LnOPD*Dum2013	1.25**(0.47)	2.62	0.02
LnHR*Dum2008	0.23***(0.03)	7.13	0.00
Dum2013	-30.96***(5.04)	-6.13	0.00
R-squared	0.997		
Adjusted R-squared	0.995		
D-W Statistics	1.81		

Note: Table 4.7 shows estimated long-run coefficients of the independent variables using ARDL model as computed by author based on the data given Appendix A. Significance Levels: ***p < 0.01; ***p < 0.05; *p < 0.10.*

The estimated Long-Run coefficients for LnGDPC show that a 1 percent increase in GDP per capita leads to about 1.16 percent increase in per capita government health expenditure. Notably, the estimated income elasticity of 1.16 for per capita health expenditure in Nepal aligns well with both theory and empirical findings for least developed countries (LDCs) like Nepal. In other words, income elasticity for health expenditure is greater than unity. Empirical evidence has shown that in low-income and middle-income countries, health expenditure often rises faster than GDP.

Likewise, a 1 percent increase in health workforce density increases government health expenditure by 0.55 percent. The positive shift in health expenditure after 2008 due to health workforce policy is evident. Moreover, GDP per capita became more influential after 2013, and post-2013 OPD visits became more cost-driving. However, a 1 percent increase in outpatient care visits leads to a 0.48 percent decrease in health spending, possibly indicating the substitution of outpatient care for costly services. A strong negative dummy effect, possibly capturing a shock or reclassification, is also present. Essentially, these effects suggest that economic growth, workforce availability in the government healthcare systems, and health system reforms have strong roles in driving and shaping health expenditure. Moreover, institutional and policy reforms captured through dummy variables have also significantly shaped the long-term trajectory of government health expenditure in Nepal.

4.7.4 Short-Run Dynamics

In the ARDL framework, after confirmation of a long-run relationship amongst the variables included in the model, we examine the short-run dynamics using the error correction representation of the ARDL model. Table 4.8 shows an ECM model where values of R^2 and adjusted R-squared are 0.737 and 0.689 respectively. The coefficient of variation indicates that in short-run more than 73 per cent explanatory power of the independent variables included in the model.

Table 4.8

ECM Representation for Selected ARDL Model

Dependent variable: Per capita Government Health Expenditure (LnPCHE)			
Explanatory Variables	Coefficient(SE)	t-Statistic	Prob.
ΔLnGDPpc	0.358**(0.16)	2.21	0.04
ΔLnHR*Dum2008	0.1072***(0.02)	5.12	0.00
ΔLnOPD*Dum2013	-0.188(0.181)	1.03	0.31
ΔDum2013	-10.48***(3.11)	-3.36	0.00
ECT(-1)	-0.75***(0.09)	-7.92	0.00
R^2	0.737		
Adjusted R^2	0.689		
D-W Statistics	1.81		

Note. Table 4.8 demonstrates ECM Representation for Selected ARDL model as computed by author based on the data given in the Appendix A. Significance Level:***p<0.01, **p<0.05, *p<0.10.

Table 4.8 clearly depicts that the error correction term (ECT) is negative and statistically significant coefficientthat further support to the existence of co-integration of the dependent variable per capita government health expenditure with its explanatory variables included in the model. The short-run dynamics of the ARDL model are captured through the conditional error correction regression. The coefficient of Error Correction Term(ECT) is 0.75 accompanied with statistically significant p-value ($p < 0.001$),indicating the presence of a stable long-run relationship**.** This implies that approximately 75 percent of any deviation from the long-run equilibrium is corrected within a year, suggesting a relatively fast speed of adjustment of health expenditure back to its long-run path. In other words, it confirms that the system is stableand adjusts quickly toward long-run equilibrium.The estimated short-run coefficients of all the explanatory variables are significant at one percent, five percent level and 10 percent level (Table 4.9). To sum up, GDP growth and government healthcare workforce expansion drive increased government health expenditure in the short run.

4.7.5 Diagnostic Test Results

Diagnostic tests are to be conducted to ensure that the estimated ARDL modelling framework yields best, linear, unbiased and efficient (BLUE) estimators. Moreover, these test assesses the reliability and robustness of the estimated coefficients. The choice of the tests dependents on the econometric technique employed in the study. In the context of the ARDL modelling framework, the study applies the most commonly used diagnostics, which can be grouped into three broad categories: lag structure diagnostics, coefficient diagnostics, and residual diagnostics. In this regard, lag structure diagnostics ensure that the selected lag length adequately captures the dynamic relationships among variables. Likewise, coefficient diagnostics examine the stability and statistical validity of the estimated parameters over time. The details of all estimated diagnostic test results are discussed subsequently.

Regression Specification Error Test Result

Table 4.9 shows Ramsey (1969) RESET Test result to ensure the correctness of the specified functional form. Ramsey RESET for model specification indicates that the model has no evidence of any misspecification.

Table 4.9

Ramsey RESET Test Result

Omitted Variables: Squares of fitted values			
Parameters	Value	df	Probability
t-statistic	0.8874	14	0.3898
F-statistic	0.7875	(1, 14)	0.3898

Note. Table 4.9 Ramsey RESET test result for estimated model as computed by the author based on the data given in the Appendix A.

Table 4.9 shows the calculated probability values of F-statistics and t-statistics. Evidently, the probability values of F-statistics and t-statistics are like 0.3898 and 0.3898 > 0.05, which exceeds 5 percent significance level, indicating the correctness of the functional form of the model.

Serial Correlation LM Test Result

Table 4.10 below shows that the estimated result of Serial correlation test or LM test. Serial correlation test is used to measure the serial correlation of residuals. Essentially, it is assumed that the error terms in the regression equation are uncorrelated with one another. Hence, this phenomenon is called serial correlation.

Table 4.10

Serial Correlation Test result

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.6973	Prob. F(2,14)	0.5144
Obs*R-squared	2.3556	Prob. Chi-Square(2)	0.3080

Note. Table 4.10 demonstrates serial correlation test results for estimated models as computed by the author based on the data given in Appendix A.

The result in Table 4.10 shows that the probability value of F-statistics and observed R-squared are like 0.5144 and 0.3080 >0.05 respectively, which clearly exceeds the 5 percent significance level. This indicates the acceptance of null hypothesis i.e. there is no serial correlation in residuals and the residuals are not serially correlated. This result confirms the assumption of no serial correlation of error terms in the ordinary least square method.

Heteroscedasticity Test Result

Table 4.11 presents the result of heteroscedasticity test. Heteroscedasticity test measures the nature of existence of variance of residual over the period of time. There is assumption that the residuals must have constant variance (homoscedasticity) in the regular OLS estimation as well as for the ARDL model for robustness of the estimated coefficients.

Table 4.11

Heteroscedasticity Test Result

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.6044	Prob. F(10,15)	0.7875
Obs*R-squared	7.4677	Prob. Chi-Square(10)	0.6807
Scaled explained SS	2.5158	Prob. Chi-Square(10)	0.9906

Note. Table 4.11 demonstrates heteroscedasticity test results for estimated models as computed by the author based on the data given in Appendix A.

Table 4.11 shows that the probability value of F-statistics and observed R-squared are 0.7875 and 0.6807 respectively which clearly exceeds 5 percent significance level, meaning the acceptance of the null hypothesis i.e. no heteroscedasticity in residuals. This means there is homoscedasticity.

Normality Test Result

Table 4.12 presents the normality test results. Normality assumption is crucial for regression estimation. Essentially, ordinary least square and time series data assumes the normal distribution of residuals error terms. For the normality test, the Jarque-Bera (JB) statistics is observed in order to confirm whether the residuals are normally distributed or not.

Table 4.12

Statistics of Normality Test

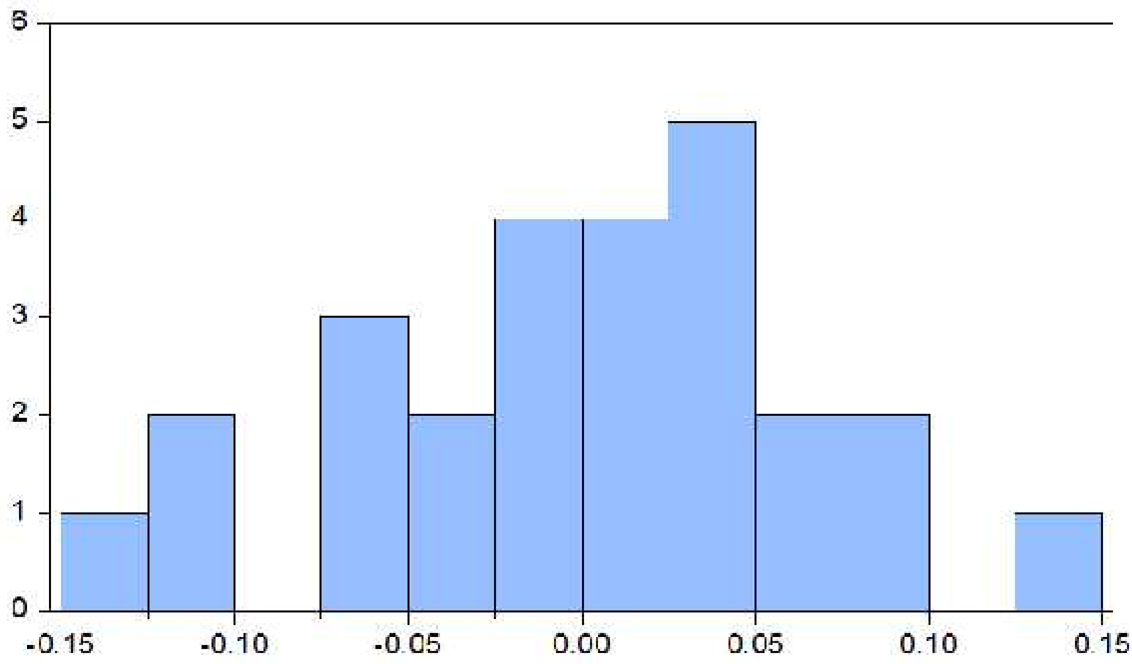
Jarque-Bera Statistics	P-Value
1.05296	0.59067

Note. Table 4.12 demonstrates statistics of normality test results for estimated model as computed by the author based on the data given in the Appendix A.

Evidently, Table 4.2 shows the estimated JB statistics as 1.05296 with its probability value 0.59067 which clearly exceeds the 5 percent significance level. It indicates acceptance of the null hypothesis i.e. the residuals are normally distributed. Likewise, the histogram of normality test as displayed in Figure 4.1 also confirms normality od the distribution.

Figure 4.1

Histogram of Normality Test Result



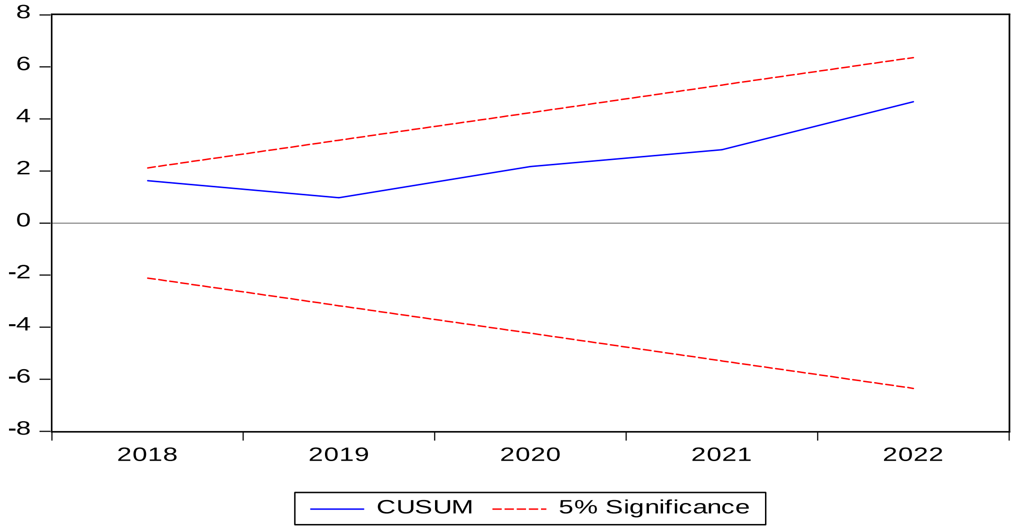
Note. Figure 4.1 demonstrates statistics of normality test results for estimated models as computed by the author based on the data given in Appendix A.

Stability Test Results

Figure 4.2 and 4.3 presents the Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Square of Recursive Residuals(CUSUMQ). To ensure stability of the long-run coefficients together with the short-run dynamics CUSUM and CUSUMQ are applied. Moreover, the stability of the estimated coefficients of the error correction model and a graphical representation of CUSUM and CUSUMQ statistics are shown in Figure 4.2 and 4.3 respectively. Therefore, we cannot reject the null hypothesis if the plot of these statistics remains within the critical bound on the 5 percent significance level.

Figure 4.2

Plot of Cumulative Sum of Recursive Residuals

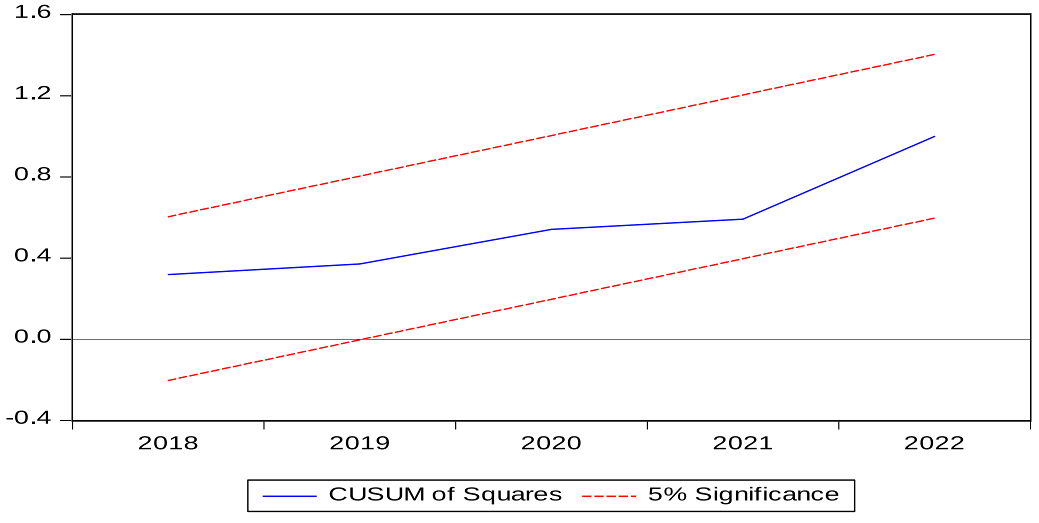


*Note.*This figure demonstrates the plot of cumulative sum test results for the estimated model as computed by the author based on the data given in the Appendix A.

Figure 4.2 and 4.3 clearly show that the plots of both the CUSUM and the CUSUMQ are within the boundaries and hence providing evidence that these statistics confirm the stability of the model. Since both of the plots lie between the critical regions at 5 percent level of significance, indicating the stability of the model and no evidence of any significant structural instability. Therefore, the model does not suffer from any structural instability over the period of the study.

Figure 4.3

Plot of Cumulative Sum of Square of Recursive Residuals



Note. This figure demonstrates the plot of the cumulative sum of squares test result for the estimated model as computed by the author based on the data given in Appendix A.

4.8 Discussion

The first objective of this study is to identify the factors associated with the per capita government healthcare expenditure in Nepal. The time series econometric analysis confirms the long-run relationship between per capita government health expenditure and its predictors included in this study. In other words, the study demonstrated that the GDP per capita, annual out-patient visit frequency in the government healthcare system, and health human resources density in the government healthcare system are the strong predictors of healthcare expenditure in Nepal. Moreover, the long-run estimated coefficients indicate that a 1 percent change in GDP per capita, annual OPD visit frequency in government healthcare system, health human resources density in government healthcare system cause change in per capita government health expenditure by 1.16 percent, 0.48 percent, and 0.55 percent respectively. The time series analysis result gives ample space for interpretation and insights for policy implication. The discussion for each variable coefficient is as follows:

Firstly, the finding suggests that there is significant positive influence of GDP per capita on per capita government health expenditure in Nepal. Moreover, the income elasticity coefficient on health expenditure is 1.15, which is greater than unity, indicating healthcare as luxury. In other words, the result is theoretically grounded and empirically consistent for Nepal being the least developed country. In fact, in the low-income countries, proportionate change in healthcare expenditure is higher than GDP growth. Being a low-income country, it is also consistent for Nepal. Since the elasticity is confirmed with the previous studies such as Kaur (2023), Moayedfard et al. (2020), Raghupathi and Raghupathi (2020), Barkat et al. (2019), Furuoka et al.(2012), Pan et al. (2012), Xu et al.(2011), Eik et al.(2009) have explored significant positive influence of GDP per capita on per capita government health expenditure. But, Farag et al’s (2012) result is albeit contrasting as it asserts that there is weaker GDP growth and government health expenditure is weaker in developing countries compared to developed ones. Intuitively, it suggests that as a country’s wealth increases (measured by GDP per capita), the government tends to allocate more resources toward healthcare provision for each individual. In this concern, the finding indicates that economic growth of Nepal contributes directly to better healthcare provisions through increased government expenditure. Eventually, this may lead to improvements in healthcare access, quality of services, and overall public health. Therefore, as policy implication, economic growth should be translated into health infrastructure installation such asbuilding new hospitals, improving existing health facilities, hiring more medical professionals, and expanding medical technology. This may ensure that rising healthcare expenditure is spent efficiently to meet the growing healthcare needs of the population.

This analysis also demonstrates that annual out-patient department (OPD)visit frequency in the government healthcare system is a significant factor influencingper capita government health expenditure. This finding is also supported by the previous empirical studies such as Phelps (2017), Fenton et al. (2012), and Wang et al. (2016). In fact, annual OPD visit frequency is regarded as the proxy of health seeking behavior of people which is seen in increasing trend. Intuitively, the significant positive influence suggests that when the frequency of OPD visits increases, the government's per capita healthcare expenditure rises. This is because more OPD visits lead to higher utilization of healthcare resources, such as medical staff time, medications, diagnostic services, and medical equipment. Furthermore, the increasing trend of OPD visit frequency is likely to increase operational costs, including healthcare staffing, and medical supplies which contribute to the overall per capita government health expenditure.Alternatively, it can be inferred that a significant number of OPD visits may be driven by chronic diseases such as hypertension, diabetes, and cardiovascular conditions. Concerning this, governments can implement programs to manage these diseases more effectively through lifestyle interventionsand community health programs.

The analysis result shows that the health human resources density in the government healthcare system and per capita government healthcare expenditure is significantly and positively correlated. This result of the study is found to be in compliance with the previous empirical studies such as Moayedfard et al. (2020),Samadi and Rad (2013) Rahaman (2008). These results give some insights for interpretation. Intuitively, an increased number of physicians in the government healthcare system reflects better access to healthcare services and leads to greater utilization of preventive as well as diagnostic treatments and medications, which increases per capita healthcare costs. Therefore, this correlation in Nepal suggests that expanding the medical professionals and workforce leads to higher healthcare costs, reflecting both increased access and utilization of government healthcare services. Essentially, increasing the number of physicians is a prerequisite to improve healthcare provision. At the same time, the government should also focus on optimizing resource allocation to ensure that rising costs will not be problematic from a sustainability point of view. Similarly, emphasis needs to be given to implement efficiency measures and controlling expenditures. The interacting term dummy variable 2013 had a significant impact on per capita government health expenditure.

In conclusion, the ARDL model provides robust evidence that per capita healthcare expenditure in Nepal is influenced by economic growth, service utilization, and human resource availability, with policy interventions playing a significant modifying role. The responsiveness of expenditure to GDP growth confirms the need to expand fiscal space for health. Meanwhile, the impact of utilization and HR underscores the need for better system design and workforce efficiency. Policies introduced in 2008 and 2013 had both immediate and long-run implications for healthcare spending, with the latter reform notably enhancing the effects of economic and service-related variables. This suggests that policy architecture in Nepal must anticipate both demand and supply-side pressures, and adopt a systems-thinking approach to ensure sustainable health financing. Based on the empirical findings and their discussion, we may draw several critical policy insights for future improvements of healthcare expenditure optimization.

Nepal must proactively align economic growth with public health investment. Budgetary allocations to the health sector should be indexed to economic performance, ensuring that growth translates into improved service coverage and quality, rather than just higher OOP payments for healthcare.The significant role of OPD visits or healthcare utilization highlights the need for demand-side management strategies. These may include gatekeeping mechanisms in primary care, preventive health promotion, and digital health tools to reduce unnecessary visits and optimize time and resources. Additionally, the health insurance program should be strengthened with better provider contracting and cost controls.

Scaling up health human resources is essential; the significant expenditure impact calls for more efficient workforce planning. This includes task-shifting, digital upskilling, and integrating HR planning into overall health financing frameworks. Incentives should focus not just on deployment but also on productivity and retention.The dual effects of the policy reforms, expanding utilization while initially suppressing direct expenditure, demonstrate that well-designed policies can balance access and cost. Future policies should adopt a health system strengthening approach that includes risk pooling, results-based financing, and strategic purchasing.

The interaction effects of policy dummies highlight the importance of continuous policy monitoring and evaluation. Nepal's health sector can benefit from establishing a national health accounts system and health policy observatory to track the fiscal and service-delivery impacts of reforms.Given Nepal's federal structure, future expenditure patterns will also be shaped by how local governments allocate resources. The national government should ensure equitable health financing transfers, capacity building for local budgeting, and performance-based grants to avoid inefficiencies and regional disparities.

Overall Policy Implications

The long-term trends in Nepal's per capita public healthcare expenditure (PCHE), as analyzed in relation to GDP per capita (GDPpc), OPD visit frequency, and health human resources density (HR) density, offer valuable insights for policy implication. Moreover, the increase in expenditure must be understood within the broader context of health service utilization, workforce availability, and economic growth to develop actionable policies.

The strong correlation between GDP per capita and PCHE suggests that economic growth provides fiscal space for increased public health expenditure. Evidently, as GDP rose from NPR 10,850 in 1994/95 to NPR 169,038 in 2021/22, public health expenditure grew proportionally (Ministry of Finance, 2023). This trend highlights the importance of macroeconomic stability and sustained economic growth for expanding government financing of the health sector.

This gives valuable policy implications for budgetary management. Essentially, it is vital for the Government of Nepal (GoN) to embed health as a priority sector within its economic development strategy for ensuring sustainable financing of public healthcare. In other words, budgetary allocation rules could be linked more explicitly to GDP growth, for example by setting a minimum percentage of GDP (e.g., 5%) to be spent on health, in line with WHO recommendations. Moreover, economic policies that enhance domestic revenue generation, such as tax reforms and improved fiscal decentralization, may provide a more reliable funding base for health.

Notably, a high rate of increase in annual OPD visits frequency is observed from FY 1994/95 to FY 2021/22 (Ministry of Finance, 2023) that signals a surge in healthcare utilization, possibly due to population growth, health awareness, increased disease burden, and policy initiatives like free basic health services. However, this increase may strain infrastructure and human resources could degrade service quality if not addressed. This gives valuable policy implications for accommodating rising healthcare demand. In other words, public investment should focus on expanding and modernizing primary care facilities, particularly in rural and underserved areas, to accommodate the rising healthcare demand. This includes increasing the number of healthcare providers and upgrading existing centers into primary hospitals with diagnostic and minor surgical capabilities. Simultaneously, the health information system must be improved and strengthened to monitor real-time health service utilization patterns for efficient resource deployment.

The data clearly shows that HR density per 10,000 populations in government facilities peaked in the early 2000s but declined steadily after 2010, dropping from above 36 to about 30.95 by FY 2021/22. This decline in human resource density increased annual OPD visits and public health expenditure raises concerns about healthcare system efficiency and personnel workload (Appendix A). This also gives valuable policy implications for rethinking about the healthcare system efficiency and personnel workload. The government must prioritize health workforce planning and management as a cornerstone of efficiency and strengthening of the health system. In this context, strategies may include recruiting and retaining more health professionals, especially in peripheral areas, followed by expanding pre-service education through medical colleges and nursing schools. Despite rising government healthcare expenditures, disparities in service delivery and health outcomes persist across provinces and urban-rural areas. Inadequate targeting of public health investments can undermine the effectiveness of increased health expenditure (Dhungana, 2023).

This also provides valuable policy implicationsto improve the effectiveness of increased health expenditure. Government of Nepal in general and Ministry of Health and Population in particular should adopt a program-based budgeting approach, focusing on measurable health outcomes rather than input-based allocations. In fact, performance-based financing models and district-level budget allocations based on need (e.g., remoteness, disease burden) can improve equity. Likewise, public expenditure tracking surveys should be institutionalized to identify and correct leakages and inefficiencies.

As healthcare utilization grows and workforce constraints persist, digital health solutions can improve efficiency, particularly in areas with limited access to physical services. This also provides valuable policy implications for seeking potential areas of its use for government health expenditure optimization. Intuitively, the government should invest in telemedicine, electronic health records, and digital capacity-building among health workers. In fact, these innovations not only improve care delivery but also generate data for evidence-based planning, helping optimize the use of government health budgets. In this regard, the government can launch piloting and scaling up e-health platforms in partnership with private and academic sectors to offer cost-effective ways to expand access.

Moreover, reliable data and robust monitoring are essential to understand trends in healthcare expenditure and service delivery. Currently, observable, inconsistent, and fragmented data systems hinder evidence-based decision-making. This also provides valuable policy implications for developing the national health expenditure surveillance mechanism, integrating data from the Ministry of Health and Population, Ministry of Finance, and local level governments. In addition, more operational and econometric research, such as cost-effectiveness studies, health impact evaluations, and benefit incidence analysis, should inform resource allocation and policy design. Essentially, academic partnerships with national universities and think tanks can be key to institutionalizing such evidence generation. To sum up, the findings confirm a stable long-run relationship between health expenditure and key economic, institutional, and health service-related variables, supported by both the bounds test and the error-correction term. In the long run, GDP per capita, health human resources density, and institutional reforms (proxy for structural break dummies) significantly influence government health expenditure. The results highlight the need for sustainable economic growth, investment in government health system infrastructure, including human resources in the government healthcare system, and careful planning and implementation of policy reforms. These measures are crucial for enhancing fiscal space for health and ensuring equitable and efficient health service delivery. In nutshell, the ARDL model provides valuable insights for health policymakers in Nepal, showing the importance of macroeconomic and institutional factors in shaping public health expenditure trends.

CHAPTER V
ANALYSIS OF OUT-OF-POCKET PAYMENTS FOR HEALTHCARE IN NEPAL

5.1 Introduction

This section analyses the determinants of OOP payments for healthcare in Nepal using time series data. Obviously, OOP payments for healthcare is crucial for accessibility and affordability of healthcare service. The section aims to uncover temporal patterns and causal relationshipsbetween per capita OOP payments for healthcare and its linkage with macroeconomic factors. In the Nepali context, a significant portion of health expenditure is covered by OOP payments from households (Thapa & Singla, 2019). The rising trend in OOP health expenditure can jeopardize thefinancial security of low-income households, trapping them in poverty. In other words, these payments not only discourage households from seeking healthcare but also cause considerable hardship and financial impoverishment, especially among the poor (Anuranga et al., 2007). Therefore, insufficient public healthcare funding exacerbates this issue, creating barriers to equitable and accessible healthcare services for the general population. This inadequacy likely leads to deteriorating health outcomes (Chang & Wing, 2005). As a result, labor force productivity and economic growth are hindered. Therefore, optimal expenditure on healthcare is crucial for developing a healthy, productive, and innovative labor force (Weinhold et al. 2014).

The Constitution of Nepal 2015 elevated healthcare to a constitutional right, mandating the state to provide both preventive and curative health services to all, including the elderly, persons with disabilities, and marginalized groups (Department of Health Service, 2023). These constitutional provisions have driven an upsurge in public health spending. Yet, despite increased government expenditure, there remains a dearth of comprehensive studies investigating the determinants of government health expenditure, OOP payments for healthcare, and health outcomes in Nepal. Moreover, the government continues to grapple with fiscal constraints that challenge the sustainability and effectiveness of the healthcare system, which is essential to realizing the constitutional vision of health as a fundamental right (Adhikari et al., 2022). Based on the data presented in Appendix B, analysis of the trend and patternof the included variables is presented below:

5.2 Trend and Pattern of Private Health Expenditure in Nepal

This trend analysis is based on the data of Appendix B. The trend of OOP payments for healthcare in Nepal over time provides valuable insights into the changing dynamics of macroeconomic conditions, healthcare financing, education, price levels, and employment in the country. The data encompasses key macroeconomic and social variables such as GDP per capita (GDPpc), remittances per capita (Remtpc), Consumer Price Index (CPI), and unemployment rates (Unemp) alongside per capita OOP payments for healthcare.

Trend in Per Capita OOP Payments for Healthcare

Per capita OOP healthcare expenditure in Nepal shows a consistent upward trend over the two and half decades, starting from NPR 365 in FY 1995/96 to NPR 4,016 in FY 2021/22, an almost 11-fold increase. This rising trend suggests that households are increasingly bearing the burden of healthcare costs directly, reflecting either inadequate risk pooling mechanisms such as limited public healthcare coverage, or cost of medical services risingin private and public sectors. Notably, the increase in OOPpc is not proportional throughout the period. FY 1995/96–2004/05 showed a slow rise of OOPpc and rose moderately from NPR 365 to NPR 702. This phase coincides with low-income growth and limited access to modern healthcare technologies. However, during FY 2005/06–FY 2011/12, an accelerated rise in OOPpc was observed, with OOPpc jumping to NPR 1,544 in FY 2011/12, possibly driven by rising private healthcare service use, post-conflict economic liberalization, and increasing chronic disease prevalence. Similarly, during the period FY 2012/13–FY 2021/22 an even sharper surge is observed (Appendix B).

The most significant rise occurred during this period, with OOPpc nearly doubling from NPR 2,049 in FY 2012/13 to NPR 4,016 in FY 2021/22. This could be attributed to costlier health services, increased health-seeking behavior due to improved education (MYS rising to 5.1 years),and possibly due to the impact of COVID 19 pandemic during FY 2019/20– FY 2020/21, which forced private spending on health essentials. The upward trend indicates that despite government efforts to provide basic health services, OOP payments for healthcare remain a substantial component of healthcare financing, risking financial hardship and catastrophic health expenditure for many households (Appendix B). Nepal’s GDPpc shows steady and substantial growth during FY1995/96 to FY 2021/22(Appendix B). This growth aligns with economic improvements, driven largely by remittances, tourism, and post-conflict reconstruction. However, the gap between GDPpc growth and OOPpc growth suggests that although the economy has expanded, the relative burden of healthcare costs on households may not have reduced proportionally, potentially indicating that health service costs are rising faster than household incomes, or that public health system improvements have not fully shielded households from direct payments.

Trend in Remittances Per Capita and OOP payment for Health

Remittances, an important pillar of Nepal’s economy, grew from a mere NPR 207.03 per capita in FY 1995/96 to NPR 34,146 in FY 2021/22, an astonishing 164-fold increase. Evidently, remittances rose sharply after FY 2000/01, coinciding with labor migration policies and economic globalization. Rising remittance income likely allowed households to afford more or better-quality healthcare services (including private care), thereby increasing OOP payments voluntarily. Evidently, households with remittance income may have shifted towards private healthcare providers due to perceived higher quality, which helps explain the OOP surge. Yet, this also reflects possible systemic inadequacies in the public health system, pushing even remittance dependent families towards private expenditure (Appendix B).

Trend in Consumer Price Index and OOP payment for Health

The Consumer Price Index (CPI) demonstrates significant volatility during the study period. CPI rose gradually from 7.66 percent in FY 1995/96 to a peak of 12.62 percent in FY 2008/09, reflecting inflationary pressures during political instability and global economic crises. Post-2009, CPI stabilized around 7-9 percent except during dips in FY 2016/17–2018/19, and a marked fall to 3.6 percent in FY 2020/2, possibly due to reduced demand and supply constraints during the COVID-19 pandemic. CPI fluctuations influence the real cost of healthcare services, implying that a higher CPI raises overall price levels, indirectly affecting healthcare costs and OOP payments. However, the consistent rise in OOP payments for health despite CPI moderation suggests other cost drivers (such as demand-side factors and private sector dominance) (Appendix B).

Trend in Unemployment Rate and OOP payment for Health

Unemployment remained high but relatively stable, averaging around 10.5 percent until FY 2018/19, before spiking to 13.07 percent in FY 2019/20, likely due to COVID-19 lockdowns and international labor market disruptions. A high unemployment rate could also limit people's ability to afford healthcare services without facing financial stress. Yet, the concurrent rise in OOP payments for healthcare suggests that many Nepalese households may be relying on remittance income or borrowing to meet healthcare costs rather than on wage income which is a risky coping strategy that could increase vulnerability to impoverishment from health shocks (Appendix B).

Based on the nature of interrelationship among indicators, despite GDPpc and remittance inflow per capita (Remtpc) increases, the reliance on OOP payments remains heavy in Nepal, indicating insufficient financial protection mechanisms such as health insurance coverage. The large growth in remittance flow has possibly fueled higher private health expenditure, causing households to bypass public facilities, but this reliance on remittance-driven healthcare financing is unsustainable in the long run. The slow progress in education (MYS) may also limit households' ability to make cost-effective healthcare decisions, exacerbating inefficient spending. Similarly, CPI inflation contributed to healthcare cost increase during certain periods, but OOP payments for health expenditure growth surpasses general inflation, suggesting that healthcare-specific price dynamics (like imported medicines, specialized services) are significant contributors. Finally, unemployment trends suggest structural labor-market weaknesses, but the stability of OOP payment growth for healthcare indicates that healthcare spending is considered a necessary (inelastic) expense, irrespective of employment status.

The trend analysis gives insight for policy implications and concerns as well. Firstly, high and rising OOP payments for health remain a risk for financial catastrophe and health inequality, especially for poor and rural households not benefiting from remittances.The government's policies for expanding public health services, introducing insurance schemes, and improving quality in public facilities are essential to reduce reliance on private sectors.Obviously, remittance dependency in health financing is fragile and risky, meaning that any global shock in the foreign employment destination such as Gulf employment restriction could jeopardize household ability to pay for healthcare.Likewise, improvement in education and employment generation is critical, not only to reduce poverty but also to enable cost-conscious healthcare choices.

To sum up, the data reveal that while Nepal has achieved economic growth and improved remittance inflows, these positive macroeconomic changes have not been translated into reduced OOP payments for healthcare. Instead, households continue to bear a heavy financial burden for healthcare services, reflecting gaps in public healthcare provision, limited insurance coverage, and rising demand for private services. This shows the urgent need for health financing reforms to achieve universal health coverage and protect households from financial hardship during illness.

5.3 Econometric Analysis

This econometric analysis is based on annual time series data spanning from FY 1995/96 to FY 2021/22. The model is specified as OOP payments for healthcare as a function of GDP per capita, remittance per capita, consumer's price index, and unemployment percentage. Nepal's government health expenditure amounts to approximately 2.4 percent of its GDP, with current health expenditure (CHE) per capita estimated at USD 65.30 (MoPH, 2023). Similarly, the data reveal that domestic general government health expenditure (GGHE-D) and OOP payments account for 33.20 percent and 51.26 percent of CHE respectively. This historical pattern of underfunding indicates the government of different level are expected increase up to 10 percent of total budget to public healthcare sector (NHRC, 2022). Heavy reliance on OOP payments highlights a regressive health financing mechanism that imposes significant financial burdens on poor households, limiting their access to healthcare services (Łyszczarz & Abdi, 2021). Without addressing this challenge, the realization of UHC in Nepal will remain elusive.

5.4 Augmented Dickey Fuller Unit Root Test

The Augmented Dickey Fuller test is carried out to test the stationarity of the data series. The ADF unit root test confirmed the stationarity of the data series in mixed form i.e., at level and first difference. The result is presented in Table 5.1 below:

Table 5.1

Augmented Dicky Fuller Unit Root Test Results

Variables	ADF-Statistics	p-value	Critical value at			Order of Integration
			1%	5%	10%	
LnOOPpc	0.121	0.960	-3.7240	-2.986	-2.632	
ΔLnOOPpc	-3.920	0.006	-3.7370	-2.991	-2.6350	I(1)
LnGDPpc	0.267	0.971	-3.7240	-2.986	-2.632	
ΔLnGDPpc	-3.300	0.027	-3.7370	-2.991	-2.635	I(1)
LnRMTpc	-2.173	0.023	-3.7240	-2.986	-2.632	I(0)
ΔLnRMTpc	-5.280	0.000	-3.7370	-2.991	-2.635	I(1)
LnCPI	-2.354	0.164	-3.7240	-2.986	-2.632	
ΔLnCPI	-5.854	0.000	-3.7370	-2.991	-2.635	I(1)
LnUnemp	-3.560	0.014	-3.7240	-2.986	-2.632	I(0)
ΔLnUnemp	-5.737	0.000	-3.7370	-2.991	-2.635	I(1)

Note. This table demonstrates the Augmented Dickey Fuller test result as computed by the author based on the data given in Appendix B.

Table 5.1 above demonstrates ADF unit root test results. The results indicate that the variables LnOOPpc and LnGDPpc are non-stationary at level, with ADF statistics of 0.121 and 0.267 respectively, and high p-values (> 0.95). However, their first differences are statistically significant at 1 percent and 5 percent levels, confirming that both variables are integrated of order one, I(1). In contrast, LnRMTpc and LnUnemp are stationary at level, with ADF statistics of -2.173 and -3.560 respectively, and p-values below 0.05, indicating they are I(0). However, their first differences are also statistically significant which confirm the robustness.

LnCPI is non-stationary at the level but becomes stationary after first differencing, thus I(1). Overall, the data exhibit a mix of I(0) and I(1) variables, suggesting the use of an ARDL (Autoregressive Distributed Lag) model is appropriate for further empirical analysis, as it can handle variables of different integration orders.

5.5 Phillip-Perron Unit Root Test

As the result is presented below, the study also proceeds to the Philip-Perron unit root test for further confirmation of the given data series of the included variables. The Philip-Perron test for unit root also confirmed the stationarity of the data series at the level and after the first differencing (Table 5.2).

Table 5.2

Phillip-Perron Unit Root Test Result

Variables	PP-Statistics	p-value	Critical value at			Order of Integration
			1%	5%	10%	
LnOOPpc	0.029	0.952	-3.724	-2.986	-2.632	
ΔLnOOPpc	-3.92	0.006	-3.737	-2.991	-2.635	I(1)
LnGDPpc	0.141	0.962	-3.724	-2.986	-2.632	
ΔLnGDPpc	-3.274	0.027	-3.737	-2.991	-2.635	I(1)
LnRMTpc	-3.351	0.023	-3.724	-2.986	-2.632	I(0)
ΔLnRMTpc	-5.279	0.000	-3.737	-2.991	-2.635	I(1)
LnCPI	-2.322	0.173	-3.724	-2.986	-2.632	
ΔLnCPI	-5.918	0.000	-3.737	-2.991	-2.635	I(1)
LnUnemp	-2.794	0.014	-3.724	-2.986	-2.632	I(0)
ΔLnUnemp	-5.343	0.000	-3.724	-2.986	-2.632	I(1)

Note. This table demonstrates Phillip-Perron test results as computed by the author based on the data given inAppendix B.

Table 5.2 presents the results of the Phillips-Perron (PP) unit root test, which examines the stationarity of key macroeconomic variables used to analyze the determinants of OOP healthcare payments in Nepal. The results show that both LnOOPpc and LnGDPpc are non-stationary at the level, as indicated by their high p-values (0.952 and 0.962, respectively) and PP statistics well above the critical values. However, their first differences are statistically significant at 1 and 5 percent levels, with PP statistics of -3.92 and -3.274, confirming the stationarity after first differencing.

Moreover, Ln RMTpc identified as stationarity at level I(0), with a PP statistic of -3.351 and a p-value of 0.023, which is below the 5 percent significance level. Similarly, LnUnemp is also stationary at level, indicating it is I(0). LnCPI, however, is non-stationary at the level but becomes stationary after first differencing, indicating it is I(1). Overall, the mixed integration order across variables supports the use of an ARDL analysis framework, which can robustly handle such data structure in long-run relationship analysis.

In conclusion, Tables 5.1 and 5.2 show the ADF test and the Phillip-Perron unit root test. The result clearly indicates that the included variables are integrated at mixed order i.e. I(0)and I(1). Under this condition, essentially ARDL approach to co-integration is to be used.

5.6 Descriptive Statistics

Table 5.3 below presents descriptive statistics of the key variables used in the model. The descriptive statistics affirm that the mean value forLnOOP payment for healthcare is 7.053 with standard deviation of 0.764. The mean value of the LnGDP capita is 10.61 with standard deviation of 0.832. The remittance has an average of 8.492 on with standard deviation 1.616. Similarly, the mean consumer price index is 0.797 with standard deviation 0.196. Similarly, the mean of unemployment is 2.381 with standard deviation 0.049 (Table 5.3).

Table 5.3

Descriptive Statistics of the Variables

Variables	LnOOPpc	LnGDPpc	LnRMTpc	LnCPI	LnUnemp
Mean	7.053	10.611	8.492	0.797	2.381
Median	6.899	10.465	8.818	0.871	2.367
Maximum	8.279	11.895	10.402	1.101	2.574
Minimum	5.900	9.395	5.333	0.884	2.364
Std. Dev.	0.764	0.832	1.616	0.196	0.049
Skewness	0.206	0.137	-0.578	-0.421	3.282
Kurtosis	1.561	1.573	2.139	2.064	12.062
Jarque-Bera	2.428	2.287	2.249	1.716	140.868
Probability	0.297	0.319	0.325	0.423	0.278
Observations	27	27	27	27	27

Note. This table presents descriptive statistics computed by the author from the data in Appendix B.

5.7 Structural Break Test

Table 5.4 below presents the Bai-Perron breakpoint test result. The Bai-Perron breakpoint test indicates statistically significant structural breaks in the model's variables at the 5 percent level of significance. Evidently, LnGDPpc exhibited a structural break in 2013**,** possibly due to a policy shift. Moreover, LnRMTpc shows a significant break in 2008**.** Likewise, LnCPI and LnUnemp showed structural breaks in 2009 and in 2011. So, the test provides strong evidence of a structural break in the data series, which should be accounted for further time series modelling and analysis. In this regard, creating dummy variables and generating interacting terms with the respective variables correspond to the break date points is a standard option.

Table 5.4

Bai-Perron Breakpoint Test Result

Variable	Sequential F-Statistic	Scaled F-Statistic	Critical Value (5%)	Significant 5%	Break Date	Comments
LnGDPpc	16.741	33.482	11.47	Yes	2013	Evidence of break
LnRMTpc	151.200	302.401	11.47	Yes	2008	Evidence of break
LnCPI	93.431	186.862	11.47	Yes	2009	Evidence of break
LnUnemp	62.521	125.043	11.47	Yes	2011	Evidence of break

Note. Table 5.4 demonstrates the Bai-Perron break point test result for ensuring detection of break of data used in proposed regression model computed by author.

The researcher has pointed to creating an additional dummy variable and including it as an explanatory variable as a policy dummy, free of cost medicine and maternity as a remedy for structural break.

5.8 ARDL Co-integration Test Results

The ARDL co-integration analysis starts from selection of appropriate lag lengths**,** followed by the estimation of the Long-Run Relationship, the Error Correction term, andDiagnostic Tests. They are presented as follows:

Lag Length Selection

Table 5.5 below presents the optical lag-length selection test to ensure accurate and efficient time-series modeling. In general, Akaike Information Criterion (AIC) is adopted for the selection of the optimal lag length. However, in this case, all the criteria are referring for choosing lag one.

Table 5.5

Optimal Lag Length Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-136.5652	NA	5.90e-07	11.19732	11.63282	11.32272
1	100.6868	292.0025*	5.17e-12*	-0.822063*	3.532886*	0.432005*

Note. Table 5.5 above demonstrates optimal lag length selection criteria results as computed by the author based on the data given in Appendix B.

Moreover, Table 5.5 shows that lag 1 is identified as the most appropriate, as it minimizes the Final Prediction Error (FPE) and Akaike (AIC), Schwarz (SC), and Hannan-Quinn (HQ) information criteria, and maximizes the Log-likelihood (LogL). Essentially, the Likelihood Ratio (LR) test also strongly supports lag 1 with a high test statistic of292.0025. The asterisks (*) denote the optimal values. Therefore, for accurate and efficient time series modeling, lag 1 is optimal, suggesting that including one lag captures the dynamics effectively.

Bound Test Results

The result presented here summarizes the outcome of the ARDL Bounds Test for cointegration, which is used to examine whether a long-run relationship exists among the variables in a model. The null hypothesis of the test states that no long-run relationship exists among the dependent and independent variables. In other words, this is tested by comparing the computed F-statistic against the critical value bounds at different significance levels. The F-bound test was conducted to empirically examine the long-run and short-run relationship among the selected variables, such as per capita OOP payments for healthcare expenditure, GDP per capita, remittance inflow per capita, consumer price index, unemployment rate, and dummy interaction terms with explanatory variables included in the model. The cointegration relationship amongst the selected variables is tested using ARDL model bound testing approach. The bound test result of Table 5.6 indicates that thecomputed F-statistics of value 15.145 is obviously higher than lowerbound I(0) and upper bound I(1) critical values at the given level of significance (15.145 > 3.79 > 3.11 > 2.79 > 2.45). Therefore, we can reject the null hypothesis that there is no long-run relationship between dependent variable per capita OOP payments for healthcare with independent variables GDP per capita, remittance inflow per capita, consumer price index as a proxy of inflation rate, unemployment rate and interaction term dummies. Therefore, we conclude that there is a long-run relationship between dependent and independent variables.

Table 5.6

Bound Test for Cointegration Analysis

Null Hypothesis: No long-run relationship exists		
Test Statistics	Values	K(Explanatory Variables
F-statistic	15.145	8
Critical Value Bounds		
Significance	I(0) Bounds	I(1) Bounds
10 %	1.66	2.79
5%	1.91	3.11
1%	2.45	3.79

*Note.*Table 5.6 shows the Bound Test for cointegration result as computed by the author based on the data given in Appendix B.

Table 5.6 estimated result indicates a strong long-term equilibrium relationship among the variables in the model. In health economics, applying this test to a model where the dependent variable is per capita OOP healthcare payments or healthcare expenditure, and independent variables include GDP per capita, remittances, consumer price index, unemployment, among others, suggests that these macroeconomic and structural factors systematically impact long-term healthcare payment trends. This finding is significant for policymakers and researchers alike. It implies that macroeconomic policies and structural changes such as improvements in education, employment, or price stability and so on have lasting effects on healthcare financing, especially OOP health expenditures. For instance, increases in GDP per capita or remittances over time can enhance households' financial capacity to spend on health services, thus affecting OOP trends in the long run.

Moreover, the existence of a long-run relationship justifies estimating of a long-run ARDL model, which can then be used to quantify the magnitude and direction of each variable's effect on the dependent variable over time. Additionally, an error correctionterm (ECT) can be included in the short-run dynamics to capture the speed of adjustment implies correcting back the earlier error.

In conclusion, the ARDL Bounds Test provides strong evidence of co-integration**,** confirming that the variables under study are not independent but are interlinked over the long term. This supports the theoretical framework that healthcare expenditure is driven by both economic capacity and systemic health determinants over time.

Long-Run and Short Coefficient of Test Results

The ARDL model can be established to determine long run and short run relationships. The estimated regression equation output result shows that in the long-run per capita OOP payments for healthcare is positively correlated with GDP per capita, remittance inflow per capita, and mean years of schooling and inversely correlated with consumer's price index.Table 5.7 below presents the estimated result of ARDL model, after ensuring a co-integration relationship between the series.

Table 5.7

Estimated Long-Run Coefficients Using the ARDL Approach

Dependent Variable: Per capita OOP payments for healthcare			
Explanatory Variables	Coefficient(S.E.)	t-Statistic	p-value
LnGDPpc	0.499***(0.177)	3.542	0.00
LnRMTpc	0.089**(0.037)	2.396	0.03
LnCPI	1.545*(0.088)	5.642	0.08
LnUNEMP	0.299(0.056)	0.268	0.28
LnGDPpc*Dum2013	3.58E-07(5.3E-07)	0.669	0.51
LnRMTpc*Dum2008	0.006(0.025)	0.253	0.80
LnCPI*Dum2009	-0.003(0.097)	-0.031	0.97
LnUNEMP*Dum2011	0.111**(0.044)	2.538	0.02
R^2	0.998		
Adjusted R^2	0.996		
D-W Statistics	1.87		

*Note.*Table 5.7 above demonstratesestimated long-run coefficients using the ARDL approach as computed by author based on the data given in Appendix B.

Significance Level: ***p<0.01, **p<0.05, and p<0.10

The estimated ARDL model result shows the co-integration relationship between OOP payments for healthcare and the explanatory variables included in the model where F-statistic is 15.15 and a t-stat of5.61, confirming co-integration. Moreover, very high R^2 indicates strong explanatory power, followed by the Durbin–Watson statistic (1.87) suggests no serious autocorrelation problem. Long-run coefficients showed that a 1 percent increase in GDP per capita is associated with a 0.5 percent increase in OOP payments healthcare. Similarly, a 1 percent increase in remittance inflow in per capita terms causes 0.089 percent increase in OOP healthcare expenditure. The result also showed the effect of inflation on OOP payments for healthcare but the impact is weak and statistically insignificant. Essentially, unemployment has a positive but statistically insignificant relationship with OOP payments for healthcare expenditure. Moreover, structural dummies were mostly insignificant, implying long-run factors dominate in explaining changes in OOP payments for healthcare expenditure. Therefore, the analysis concludes that there is a valid co-integration relationship among variables included in the model such as per capita OOP payments for healthcare expenditure, GDP per capita, remittance inflow per capita, CPI and unemployment percent.

The estimated result presented in Table 5.7invaluable to make inference as policy lessons. Firstly, the long-run estimates of ARDL model suggests that economic growth, remittance inflow per capita, and inflation are key long-run drivers of per capita OOP payments for healthcare. However, unemployment does not have a long-run causal effect in statistical significance**,** except during a specific shock period.

Secondly, the long-run estimate of the ARDL model results also reveal that OOP payments for healthcare in Nepal is found to be income-responsive, strongly remittance-supported, followed by the high inflation sensitivity. Likewise, the effect of unemployment is becoming significant during economic stress periods only. Intuitively, this pattern indicates weak financial protection in the health system of Nepal, as households are likely to be compelled to rely more on private resources rather than public financing.

Thirdly, the estimated result also reflects that economic growth alone does not automatically reduce financial burden of households in healthcare; in the absence of adequate risk-pooling mechanisms. Moreover, rising incomes may translate into higher private spending rather than improved financial protection for healthcare. The result also indicates that remittance inflow acts as an informal health-financing mechanism for households. Probably, the reliance on remittances may mask structural weaknesses in public health financing and insurance coverage.

Short-Run Dynamics Results of ARDL Process

In ARDL framework, short-run dynamics describe how the dependent variable adjust in the immediate period following changes its past values and in the explanatory variables, before the system converges to its lo-run equilibrium. The estimated short-run ECM results are given in Table 5.8.

Table 5.8

ECM Representation for Selected ARDL Approach

Dependent Variable: Per capita OOP payments for healthcare			
Variable	Coefficient(S.E.)	t-Statistic	p-value
Δ(LnGDPpc)	0.522**(0.098)	5.353	0.001
Δ(LnRMTpc)	-0.069(0.041)	-1.694	0.125
Δ(LnCPI)	0.005(0.032)	0.166	0.872
Δ(LnUNEMP)	0.255(0.141)	1.809	0.104
Δ(LnGDPpc*Dum2013)	0.000**(000)	-3.218	0.011
Δ(LnRMTpc*Dum2008)	0.011(0.010)	1.032	0.329
Δ(LnCPI*Dum2009)	-0.017(0.042)	-0.396	0.701
Δ(LnUNEMP*Dum2011)	0.034*(0.015)	2.156	0.059
ECT(-1)	-0.857***(0.113)	-7.550	0.000

*Note.*This tables demonstratesECM representation for selected ARDL

approach as computed by author based on the data given in the Appendix B. Significance Levels: ***p < 0.01; ***p < 0.05;* p < 0.10.*

The estimated result of the short-run ARDL Error Correction Model (ECM) given in Table 5.8 above reveals that GDP per capita is the most significant short-run driver of per capita OOP payments for healthcare in Nepal. Evidently, a 1 percent increase in GDP per capita is associated with a 0.52 percent increase in OOP payments for healthcare in the short run, suggesting a significant share of healthcare expenditure is OOP payments. However, other macro variables, such as per capita remittance inflow, inflation, and unemployment, do not significantly affect the short-run OOP payments. Structural break is observed relating explanatory variables in between 2008 to 2013 and interacting terms were included in the repressor that likely represents a policy or system-level change that reduced OOP as indicated by negative coefficient sign. The error correction term (ECT) showed a negative and statistically significant coefficient (-0.857, p<0.01), which implies that there is a tendency for the dependent variable to adjust back towards its long-term equilibrium following a short-term shock. In other words, the error correction mechanism confirms a stable long-run equilibrium, with a fast speed of adjustment. Other macro variables, such as unemployment and the 2011 dummy, do not significantly affect short-run OOP changes. Perhaps, a significant policy intervention period in between 2008 to 2014, such as a Universal Health Coverage (UHC) initiative or subsidy expansion, appears effective in reducing the financial burden to the people.

Error Correction Model (ECM) result provides some key policy lessons. Firstly, the results may indicate how short-term macroeconomic shocks and fluctuations translate into immediate changes in household healthcare expenditure patterns as reflected by OOP payments for healthcare. Moreover, the results may also indicate that healthcare expenditure adjustment occurs through household OOP payments for healthcare rather than institutional risk-sharing mechanisms of the government.Furthermore, the result may also reflect that there is substantial scope for strengthening public financing, expanding prepayment and insurance coverage, meant for protecting households during unemployment shocks. Therefore, it is critical for reducing the persistent reliance of households on OOP payments for healthcare.

5.9 Diagnostic Test Results

Diagnostic tests are to be conducted to ensure that the estimated ARDL modelling framework yields best, linear, unbiased and efficient (BLUE) estimators. Moreover, these test assesses the reliability and robustness of the estimated coefficients. The choice of the tests dependents on the econometric technique employed in the study. In the context of the ARDL modelling framework, the study applies the most commonly used diagnostics, which can be grouped into three broad categories: lag structure diagnostics, coefficient diagnostics, and residual diagnostics. The reliability of the result of the estimated ARDL model is further investigated through its diagnostic test such as the Regression Specification Error Test (RESET), serial correlation test, heteroscedasticity test, normality test and stability test. Likewise, coefficient diagnostics examine the stability and statistical validity of the estimated parameters over time. The details of all estimated diagnostic test results are discussed subsequently.

Regression Specification Error Test Result

RESET Test is a general specification test for the linear regression model. Moreover, it examines whether non-linear combinations of the fitted values help explain the dependent variable. The intuition behind the RESET is that if the model is correctly specified, then adding powers of the fitted values should not provide additional explanatory power. In this context, a statistically significant result indicates potential problem of omitted variable bias or incorrect functional form.Table 5.9 presentsthe

RESET test result. Based on the RESET test result, the null hypothesis is accepted indicating no error in specification.

Table 5.9

RESET Test Result

Omitted Variables: Squares of fitted values			
Parameters	Value	df	Probability
t-statistic	0.4998	13	0.6255
F-statistic	0.2498	(1, 13)	0.6255

Note. Table 5.9 shows the RESET test result for the estimated model as computed by the author based on the data given in the Appendix B.

To sum up, the Ramsey RESET for model specification indicates that the model has no evidence of any misspecification.

Serial Correlation LM Test Result

Serial correlation test measures the serial correlation of residuals. It is assumed that the error terms in the regression equation are uncorrelated with one another. This phenomenon is called serial correlation. Table 5.10 shows that the estimated output indicates no serial correlation.

Table 5.10

Serial Correlation Test Result

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.1137	Prob. F(1,13)	0.7412
Obs*R-squared	0.2259	Prob. Chi-Square(1)	0.6348

Note. Table 5.10 above shows serial correlation test results for the estimated model as computed by the author based on the data given in the Appendix B.

Table 5.10 result shows that F-Statistic value is0.1137 with probability value 0.7412>0.05 and observation times R-squared value 0.6348 > 0.05, which exceeds 5 percent significance level. This means the acceptance of the null hypothesis, i.e., there is no serial correlation in residuals or residuals are not serially correlated. Therefore, this result fulfills the assumption of no serial correlation of error terms in the ordinary least square method.

Heteroscedasticity Test Result

There is an assumption that the residuals must have constant variance (homoscedastic) in the regular OLS estimation as well as for the ARDL model for robustness of the estimated coefficients. This test measures the nature of the residual variance over time. The detailed result of heteroscedasticity test is shown in Table 5.11.

Table 5.11

Heteroscedasticity Test Result

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.4762	Prob.F(12,13)	0.8956
Obs*R-Squared	7.9392	Prob.Chi-Square(12)	0.7899
Scaled explained SS	4.4088	Prob.Chi-Square(12)	0.9749

Note. Table 5.11 shows heteroscedasticity test results for the estimated model as computed by the author based on the data given inAppendix B.

Table 5.11 shows that the probability value of F-statistics and observed R-squared are 0.8956 and 0.7899, respectively, which clearly exceeds 5 percent significance level. This means the acceptance of the null hypothesis i.e. no heteroscedasticity in residuals. It means that there is homoscedasticity.

Normality Test Result

The normality assumption is very important for regression estimation. The histogram normality test shows the distribution of residuals. It observes the normal distribution of residuals. For the normality test, basically the Jarque-Bera statistics is observed in order to confirm whether the residuals are normally distributed or not. In Table 5.12, the estimated Jarque-Bera statistic is 6.1567 with its probability value 0.05, which is clearly on the borderline of the 5 percent significance level. But, other diagnostic tests such as autocorrelation, heteroscedasticity, and stability tests, are robust, meaning that it is not a major issue. Therefore, we can accept that the residuals are normally distributed.

Table 5.12

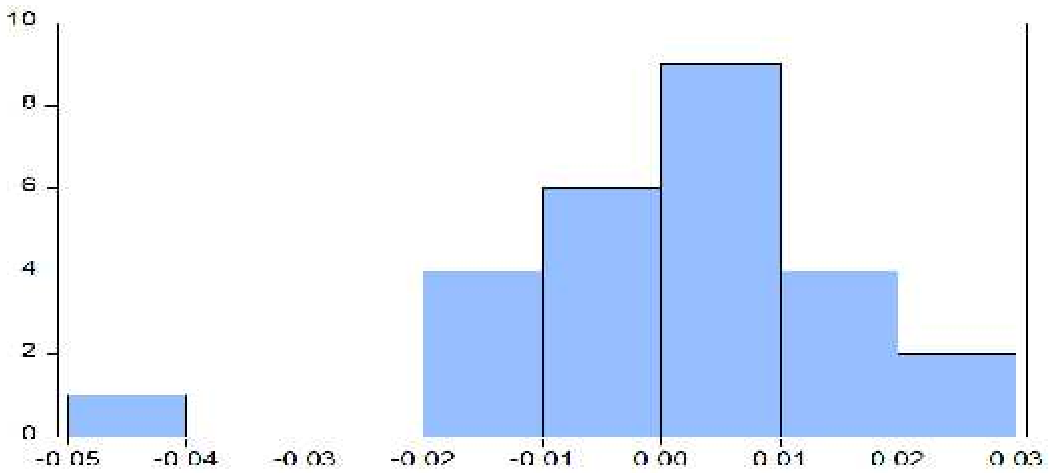
Normality Test Result

Statistical Tools	Statistical value
Mean	-7.73e-06
Median	-0.001469
Maximum	0.026113
Minimum	-0.041572
Standard Deviation	0.013700
Skewness	-0.764643
Kurtosis	4.828778
Jarque-Bera	6.156736
Probability	0.05

Note. Table 5.12 shows normality test results for the estimated model as computed by the author based on the data given in Appendix B.

Figure 5.1

Histogram of Normality Test Result



Note. This figure shows normality test results for the estimated model as computed by the author based on the data given in Appendix B.

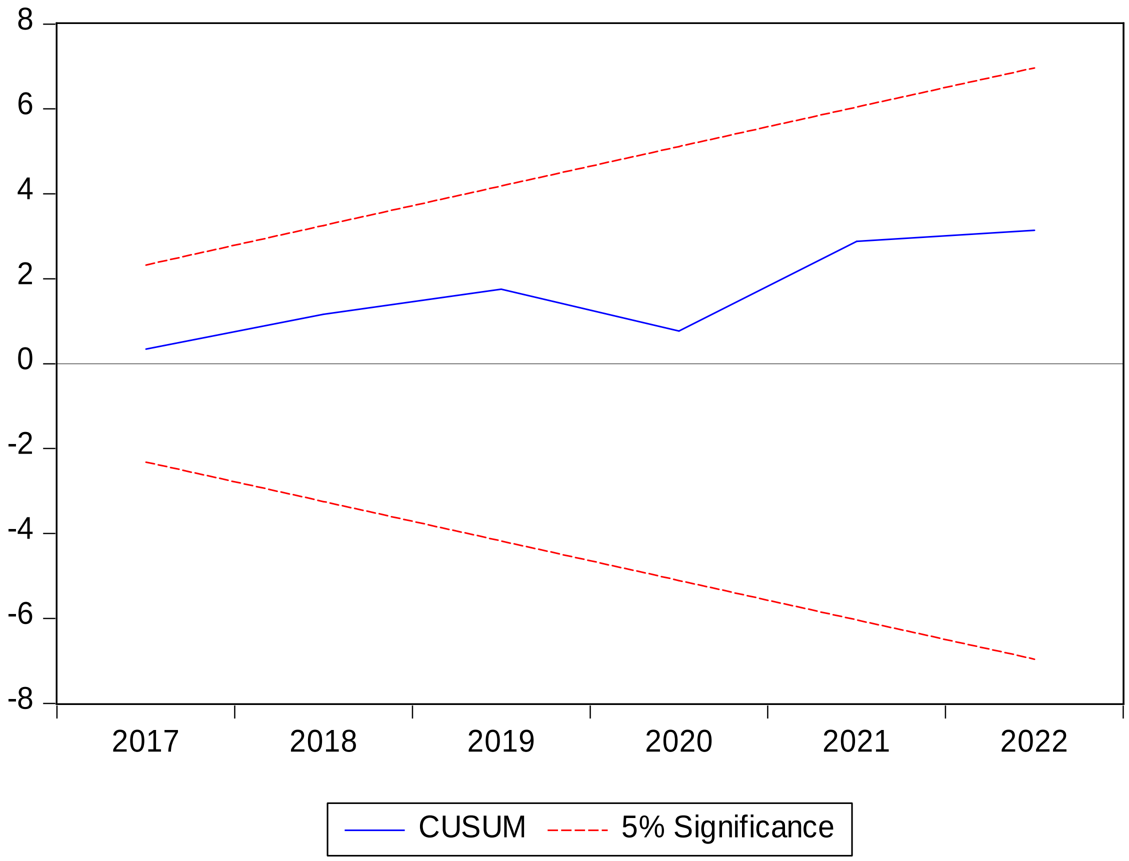
Stability Test Results

The researcher has conducted a model stability diagnostic test to ensure the stability of estimated parameters across various sample sizes. To ensure stability of the long-run coefficients together with the short-run dynamics, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) are applied. The stability of the estimated coefficients of the error correction model and a graphical representation of CUSUM and CUSUMQ statistics are shown in Figure 5.2 and 5.3. We cannot reject the null hypothesis if the plot of these statistics remains within the critical bounds on the 5 percent significance level.

Figures 5.2 and 5.3 clearly show that the CUSUM and CUSUMQ plots are within their boundaries, providing evidence that these statistics confirm the model's stability. Since both of the plots lie between the critical regions at a 5 percent level of significance, the model is stable indicating no evidence of any significant structural instability. Therefore, the model does not exhibit any structural instability over the study period.

Figure 5.2

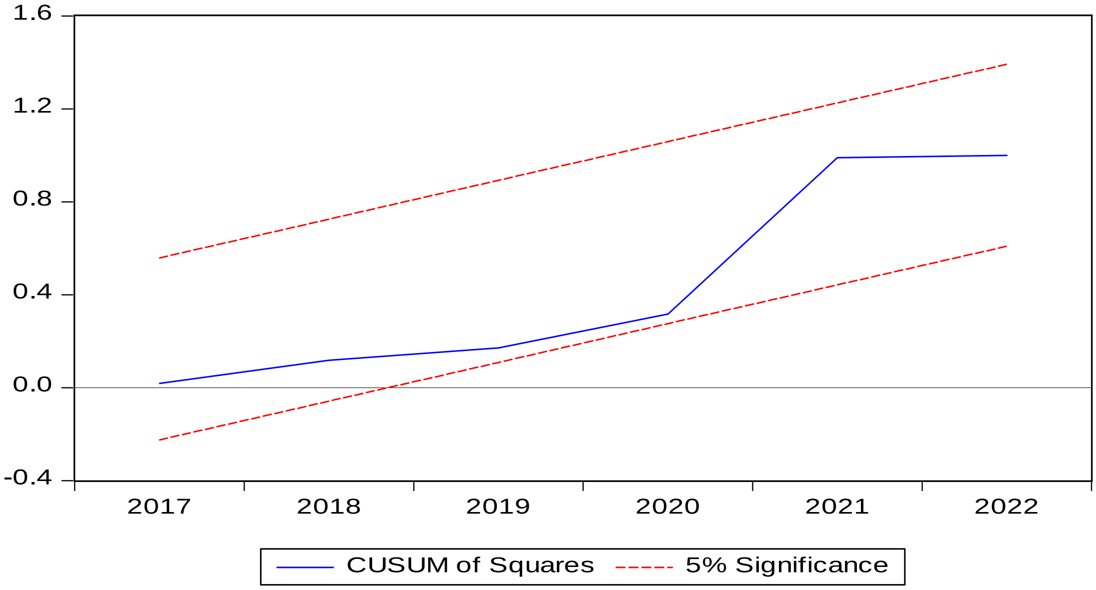
Plot of Cumulative Sum of Recursive Residuals



Note. This figure shows CUSUM test results for the estimated model as computed by the author based on the data given in Appendix B.

Figure 5.3

Plot of Cumulative Sum of Square of Recursive Residuals



Note. This figure shows CUSUM test results for the estimated model as computed by the author based on the data given in Appendix B.

5.10 Discussion

The second objective of this study is to examine the macroeconomic factors influencing OOP payments for healthcare in Nepal. The result shows a positive and statistically significant coefficient (0.499) for GDP per capita. In other words, the positive correlation between GDP per capita and OOP healthcare payments in Nepal indicates that economic growth leading to increase in healthcare expenditures. Moreover, the estimated coefficient value is 0.499 which is less than unity implies that healthcare service is an essential good for Nepalese. This indicates that as income levels rise, people tend to spend on healthcare as OOP payments for healthcare but less than the growth in income. Alternatively, this may suggest that the government healthcare system is either insufficient or not fully meeting the healthcare needs of people. Consequently, people may reach out to private healthcare providers, which often causes higher OOP payments for healthcare. If so, it may indicate gaps in the accessibility, availability, or quality of government-provided healthcare services of Nepal.

This result aligns with findings of Deraro et al. (2022), Łyszczarz and Abdi (2021), World Health Organization (2019), Imlak and Shabda (2016), Keegan et al. (2013), Savedoff et al. (2012) who demonstrated that higher income levels in developing countries led to increased healthcare expenditure due to greater access and demand for quality healthcare services. But, the result contrasts with Musgrove et al. (2002) which showed a significant negative relation between OOP and GDP per capita. Intuitively, in the Nepali context, as incomes rise, people are likely to seek better healthcare services, leading to higher OOP payments for healthcare. However, more reliance on OOP payments can increase vulnerability, as highlighted by Wagstaff and Van Doorslaer(2003)**,** and they noted that high OOP payments can worsen the financial status and increase poverty among poorer households. Based on the result and discussion, we can infer some insights for policy implications. First, given the increasing healthcare demand with economic growth, the government needs to focus on expanding healthcare infrastructure and subsidizing healthcare costs to reduce the burden of OOP payments, especially for financially vulnerable households. Second, the government should develop sustainable healthcare financing models like social health insurance or tax-based systems to reduce reliance on OOP payments and ensure equitable access to healthcare.

The positive and significant association of GDP per capita with OOP payments suggests that rising income alone does not protect households from high healthcare costs. This underlies the inadequacy of current financial protection mechanisms. Therefore, policy insight may beto strengthen the national health insurance framework and expand benefit packages to reduce direct payments at the point of service.

The analysis of the result demonstrates that remittances per capita show a positive and statistically significant effect ($\beta = 0.089$). The result aligns with previous studies such as Khan et al. (2021), Al-Kabir et al. (2018), Kalaj (2015), Jorge (2008), Meyer and Shera (2015), and Acosta et al. (2007). Intuitively, this suggests that remittance inflows significantly support OOP payments for healthcare costs. Perhaps this finding suggests that the remittance income may be used substantially for medication. Considering these findings, it is pertinent to discuss policy implications as well. Firstly, given the large volume of remittance inflow in Nepal, the remittance receiving households need to be encouraged to enroll in health insurance schemes. Secondly, financial institutions should introduce incentives for remittance-receiving households to contribute to health savings accounts too. Moreover, findings show that remittances positively influence OOP in the long run, households receiving them should be prioritized for insurance schemes. Therefore, policy insight may be introducing subsidized insurance enrolment mechanisms or compulsory schemes for remittance receiving families.

The analysis of the result furtherdemonstrates that the coefficient for CPI is positive (1.545) and statistically significant($p<0.10$), suggesting inflation is compelling to pay high OOP payments for healthcare in the long run. Alternatively, we may infer that this finding is due to the relatively inelastic demand for essential healthcare services, in which people continue to spend despite rising costs. The direction of the result is also supported by international studies such as Smith et al. (2009), Reichert and Cebula (1999), Newhouse (1993). Intuitively, this could be because higher overall prices for other essentials such as food, housing, and transportation, might force households to reallocate their expenditure away from healthcare toward more immediate needs. Eventually, inflation reduces healthcare expenditure. As a policy measure, the government should consider providing additional subsidies or financial assistance to low-income households to enhance their financial protection and ensure their continued access to essential healthcare services during periods of high inflation. By implementing these measures, the government will be in a position to ensure that inflation does not hinder access to essential healthcare services. To sum up, inflation significantly drives up OOP payments for healthcare, emphasizing the need for price controls and essential medicine subsidies. In this regard, policy implications may lead toestablishing a national drug price regulatory authority and expanding price ceilings on essential health services.

The coefficient for the control variable unemployment bears positive sign but statistically insignificant, suggesting no clear long-run impact on OOP payments. Probably, this counterintuitive result may indicate that unemployed individuals, particularly in a context with informal employment, may be deprived of health insurance coverage and forced to rely on private resources. This result differs from Grossman (1972), who postulated that health is both a consumption and an investment good, and maintaining health requires resources. Obviously, the capacity to spend on health for unemployed people will be reduced due to income constraints. However, this reduction in health expenditure may not necessarily reflect a lower need for care but rather a forced reduction in utilization because of financial constraints given the preference for other survival stuff for family members.

However, the previous empirical literature such as Grigorakis et al. (2022), Grigorakis et al. (2018) and Hughes and Khaliq (2014) is somehow aligned with this result. In developing countries like Nepal, unemployment may not directly influence OOP payments, as informal employment and social and community support often compensate for income loss. Conversely, Zheng et al.'s (2020) study suggested that the impact of unemployment on OOP payments varies across countries, influenced by healthcare systems and levels of economic development. The study also argued that economic recessions cause unemployment and this unemployment often reduces individuals' willingness to make OOP payments for healthcare, based on their study of 60 countries where the financial crisis of 2008 significantly reduced their willingness to pay for healthcare. Strengthening job creation policies can foster economic stability and indirectly support households in managing healthcare expenses, even if unemployment alone is not a direct driver of healthcare expenditure. Based on this discussion, policy implications can be suggested to strengthen job-creation policies to foster economic stability and, indirectly, support individuals in managing healthcare expenses.

Overall Policy Implications

The escalating trend in OOP payments for healthcare in Nepal poses a significant policy concern, particularly in the context of universal health coverage (UHC) and health equity. According to the trend and pattern of data on OOP payments for healthcare and correlates from FY 1995/96 to 2021/22, per capita OOP payments have surged from NPR 365 to NPR 4,016, representing nearly a tenfold increase. Obviously, this persistent rise occurred alongside substantial growth in per capita GDP and remittance inflows, fluctuating consumer price levels, and relatively stable but high unemployment rates. Essentially, these dynamics suggest that while household incomes and remittances have improved, the healthcare financing system remains heavily reliant on private spending as reflected in OOP payments for health, exposing households to financial vulnerability. The following policy implications are derived from the observed trends, patterns, and interrelationships.

The steady increase in OOP payments for health, despite rising GDP per capita and remittances, indicates that public health financing mechanisms have not adequately absorbed healthcare costs for the population. It raises serious concerns for researchers and stakeholders. Moreover, high OOP payments for health shares are often associated with delayed care-seeking, medical impoverishment, and catastrophic health expenditure.

This gives valuable insights for policy implications meant for the financial protection of the general people. In other words, the Government of Nepal should adopt more progressive health financing mechanisms to reduce OOP payments for health dependency. This may include expanding public expenditure on health as a share of GDP, ensuring that essential healthcare services are universally accessible without private payment for the vulnerable masses, and subsidizing healthcare for needy people, particularly poor and vulnerable populations, through targeted healthcare financing schemes. Likewise, improving prepayment and pooling mechanisms, such as social health insurance schemes and tax-based financing, is essential to reduce reliance on OOP payments for health.

The data clearly shows a significant increase in per capita remittance from NPR 207.03 in FY1995/96 to over NPR 34,000 in 2021/22, coinciding with rising OOP payments for health. In general, remittances have improved households' capacity to finance healthcare; however, this also masks the lack of institutional financial protection for healthcare and shifts the burden onto private sources.

This also provides valuable insights for exploring remittance-linked health financing solutions. For instance, policy can be formulated to encourage voluntary enrollment in health insurance for migrant workers and their families. Likewise, managing small remittance contributions toward health insurance premiums through formal remittance channels, and providing incentives for households to invest remittance income in health protection, such as subsidized premiums or matched contributions. This approach is expected to support financial protection while leveraging an existing income stream for optimizing private healthcare expenditure.

The impact of inflation on OOP payments for health is observed through general trend analysis and econometric analysis. In other words, Consumer Price Index (CPI) fluctuations reflect general inflation, but the impact of healthcare-specific inflation on OOP payments for health is more direct. In years of high CPI (for example, 12.62 per cent in 2008/09), a sharp increase in OOP payments for health is also visible, suggesting that inflationary pressures exacerbate financial barriers to healthcare.

This also provides valuable policy insights to reduce inflation-driven out-of-pocket payments and healthcare burdens among the general population. The policy measures might include regulating prices of essential medicines, diagnostics, and services through price caps, along with increasing budget allocations to cover inflation-adjusted operational costs in public hospitals to prevent cost-shifting to patients. Additionally, establish a health price index to monitor and control healthcare-specific inflation, along with regular price monitoring to ensure that health services remain affordable and accessible, especially for low-income groups.

In Nepal, unemployment has remained persistently high over the years, peaking above 13 percent during the COVID-19 pandemic in FY 2019/20. Since unemployed people and informal workers are typically outside the scope of employer-based health insurance coverage, they are disproportionately vulnerable to high OOP payments for healthcare.

This critical situation also provides insights into policy implications. Therefore, the government needs to introduce health protection programs targeting unemployed and informal-sector workers, and this may be operationalized using employment and poverty registry data to automatically enroll low-income and jobless individuals into government-subsidized health insurance schemes. Essentially, it is better to combine employment generation initiatives with access to subsidized healthcare services for the unemployed. So, providing financial protection to the jobless and underemployed is central to equitable health access to achieve UHC goals in Nepal.

Despite the introduction of the Social Health Security Programme, which was meant for health insurance about a decade back, coverage remains limited, and OOP payments for health continue to rise. Based on global experience, if OOP for healthcare accounts for 30-40 per cent of total health expenditure, it indicates sufficient protection. Moreover, if OOP for healthcare is less than 15 to 20 percent,people are less likely to be pushed into poverty or experience financial hardship due to healthcare costs (Nepal Health Research Council, 2022). This also gives policy insight for health insurance reform and must be prioritized to ensure fully subsidized financing premiums for poor, informal workers, and elderly populations.

In conclusion, the analysis finds strong evidence that macroeconomic indicators, such as GDP and remittances, are critical long-run drivers of household-level healthcare spending in Nepal. Inflationary pressures also influence OOP payments, while the role of unemployment is more nuanced and context-specific. These findings emphasize the need for stronger financial risk protection mechanisms, such as universal health insurance and price regulation all of which help to mitigate the burden of OOP spending and ensure equitable access to healthcare.

CHAPTER VI

ANALYSIS OF DETERMINANTS OF HEALTH OUTCOME IN NEPAL

6.1 Introduction

This chapter analyses the socio-economic and demographic determinants of key health outcomes viz., life expectancy at birth and infant mortality rate. Evidently, Nepal has made remarkable achievements in the health outcomes during the last couple of decades. Life expectancy at birth of Nepalese people has doubled from1960 to 2022. In the 1960s, life expectancy at birth of Nepalese people was 35 years and in 2022 it increased to 71.3 years (World Bank, 2022). During this period, life expectancy at birth increased more than two times from 35 years to 71.3 years. Particularly after the 1990s, there has been a remarkable improvement in the public health sector, particularly in the extension of health care infrastructure. This led to an impressive increase in public health outcomes including life expectancy at birth (Ministry of Finance, 2022; World Bank, 2022). Likewise, Nepal has made remarkable progress in terms of reduction of infant mortality rate (IMR) and improvement in human health outcomes which is essential for human capital formation and sustainable economic growth and development. The IMR was 213 per 1000 live births in 1960 butsince the last three decades or so, there has been a continuous and substantial fall in the IMR. Evidently, this is due to the improvement in healthcare delivery, healthcare infrastructure and socio-economic, and demographic condition of Nepal. In other words, with the steady improvement in public healthcare facilities, IMR went down 25.1 per 1000 live births in 2022(MoF, 2023).

6.2 Determinants of Life Expectancy at Birth

The study used annual time series on aforementioned variables for 28 years starting from FY 1994/95 to FY 2021/22. The study has proposed two structural equations for identifying the economic, demographic, social, and institutional determinants of life expectancy at birth and infant mortality rate aligning with the prior health economics theoretical and empirical literature and WHO framework. The first, econometric model is specified to identify the determinants of life expectancy at birth in Nepali context. In other words, life expectancy at birth is the function of GDP per capita, GDP per capita squared, the composite of per capita government healthcare expenditure and health human resource per 10000 populations, infant mortality rate per 1000 live births, total fertility rate, and interacting terms of dummies to correct detected structural breaks in the respective data series. The study seeks to identify the determinants of key health outcomes in Nepal, specifically life expectancy at birth.

6.3 Trend and Pattern of Growth of Life Expectancy at Birth

This trend analysis is based on the data given in Annex C of this dissertation. Nepal's demographic and health indicators have witnessed remarkable transformations over the past three decades. Evidently, the data provides key macro-level insights into the evolving trends of life expectancy at birth (LEB) in relation to its key determinants GDP per capita (GDPpc), the squared term of GDP per capita (GDPpc), per capita government health expenditure (PCHE), health human resources (HR), and total fertility rate (TFR). These variables offer a broad perspective on how economic growth, government investment in health and education, and demographic transition have shaped health outcomes in Nepal.

Life Expectancy at Birth

Nepal has seen a steady increase in life expectancy at birth, from 57.8 years in FY 1994/95 to 71.3 years in FY 2021/22, clearly showing a gain of 13.5 years over 28 years. This 23.4 percent improvement reflects long-term progress in health service delivery, disease control, child survival, maternal health, and nutrition. Based on the nature of the data, the LEB trend can be divided into three distinct phases (Appendix C).

The first phase, between the period 1994/95–2004/05, shows gradual improvementof life expectancy increased from 57.8 to 64.7 years. This period marks post-democracy reforms, gradual expansion of rural health services, immunization programs, and increased donor-supported health investments (Appendix C). The second phase, between the period 2005/06–2011/12, shows a moderate gain when LEB rose to 68 years. This period benefitted from post-conflict health sector recovery, increased government expenditure, and community-based healthcare programs. The third phase, between 2012/13–2021/22, indicates plateauing growth, when LEB increased by just 2.9 years in this final decade. It is clear that gains continued, but the rate of increase slowed, reflecting non-linear relations. Likewise, this also suggests the need for higher-quality care and chronic disease management to sustain further improvements.

Infant Mortality Rate and LEB

The data show that IMR in Nepal decreased from 79.5 deaths per 1,000 live births in FY 1994/95 to 23 in FY 2021/22, a 71 percent decline. The sharpest drop occurred between 1994/95 and 2005/06, when IMR fell from 79.5 to 45.9, supported by the substantial investment in maternal and child health (MCH) interventions, widespread immunization, educational status, and community health volunteer programs (Appendix C). Likewise, between 2005/06 and 2015/16, IMR continued to decline but at a slower rate (from 45.9 to 29.2), suggesting that further reductions required targeted neonatal care and institutional delivery coverage. In the most recent period (2016/17–2021/22), IMR declined marginally, from 27.8 to 23. This slow pace suggests diminishing returns from traditional interventions and the need to focus on quality care at birth, neonatal intensive care, and nutrition. The inverse relationship between LEB and IMR is clearly visible in the data trend as IMR declines, more infants survive, contributing to higher average life expectancy (Appendix C).

GDP Per Capita and LEB

GDP per capita has grown more than 15 times, from NPR 10,850 in FY 1994/95 to NPR 169,038 in FY 2021/22. It clearly indicates that economic development plays a key enabling role in improving health throughgreater public health financing, household affordability of healthcare, improved living conditions (housing, sanitation, water), better maternal and child nutrition, and so on. There is a clear positive correlation between GDPpc and LEB, and an inverse correlation with IMR, indicating that macroeconomic growth has positively impacted population health. However, disparities in income distribution and access to health might limit the extent of health benefits derived from economic growth.

Per Capita Government Health Expenditure and LEB

Government health expenditure per capita rose from NPR 71 in FY 1994/95 to NPR 4,096 in FY 2021/22, which is more than 57-fold increase. This reflects expanded government health programs, including free basic healthcare, post-conflict and post-disaster investments (post-2006 peace process and 2015 earthquake recovery), and increased donor support and national commitment to universal health coverage. The rise in PCHE aligns with the improvements in LEB and reductions in IMR, but it’s also notable that the rise in expenditure has not produced proportionate gains in LEB in recent years, suggesting a need to assess efficiency, equity, and quality of health expenditure. Moreover, it may be due to non-linear relationsbetween per capita GDP growth and growth life expectancy at birth(Appendix C).

Health Human Resources Density and LEB

Health human resources per 10,000 population increased from 13.84 in FY 1994/95 to a peak of 37.23 in FY 2004/05, but then declined and plateaued, remaining below 32 by FY 2021/22. This trend reveals that while economic and financial resources improved substantially, human capital in health did not grow proportionally, possibly due to brain drain of medical professionals, and inadequate training capacity, and geographic misdistribution of health professionals and workers. The dip in HR after FY 2005/06 is serious and needs proper attention. It may reflect the slower progress in reducing IMR and boosting LEB in later years, despite higher health expenditure (Appendix C).

Total Fertility Rate and LEB: Demographic Transition

TFR declined from 4.87 children per woman in FY 1994/95 to 2.00 in FY 2021/22, marking Nepal's transition to replacement-level fertility. Intuitively, lower TFR contributes to reduced maternal and infant mortality, better allocation of household resources per child, and decreased strain on health services. It implies as TFR declined, IMR also fell, and LEB rose. In fact, these interconnected trends confirm the demographic dividend effect, where a smaller family sizes supports improved health outcomes and human capital investment (Appendix C).

The strongest observed effects seem to come from GDPpc, MYS, and TFR, indicating that broader development and social investments have played a pivotal role in improving population health outcomes, alongside direct health system investment. However, the mismatch between financial investment (PCHE) and service delivery (HR) signals inefficiencies that may limit further health gains. The data shows recent plateauing of Progress, meaning that from FY 2015/16 onward, both LEB and IMR trends show signs of flattening. Evidently, LEB increased by only 1.8 years from FY 2015/16 to FY 2021/22 and IMR declined by only 6.2 deaths per 1,000 live births in the same period. Despite rising PCHE and GDPpc, health outcome gains are slowing, suggesting the need for better quality of care, investment in non-communicable disease management, targeted efforts to address equity and access (especially among marginalized populations), and systemic reform in public healthcare, particularly around workforce development and primary care revitalization (Appendix C).

Nepal has achieved notable progress to increase longevity and reduce infant death rate, supported by economic growth, increased public health sector investment, rising education level, and reduced fertility. However, challenges remain in ensuring the efficiency and equity of healthcare delivery. Future policy must focus not just on increasing spending but on translating resources into effective, inclusive, and high-quality healthcare services to sustain and accelerate health gains.

6.4 Empirical Result of Econometric Analysis

The study used annual time series on the aforementioned variables for 28 years starting from FY 1994/95 to FY 2021/22. The simultaneous relationship between life expectancy at birth (LEB) and infant mortality rate (IMR) is endogenous in each other's models, violating the classical OLS assumption of exogeneity of regressors. In this situation, estimating each equation separately with OLS or even ARDL (which assumes weak exogeneity of regressors in the conditional model) would yield biased and inconsistent estimates. This is so because a fall in infant mortality likely raises life expectancy, and longer life expectancy may reflect broader public health improvements that also lower infant mortality. To address this, the study used 2SLS estimation techniques (Appendix C).

6.5 Augmented Dickey Fuller Unit Root Test

Augmented Dickey Fuller Test the test for the stationarity of the data series is carried out for ensuring the stationarity of data series (Table 6.1).

Table 6.1

Augmented Dickey Fuller Test Result

Variables	ADF statistics	P-value	Critical values at 1 %	5 %	10%	Order of integration
LnLEB	-4.095	0.005	-3.788	-3.012	-2.646	I(0)
ΔLnLEB	-2.802	0.073	-3.752	-2.998	-2.638	
LnGDPpc	0.267	0.972	-3.711	-2.981	-2.630	
ΔLnGDPpc	-3.301	0.026	-3.724	-2.986	-2.632	I(1)
LnPCHE_HR	1.617	0.460	-3.699	-2.976	-2.627	
ΔLnPCHE_HR	-4.716	0.000	-3.711	-2.981	-2.629	I(1)
LnIMR	-2.842	0.006	-3.711	-2.981	-2.629	I(0)
ΔLnIMR	-0.489	0.878	-3.724	-2.986	-2.632	
LnMYS	-0.774	0.807	-3.769	-3.005	-2.642	
ΔLnMYS	-3.995	0.006	-3.788	-3.012	-2.646	I(1)
LnTFR	1.617	0.460	-3.699	-2.976	-2.627	
ΔLnTFR	-4.716	0.000	-3.711	-2.981	-2.629	I(1)

Note. This table demonstrates Augmented Dickey Fuller test results for variables used in the model as computed by the author based on the data given in the Appendix C.

Table 6.1 presents the Augmented Dickey-Fuller (ADF) test results used to examine the stationarity of key variables in the model. The null hypothesis of the ADF test assumes the presence of a unit root (i.e., non-stationarity). A variable is considered stationary if its ADF statistic is more negative than the critical value at the 1 percent, 5 percent, or 10 percent significance levels. The variables LnGDPpc, LnPCHE_HR, LnMYS, and LnTFR are non-stationary at levels but become stationary after first differencing, implying they are integrated of order one, I(1). Notably, ΔLnGDPpc and ΔLnMYS are significant at 5percent level, while ΔLnPCHE_HR and ΔLnTFR are highly significant at 1percent level.

Interestingly, LnIMR (log of infant mortality rate) appears stationary at level I(0), with an ADF statistic of -2.842 and p-value 0.006, exceeding the 5 percent critical value. However, its first difference does not improve significance, indicating some inconsistency in its integration level. These findings suggest that most variables in the model are I(1), justifying the use of cointegration and error correction models.

6.6 Phillip-Perron Unit Root Test

Table 6.2 presents the Philip-Perron (PP) unit root test results. The Philip-Perron unit root test result also confirmed the stationarity of data series at level after first differencing.

Table 6.2

Philip-Perron Unit Root Test Result

Variables	PP-statistic	P-value	Critical values at 1%	5%	10%	Order of integration
LnLEB	-7.496	0.000	-4.356	-3.595	-3.233	I(0)
ΔLnLEB	-0.918	0.744	-3.711	-2.981	-2.629	
LnGDPpc	0.126	0.962	-3.711	-2.981	-2.630	
ΔLnGDPpc	-3.352	0.023	-3.724	-2.986	-2.633	I(1)
LnPCHE_HR	1.617	0.460	-3.699	-2.976	-2.627	
ΔLnPCHE_HR	-4.716	0.000	-3.711	-2.981	-2.629	I(1)
LnIMR	-5.499	0.000	-3.711	-2.981	-2.630	I(0)
ΔLnIMR	-2.558	0.300	-4.374	-3.603	-3.238	
LnMYS	-1.072	0.708	-3.770	-3.005	-2.642	
ΔLnMYS	-4.748	0.006	-4.468	-3.645	-3.261	I(1)
LnTFR	-1.072	0.708	-3.770	-3.005	-2.642	
ΔLnTFR	-4.748	0.006	-4.468	-3.645	-3.261	I(1)

Note. This table demonstrates the Philip-Perron unit root test result for the variables used in the model as computed by the author based on the data given in the Appendix C.

Table 6.2 presents the Philip-Perron (PP) unit root test results shows that LnLEB (Life Expectancy at Birth) and LnIMR (Infant Mortality Rate) are stationary at levels, as their PP-statistics (-7.496) are significantly lower than the critical values at all significance levels (1%, 5%, 10%). Their p-values (0.000) confirm this.LnGDPpc (GDP per capita), LnPCHE_HR (Per Capita Health Expenditure), LnMYS (Mean Years of Schooling), and LnTFR (Total Fertility Rate) are non-stationary at levels (p-values > 0.05). However, their first differences (Δ) become stationary, as indicated by significant PP-statistics and p-values below 0.05.The test compares PP-statistics to critical values. For instance, ΔLnPCHE_HR (-4.716) exceeds the 1percent critical value (-3.711), confirming stationarity after differencing. This suggests these variables are integrated of order one, I(1), and suitable for cointegration analysis.ΔLnIMR remains non-stationary (p-value = 0.300), indicating it may require further transformation or modeling adjustments.

ADF test and PP test forunit root test result is given in the above Table 6.1 and 6.2. The result clearly shows that included variables are integrated of I(0) and I(1). When the included variables are a mixture of order I(0) and I(1) of integration then that permits the use for further econometric analysis.

6.7 Descriptive Statistics

The descriptive statistic result for the variables used for the analysis is present in Table 6.3. The annual data point covers the period FY 1995/96 to FY 2021/22. The variables were expressed logarithmically to make comfortable interpretation in percentage terms. The descriptive analysis of the variables presented in Table 6.3 shows that the variables used exhibit reasonable central tendencies and dispersion, with no significant departures from normality.

Table 6.3

Descriptive Statistics of the Variables

Parameters	LnGDPpc	LnLEB	LnIMR	LnPCHE_HR	LnMYS	LnTFR
Mean	10.62	4.18	3.73	21.07	1.18	1.06
Median	10.47	4.20	3.71	21.68	1.12	0.99
Maximum	12.04	4.27	4.38	28.55	1.63	1.58
Minimum	9.29	4.06	3.16	11.20	0.79	0.69
Std. Dev.	0.88	0.06	0.37	4.43	0.31	0.29
Skewness	0.13	-0.50	0.14	-0.30	0.29	0.41
Kurtosis	1.59	2.08	1.79	2.70	1.53	1.80
Jarque-Bera	2.39	2.15	1.81	0.54	2.91	2.46
Probability	0.30	0.34	0.40	0.76	0.23	0.29
Sum	297.22	117.17	104.51	590.00	32.97	29.57
Sum Sq. Dev.	21.09	0.11	3.77	530.51	2.60	2.21
Observations	28	28	28	28	28	28

Note. This table demonstrates Descriptive Statistics of the variables used in the estimated model as computed by the author based on the data given inAppendix C.

Firstly, LnGDPpc has a mean of 10.62 with a standard deviation (SD)**,** ranging from 9.29 to 12.04**,** indicating moderate variability. Evidently, the distribution is nearly symmetric and slightly platykurtic. The Jarque-Bera (JB) p-value of 0.30 suggests the null hypothesis of normality cannot be rejected. Secondly, Life Expectancy at Birth (LEB)showsvery low variability(SD = 0.06**),** with values ranging from 4.06 to 4.27**.** The distribution is slightly negatively skewed **(**-0.50**)** and close to mesokurtic**.** Likewise, the JB p-value of 0.34 confirms approximate normality.

Infant Mortality Rate (IMR) has a mean of 3.73with modest dispersion. The distribution is nearly symmetric (skewness = 0.14**)** and somewhat flat **(**kurtosis = 1.79**).** TheJB p-value of 0.40indicates no significant deviation from normality. The interacting terms of per capita health expenditure with health human resources (PCHE_HR) has a mean of 21.07 with SD 4.43**,** with values ranging from 11.20 to 28.55. The distribution is slightly left-skewed (-0.30**)** and approximately mesokurtic (kurtosis = 2.70). Evidently, the JB p-value of 0.76provides strong support for normality.

Mean Years of Schooling (MYS) has a mean of 1.18**,** ranging from 0.79 to 1.63**,** with SD 0.31 and slight positive skewness (0.29**)**which suggests a relatively flat distribution. In addition, the JB p-value of 0.23indicates the distribution is plausibly normal. Furthermore, TFR has a mean of 1.06, with a slight positive skew (0.41) and a platykurtic shape (kurtosis = 1.80**)**. Its JB p-value of 0.29again suggests no strong departure from normality.

6.8 Breakpoint Unit Root Test Result

Table 6.4 below presents the breakpoint test result. The structural break status of the variables included in the model was tested using breakpoint unit root test. Evidently, Breakpoint unit root tests indicate that LEB, IMR, and TFR exhibit no structural breaks, whereas GDPpc, PCHE_HR, and MYS exhibit evidence of breaks. Significant breaks occurred in the years 2008, 2012 and 2016.

Table 6.4

Breakpoint Unit Root Test Result

Variable	Break Date	ADF t-statistic	Significance level			p-value	Evidence of Break
			1%	5%	10%		
LEB	1998	-12.369	-4.949	-4.443	-4.193	0.00	No
IMR	2021	-6.374	-4.949	-4.443	-4.193	0.00	No
GDPpc	2008	-3.026	-4.949	-4.443	-4.419	0.66	Yes
PCHE_HR	2016	2.995	4.949	-4.443	-4.193	0.69	Yes
MYS	2012	-2.460	4.949	-4.443	-4.193	0.91	Yes
TFR	2001	-12.688	4.949	-4.443	-4.193	0.00	No

Note. This table demonstrates Break point unit root test result for ensuring detection of break of data used in proposed regression model computed by author.

6.9 Econometric Analysis

This study assesses the determinants of two key health outcomes in Nepal, viz., life expectancy at birth and infant mortality rate as primary indicators of population health status. To achieve this aim, the study has proposed the simultaneous model due to the nature of the variables included in the study. In other words, life expectancy (LEB) and infant mortality rate (IMR) are included as explanatory variables in each other's equations, indicating a two-way causal relationship. It is obvious that simultaneous equation bias arises when one or more explanatory variables in a regression model are endogenous. Application of ordinary least squares (OLS) to estimate such a model would yield biased and inconsistent coefficients due to this simultaneity bias. Therefore, it is essential to address this issue, using appropriate econometric techniques such as Two-Stage Least Squares (2SLS).

This method goes beyond the ordinary least square method(OLS). In other words, the 2SLS method estimates the exact identified or over identified equation in a set of simultaneous equations. It eliminates the problem of simultaneous equation bias. Baum, Schaffer, and Stillman (2003) stated that the two-stage least square method provides consistent estimates by effectively isolating the instrumental variation, thereby capturing the true causal impact and ensuring the valid result. This can be due to omitted variable bias, measurement error, or simultaneity, where causal relationships run in both directions between the dependent and independent variables (Wooldridge, 1996).

First, life expectancy at birth is the function of GDP per capita, GDP per capita squared, the composite of per capita government healthcare expenditure and health human resource per 10000 populations, IMR per 1000 live births, total fertility rate and interacting terms of dummies to correct detected structural breaks in the respective data series. Second, IMR per 1000 live birth is the function of GDP per capita, GDP per capita squared, the composite of per capita government healthcare expenditure and health human resource per 10000 populations, IMR per 1000 live births, mean years of schooling, total fertility rate and interacting terms of dummies to correct detected structural breaks in the respective data series. The structural models reflect a bidirectional causality between life expectancy and infant mortality, acknowledging their interdependence. In these specifications, IMR and life expectancy at birth are endogenous variables. The two structural equations are given the following model 3.19 and 3.20 where life expectancy at birth and infant mortality rate are endogenous. So, these models were estimated using the 2SLS method.

6.10 Estimated Result of 2SLS

Table 6.5 presents the estimated output of 2SLS model. Evidently, the coefficient of variation value is 0.997. This result indicates that about 99 percent of the variation in life expectancy is explained by the explanatory variables included in the model, suggesting an excellent fit. The F-statistic of 1071.19 is highly significant ($p < 0.01$), confirming the joint statistical significance of the explanatory variables.

Table 6.5

Estimated Result of 2SLS Model

Dependent Variable: Life Expectancy at Birth		
Variable	2SLS	
	Coefficient(S.E.)	t-value
LnGDPpc	0.207*(0.1142)	1.82
LnGDPpc_SQ	-0.009*(0.0047)	-1.89
LnPCHE*HR	0.001**(0.0006)	2.36
LnIMR	-0.058(0.0489)	-1.19
LnTFR	-0.961**(0.0416)	-2.31
LnGDPpc*Dum2008	-0.001***(0.0004)	-2.97
LnPCHE_HR*Dum2016	-0.000(0.0002)	-0.17
Constant	3.30***(0.7914)	4.14
R^2	0.997	
F-statistic	1071.19 (p<0.01)	

Note. Table 6.5 demonstrates estimated result of 2SLS as computed by researcher based on the data given in Appendix C.The acronyms SE stands for standard error. Significance Level: ***p<0.01, **p<0.05 and *p<0.10

Evidently, the estimated coefficients and their standard error and t-value and their level of significance is presented in the above Table 6.5. The findings show that a 1 percent increase in GDP per capita is associated with a 0.207 percent in year increase in life expectancy at birth, supporting the theory that economic prosperity supports better health outcomes. However, the negative coefficient of quadratic term of GDP per capita suggests a diminishing return **(**Inverted-U relationshipbetween) GDP and life expectancy. This indicates that life expectancy increases with increased GDP per capita but at a decreasing rate which becomes slow after a certain level.

The positive and significant coefficient for interacting term between per capita government health expenditure with health human resource provision (LnPCHE*HR) indicates that more health spending per health worker is associated with higher life expectancy at birth. Conversely, the infant mortality rate (LnIMR) has expected but insignificant coefficient may suggest that fall in IMR is associated with the rise in life expectancy at birth but the strength is weak due to controlling for other variables.

The estimated result shows that higher fertility rates (LnTFR) reduce life expectancy significantly. According to Demographic Transition Theory as countries develop, fertility declines and life expectancy rises which is an essential part of the classic demographic transition. This also depicts that high fertility is typically a feature of the early stages, while low fertility and high life expectancy characterize later stages. Empirical studies especially across countries consistently show negative associations between total fertility rateandlife expectancy.

The study shows a strong positive effect of increased health expenditure per health resource on life expectancy. However, higher fertility is associated with lower life expectancy due to maternal/child health burdens. Infant mortality has a negative effect but is not significant. The 2008 policy dummy shows a negative interaction with GDP, suggesting ineffective policy or lagged effects. So, the study shows a strong positive effect of increased GDP growth followed by higher healthcare expenditure per health resource on life expectancy. Conversely, infant mortality has a negative effect but is not significant. Intuitively, the 2008 policy dummy shows a negative interaction with GDP, suggesting ineffective policy or lagged effects. There is also consistency between the estimated of 2SLS.

The 2SLS estimates provide some valuable policy lessons to academia and stakeholders. First, the result indicates that income, health expenditure interacted with human resources, demographic factors, and structural shocks play statistically significant roles in explaining the dependent variable life expectancy at birth. Second, 2SLS estimates provide valuable policy lessons by isolating the causal effects of national income, health system capacity, and demographic factors, thereby correcting for the endogeneity. Moreover, the results also suggest that economic growth alone is insufficient, and the healthcare institutional capacity and demographic transitions are central to ensure sustainable health outcomes.

Third, the positive coefficient of per capita GDP, combined with the negative and significant squared term, indicates a non-linear (inverted U-shaped) relationship. This indicates that income growth initially improves life expectancy at birth, but the marginal benefits declines and may reverse after a certain threshold. This implies that economic growth creates opportunity, but government healthcare systems, demographic management, and resilience determine whether those opportunities translate into sustainable and health outcomes as life expectancy at birth.

6.11 Diagnostic Test

It is desirable to conduct diagnostic tests to ensure the validity, consistency, and efficiency of the estimated results, after 2SLS estimation in econometric analysis. These tests help verify whether the necessary assumptions of the estimation techniques are satisfied, and whether the instruments and model specifications are appropriate. Diagnostic test results are presented in the following sections.

Test for Endogeneity

Table 6.6 below demonstrates the estimated result of endogeneity which is derived from the Durbin-Wu-Hausman test. It was used to examine whether the variable life expectancy at birth is endogenous. In this test, the null hypothesis of exogeneity was tested against the alternative that life expectancy at birth is endogenous.

Table 6.6

Test for Endogeneity

Test	Statistic	p-value
Durbin (Score) Chi2(1)	9.57768	0.002
Wu-HausmanF(1,16)	8.31832	0.010

Note: Table 6.6 demonstrates Shapiro-Wilk and Skewness/Kurtosis tests are used for normality tests as calculated by the researcher.

The estimated endogeneity results shows that the calculated p-value for the Durbin-Wu-Hausman test is less than 0.05. Moreover, we can't accept the null hypothesis (H_0) and conclude that life expectancy at birth is endogenous. Therefore, this evidence justifies the use of instrumental variables estimation.

Normality of Residuals

Table 6.7 above presents the results of the normality test. This test checks if the residuals are normally distributed by assessing skewness and kurtosis. To assess the assumption of normality, the residuals from the 2SLS regression were tested using the Shapiro-Wilk and Skewness/Kurtosis tests.

Table 6.7

Test for Normality

Pr (Skewness)	Pr (Kurtosis)	Adj. Chi^2 (2)	Prob > Chi^2
0.0015	0.0007	16.06	0.0003

Note: This Table shows the Shapiro-Wilk and Skewness/Kurtosis tests is used for normality test as calculated by the researcher.

Evidently, the skewness and kurtosis test for normality on the residuals yield p-values of 0.0015 and 0.0007, respectively. Moreover, the joint adjusted chi-square test statistic was 16.06, with a p-value of 0.0003, indicating no strong evidence against the null hypothesis of normality at the 5 percent significance level.

6.12 Determinants of Infant Mortality Rate

The second econometric model is specified as the determinants of IMR in the Nepali context. It is specified as the IMR is the function of GDP per capita, GDP per capita squared, the composite of per capita government healthcare expenditure and health human resource per 10000 populations, infant mortality rate per 1000 live births, mean years of schooling, total fertility rate and interacting terms of dummies to correct detected structural breaks in the respective data series.

6.13 Trend and Pattern of Decline in Infant Mortality in Nepal

The current study also provides a description of the trend and pattern of mortality decline in Nepal, based on the data presented in Appendix C of this dissertation. IMR per 1000 live birth is regarded as a critical indicator of a nation's population health status and socio-economic development. It reflects the probability of an infant dying before reaching one year of age. In this context, high IMR often points to systemic deficiencies in maternal health, access to quality healthcare, nutrition, and socio-economic support systems. This analysis is based on the long-term trend of IMR in Nepal and explores its relationship with key determinants such as GDP per capita (GDPpc), per capita healthcare expenditure (PCHE), health human resources (HR), life expectancy at birth (LEB), mean years of schooling (MYS), and total fertility rate (TFR) in macro perspectives**.**

General Trend of Infant Mortality Rate

During the study period, Nepal witnessed a dramatic reduction in IMR**,** from 79.5 deaths per 1,000 live births to 23per 1000 live births, which is a 71 percent decline. This trend signifies a substantial achievement in public health and healthcare delivery, particularly in maternal and child health. The pattern and trend of IMR decline can be analyzed into three phases. The first phase, FY 1994/95–2004/05, IMR fell from 79.5 to 48.2 per 1000 live births. In fact, this period marks the foundation of modern public health programs in Nepal. During the period, community-based interventions, such as immunization, safe motherhood initiatives, and the deployment of Female Community Health Volunteers (FCHVs), played a key role. The second phase, FY 2005/06– FY 2014/15, experienced a steady decline i.e. from 45.9 to 30.5 per 1000 live births. This decade included significant policy shifts, including the introduction of free maternity care, expansion of rural health infrastructure, and donor-supported child-survival programs. The third phase, FY 2015/16– FY 2021/22**,** shows a slower but continuous decline, reaching 23 per 1000 live births (Appendix C).

Economic Growth and IMR

Nepal's economic performance has improved substantially over the study period, followed by an improvement in population health outcomes. The country's GDP per capita increased substantially from NPR 10,850 in FY 1994/95 to NPR 169,038 in FY 2021/22, representing more than a fifteen-fold rise. This sustained macroeconomic expansion appears to coincide with a marked improvement in health outcomes, particularly the IMR per 1000 live births. Specifically, the IMR declined from 79.5 deaths per 1,000 live births in FY 1994/95 to 23 deaths per 1,000 live births in FY 2021/22, indicating substantial progress in child survival and overall public health (Appendix C). In other words, households with rising incomes are better positioned to seek timely healthcare, afford medicines, and access improved maternal services. However, the IMR did not decline at a constant rate with GDP per capita, suggesting that income alone is not sufficient; complementary investments in social infrastructure and healthcare services are essential. Theoretically, economic growth generally improves public resources for healthcare, nutrition, sanitation, and education, and these are all essential for child survival.

Government Investment in the Healthcare and IMR

Government investment in the healthcare sector grew massively from NPR 71 to NPR 4,096 over the period, which is a nearly 58-fold increase. This indicates a strong fiscal commitment to health by the state and development partners. We can make some valuable observations regarding its trend and pattern. Evidently, the steepest rise in PCHE occurred after FY 2005/06, coinciding with the peace process and increased international aid for rebuilding health systems. In other words, rising PCHE correlates with reductions in IMR, but in the last decade, further increases in spending yielded diminishing returns in IMR improvement. This suggests the need to shift the focus from quantity to the quality and efficiency of government health expenditure, ensuring that resources reach vulnerable populations and that services are appropriately targeted, such as neonatal care and delivery complications.

Health Human Resources Density and IMR

Health human resource density (HR) shows a mixed trend in growth during the study period. Evidently, HR per 10,000 population increased from 13.84 in FY 1994/95 to 37.23 in FY 2004/05, which is approximately 3-times growth, then stagnated or declined slightly, remaining around 30–32 in the final decade (Appendix C). The early improvement in HR was associated with expanding rural services and health post staffing. We can have critical observations regarding post-2010 stagnation in HR, which contrasts with rising PCHE. Probably, the raising concerns about the capacity to deliver health services effectively, particularly in maternal and child care. Therefore, lack of adequate and equitably distributed health professionals may explain why IMR decline has slowed in recent years.

IMR and Life Expectancy at Birth: A Mirror of IMR

Life expectancy is the mirror of IMR. Evidently, life expectancy rose from 57.8 to 71.3 years, closely mirroring the fall in IMR. This relationship is logical as fewer infants die, average life expectancy increases and provides insight for further explanation. The significant inference we can draw from this is that IMR is one of the most influential determinants of LEB, and improvements in IMR significantly contribute to overall mortality reductions. The fact that LEB continues to rise even as IMR declines more slowly suggests other health challenges, such as non-communicable diseases, are gaining importance(Appendix C).

Mean Years of Schooling and IMR

During the study period, Mean Years of Schooling (MYS) improved from 2.2 years in FY 1994/95 to 5.1 years in FY 2021/22, indicating significant educational progress. In this regard, educated mothers are more likely to seek antenatal care, vaccinate their children, and follow hygiene and nutrition best practices. Literacy improves health-seeking behavior and awareness of available services. Obviously, there is a clear negative association between MYS and IMR, and as education levels increased, IMR consistently dropped. However, despite gains, Nepal's average schooling years remain low, pointing to an opportunity for further health gains through education policy (Appendix C).

Fertility Transition and IMR

During the study period, Total Fertility Rate (TFR) dropped from 4.87 children per woman in the FY 1994/94 to 2.00 in the FY 2021/22, reaching replacement level. This demographic transition is critical for the IMR dropping trends as it indicates that high fertility is associated with shorter birth intervals and maternal depletion, which increase infant risks. Likewise, fewer births enable better parental care, nutrition, and healthcare per child. Obviously, family planning services contribute both to reduced fertility and improved maternal and child health. So, the parallel decline in TFR and IMR confirms that lower fertility is strongly associated with lower infant mortality (Appendix C).

The determinants of infant mortality rate in Nepal are influenced by various factors, including economic, health system, demographic, and educational factors. Higher GDP per capita negatively affects IMR by improving access to healthcare, nutrition, and higher living standards. Per capita health expenditure also has a negative relationship with IMR, indicating public investment in health services. Human resources availability is crucial, with more doctors, nurses, and midwives contributing to reduced infant deaths. Life expectancy at birth also has a negative correlation with IMR, while the total fertility rate is positively related.

Critical Reflections from the Trend and Pattern IMR

Despite consistent progress in the decline in IMR, the rate of decline has slowed since FY 2015/16. Evidently, PCHE and GDP per capita continued to grow rapidly, health outcome gains, especially IMR reduction, appear to have plateaued. The potential cause in this regard is inefficiency in government health expenditure, with increased resources not translating into outcome gains.

Likewise, another cause may be persistent inequality in health access across regions and ethnic groups. Another cause may be a shift in burden from communicable to non-communicable diseases, requiring a transition in service types. Moreover, human resource stagnation limits the outreach of maternal and neonatal services. These critical observations suggest that Nepal must move beyond input-based approaches and focus on quality, equity, efficiency, and health system strengthening to continue improving child survival outcomes.The critical observation also provides policy implications for strengthening primary healthcare and maternal-child health programs, especially in underserved rural areas. Increasing investment in health workforce development and equitable distribution to overcome human resource bottlenecks.

In summary, Nepal's long-term trend of declining infant mortality is a significant public health success. It has been shaped by multi-dimensional progress in macroeconomic development, healthcare investment, education level rise, demographic transition, and health service delivery. However, the recent slowdown in IMR decline underscores the need for next-generation formulation and implementation of strategies that go beyond expanding inputs to strengthening systems, ensuring quality, and achieving equitable access

6.14 Estimated Result of 2SLS

This study employed a Two-Stage Least Squares (2SLS) estimation to model the determinants of infant mortality rate (IMRt), accounting for potential endogeneity and reverse causality. The dependent variable is the infant mortality rate (IMR), and the model includes a set of socio-economic, health-related, and policy variables. Life expectancy at birth (LEBt) was treated as endogenous due to its potential two-way causality with IMR, and was instrumented using appropriate exogenous predictors.Table 6.8 present the result of the estimated 2SLS model with the coefficient of variation value (R^2)0.9946 indicating that approximately 99 percent of the variation in dependent variable life expectancy at birth is explained by the explanatory variables included in the model, suggesting an excellent fit. The F-statistic of 314.71 is highly significant ($p < 0.01$), confirming the joint statistical significance of the explanatory variables.

Table 6.8

Estimated Result of 2SLS

Dependent Variable: Infant Mortality Rate		
Variables	2SLS	
	Coefficient(S.E.)	t-value
LnGDPpc	-3.664*(2.011)	-1.82
LnGDPpc_SQ	0.171*(0.091)	-1.87
LnLEBt	-6.168*(3.376)	-1.83
LnPCHE_HR	0.075*(0.029)	-1.97
LnPCHE_HR_SQ	-0.002*(0.001)	-1.97
LnMYS	-1.348*S*(0.623)	-2.16
LnTFR	-1.563**(1.020)	-1.53
LnGDPpc*Dum2008	0.001(0.005)	0.30
LnPCHE_HR*Dum2016	-0.001(0.0002)	-0.67
LnMYS*Dum2012	0.127(0.090)	1.41
Constant	51.692**(18.164)	2.85
R^2	0.9946	
F-statistic	314.71(p<0.01)	

Note: This Table demonstrates estimated result of 2SLS as computed by researcher based on the data given in Appendix C. Significance Levels: ***p < 0.01; ***p < 0.05; *p < 0.10.*

Table 6.8 shows that GDP per capita (GDPpc) is negatively associated with IMR, having a coefficient of -3.66 (p = 0.086), which is significant at the 10 percent level. This indicates that a 1 percent increase in economic growth is linked to approximately 3.66 percent reduction of infant deaths per 1,000 live births. It implies, economic growth can lead to improvements in nutrition intake, sanitation, infrastructure, and government healthcare delivery, which collectively contribute to increase child survival rates. In fact, this relation is not linear. To assess this non-linear relation of GDP with IMR, the study has incorporated the squared term of GDP per capita (GDPpc_SQ). The squared term of GDP per capita has a positive and statistically significant coefficient (0.171, p = 0.079), reflecting a nonlinear relation or threshold effect between change in national income and change in IMR. Stating clearly, initially increases in national income reduce IMR, but beyond a certain level, the marginal benefits of income growth on infant mortality may diminish, possibly due to the reason diminishing returns from growth alone.

Life expectancy at birth (LEB) is treated as an endogenous variable and instrumented using relevant socio-economic indicators, and it exhibits a negative and statistically significant effect on the infant mortality rate (IMR) at the 10 percent level. This suggests that a 1 per cent increase in life expectancy per year is associated with a reduction of approximately 6.17 per cent in infant deaths per 1,000 live births, holding other determinants constant. This result is consistent with theoretical expectations, as longevity reflects broader improvements in population health, living standards, and access to healthcare systems that lower infant mortality.

At first glance, the interaction term between per capita health expenditure and health human resources (PCHE*HR) shows a positive coefficient (0.075, p = 0.009), which appears counterintuitive. However, this finding needs to be interpreted alongside the negative, significant squared term coefficient (-0.0022, p = 0.028). In entirety, these results imply an inverted U-shaped relationship between health expenditure and infant mortality. In other words, at lower levels, increases in government health expenditure may not be efficiently targeted or utilized, potentially reflecting administrative inefficiencies or initial-phase learning. However, after a certain threshold, higher levels of government health expenditure become effective in reducing infant mortality.

Mean years of schooling (MYS) bears a negative and statistically significant coefficient (-1.35, p = 0.045), indicating that a one-percent increase in mean years of schooling leads to a 1.35 percent fall in infant deaths per 1,000 live births. Theoretically, educational attainment, especially among women, improves health knowledge, attitude, and practice, leading to enhanced informed decision-making around childcare and fertility, thereby reducing IMR. TFR shows a negative but statistically insignificant coefficient (-1.56, p = 0.144). The direction of the result is consistent with Demographic Transition Theory. According to Demographic Transition Theory,in early stages of development, countries have high TFR and low life expectancy due to high child and maternal mortality, poor healthcare, and limited education. However, as countries develop, TFR declines due to improved education (especially for women), better healthcare, family planning, and changing economic incentives. As a result, LEB increases due to lower mortality rates, better nutrition, improved sanitation, and access to medical care. Moreover, the policy dummy variables, which were included to capture the effects of structural changes and health and development interventions, are mostly statistically insignificant. This suggests that their standalone effects on IMR are limited within the model specification, though they remain theoretically important for controlling policy-related structural breaks.

The constant term in a regression analysis represents theexpected value of the dependent variable or IMRwhen all explanatory variables are equal to zero. In this estimated model, a constant of 51.69 implies that, hypothetically, if GDP per capita growth, per capita health expenditure, life expectancy, fertility, schooling years, and all policy dummies were zero, the predicted IMR would be approximately 51.7 per 1,000 live births.

The 2SLS estimates provide key policy lessons to the academia and stakeholders regarding understanding the life expectancy at birth and its correlates. First, it identifies the key factors such as economic growth, government health system, and health human resource factors that are found to be strongly associated with infant mortality, with the necessary correction for potential endogeneity. Second, the result underlines that reductions in infant mortality is significantly driven by a combination of income growth, health system effectiveness, level of education, and demographic transition, rather than by any single policy lever. Third, income growth is found to be the most effective measure in reducing infant mortality at lower levels of development. Moreover, beyond a certain threshold level, additional income gains alone yield smaller health benefits unless complemented by targeted further health and social investments. Intuitively, this reinforces the need to shift from economic growth-centric to upgrade the quality-of-spending strategies as the development progresses over a time. To sum up, infant survival improves not merely when economies grow over a time, but when the economic growth is translated into capability of health institution framework, education level of households, and resilient health systems.

6.15 Diagnostic Test

The essential diagnostic test results, such as the test for endogeneity and normality, are presented and discussed in the following section.

Test for Endogeneity

The Durbin-Wu-Hausman test is used for endogeneity tests. It was employed to determine whether the variable life expectancy at birth is endogenous. In this test, the null hypothesis of exogeneity was tested against the alternative that life expectancy at birth is endogenous.

Table 6.9

Result of Test for Endogeneity

Test	Statistic	p-value
Durbin (Score) Chi2(1)	9.57768	0.002
Wu-Hausman F(1,16)	8.31832	0.010

*Note:*Table 6.9 above demonstrates Durbin-Wu-Hausman test is used for endogeneity test as calculated by the researcher.

The estimated endogeneity results are presented in Table 6.9. Evidently, estimated p-value for Durbin-Wu-Hausman test is less than 5 percent. This indicates, we cannot accept the null hypothesis(H_0) and conclude that the life expectancy at birth is endogenous. Therefore, this evidence justifies the use of instrumental variables estimation.

Normality of Residuals

This test checks if the residuals are normally distributed by assessing skewness and kurtosis. To assess the assumption of normality, the residuals from the 2SLS regression were tested using the Shapiro-Wilk and Skewness/Kurtosis tests.

Table 6.10

Result of Test for Normality

Pr (Skewness)	Pr (Kurtosis)	Adj. Chi^2 (2)	Prob > Chi^2
0.0015	0.0007	16.06	0.0003

Note: This Table shows Shapiro-Wilk and Skewness/Kurtosis tests are used for normality tests as calculated by the researcher.

Table 6.10 above presents the result of the normality test. The skewness and kurtosis tests for normality of the residuals yield p-values of 0.0015 and 0.0007, respectively. Evidently, the joint adjusted chi-square test statistic was 16.06, with a p-value of 0.0003, indicating no strong evidence against the null hypothesis of normality at the 5 percent significance level.

6.15 Discussion

The first part of the third objective of this dissertation is to evaluate the extent to which the macroeconomic, socio-demographic, and institutional factors influence variation in life expectancy at birth in Nepal. The analysis result demonstrated a long-run relationship between the outcome variable of life expectancy at birth and the independent variables per capita GDP, per capita GDP squared, public health expenditure, the interacting term of per capita government's healthcare expenditure with health human resources density per 10000 populations in government healthcare system, infant mortality per 1000 live birth, and total fertility rate.

In other words, the estimated coefficients indicate that a 1 percent change in GDP per capita, per capita GDP squared, interacting term with health human resource density per 10000 populations with per capita government healthcare expenditure, IMR per 1000 live birth, and total fertility rate cause change in life expectancy at birth by 0.207 percent, -0.009 percent, 0.001 percent, -0.058 percent, -0.81percent respectively. However, IMR per 1000 live births was found to be the most influencing predictors of life expectancy at birth. The estimated coefficients, their standard errors, t-values, and levels of significance are presented in Table 6.4 above.

The analysis result demonstrates that the GDP per capita has a significant and positive correlation with the life expectancy at birth in Nepal. This result supports the theory that economic prosperity supports better health outcomes. However, the negative coefficient of quadratic term of GDP per capita suggests a diminishing return (Inverted-U relationship between) GDP and life expectancy. This indicates that life expectancy increases with increased GDP per capita, but at a decreasing rate, which becomes slow after a certain level.

This is also supported by the previous empirical literature such as Kaur (2023), Wirayuda et al. (2022), Jafrin et al. (2021), Wirayuda and Chan (2021), Bayar et al. (2021), Miladinov (2020), Jetter et al. (2019), and Delavari et al. (2016). Generally, the significant and positive correlation between GDP per capita and life expectancy at birth in both the long-run and short-run suggests that the economic growth of any nation directly contributes to improvements in life expectancy. Essentially, as GDP per capita increases, resource availability to individuals and society increases, leading to better living standards, improved healthcare access and education, and better nutrition, eventually leading to longevity of population. Furthermore, in the short run, the positive association suggests immediate benefits from rising GDP, such as improved healthcare infrastructure, availability of essential medicines, and better healthcare accessibility. However, in the long run, this relationship reflects the sustained benefits of economic growth, such as ongoing healthcare investments and longer life spans. In the policy perspectives, a portion of the increased national income should be allocated in healthcare infrastructure, skilled health personnel, and access to essential medicines to expand and improve the public healthcare system.

The result also demonstrates that the health human resources density in the government healthcare system has insignificant but positive correlation with the life expectancy at birth in Nepal. The previous empirical studies, like Roffia et al. (2023), Anwar et al. (2023), Jaiyesimi et al. (2016), Nguyen et al. (2016), and Anand and Barnighausen (2004), support these findings. Nevertheless, this finding provides a logical basis for discussion and yields valuable insights.

This result suggests that increasing the number of healthcare professionals has a limited impact on life expectancy at birth in Nepal. This may indicate that having more health personnel is beneficial. But, other factors like public healthcare infrastructure quality, and access to essential services play more significant roles in influencing life expectancy in the long-run. It also suggests that incremental changes in the health workforce may not be enough to produce lasting improvements in life expectancy without broader systemic and infrastructure support.The analysis result demonstrates that the IMR has significant and negative correlation with the life expectancy at birth in Nepal. Obviously, this resultsaligns with theoretical perspectives. It also supports the conclusion of empirical studies carried out in the past such as Anwar et al. (2023), Wirayuda and Chan (2021), Rabbi (2013), and Miladinov (2020). However, we can discuss on it to draw valuable insights.

Firstly, this negative correlation suggests that as fewer infants die, the average lifespan of the population improves, reflecting better overall health and healthcare quality, especially in maternal and child health. Secondly, the long-run significance suggests that sustained reductions in infant mortality have a substantial and long-lasting impact on longevity. Furthermore, the significant short-run impact of IMR on life expectancy indicates that recent improvements in infant survival rates quickly translate into life expectancy gains. In policy perspectives, the government of Nepal needs toincrease investment in maternal and child healthcare services to reduce IMR and improve life expectancy. In this regard, preventive measures such as nutrition programs, vaccinations, and public awareness campaigns should be prioritized to reduce infant mortality so as to increase life expectancy at birth.

Finally, the analysis result demonstrates that fertility rate is significantly and inversely associated with longevity in Nepal. This results in compliance with previous studies such as Khan and Tehseen (2017), Cheng et al. (2022) and Poot and Siegers (2001). Moreover, this finding also aligns with the demographic transitiontheory**.** According to this theory, as socioeconomic conditions improve, mortality declines due to improved health care, sanitation, and nutrition, causing a rise in life expectancy at birth, followed by a decline in TFR.

This finding stipulates the need for balanced development strategies. Economic growth is crucial, its health benefits can plateau or even reverse without equitable health expenditure, environmental sustainability, and targeted interventions for non-communicable diseases (NCDs). The government should ensure that policies go beyond GDP growth metrics and focus on translating economic gains into sustainable health outcomes The interaction term between per capita healthcare expenditure and health human resources has a positive and statistically significant coefficient (0.001; $p < 0.05$). In fact, this variable captures the synergistic effect of financial and human resource investments in the healthcare system. The positive sign suggests that life expectancy increases when healthcare expenditure is effectively complemented by sufficient and skilled healthcare personnel. This supports the health production function framework, where both financial and human capital inputs are necessary for improved health outcomes. Without trained personnel, financial resources may not be efficiently utilized; conversely, an abundance of health workers with poor infrastructure or insufficient supplies may also yield suboptimal results.

Nepal must prioritize the balanced scaling of both healthcare financing and workforce development. Investments in primary health care, training of mid-level providers, retention of rural doctors, and performance-based financing mechanisms should be pursued in tandem. Strengthening institutions such as the Nepal Health Training Center and implementing region-specific human resource for health (HRH) policies are essential for maximizing the impact of health investments. Regardless of statistical significance in this model, IMR reduction should remain a top health policy priority. Targeted programs like neonatal intensive care, vaccination drives, and maternal nutrition programs should be enhanced, especially in provinces with poor health indicators. Moreover, improving health information systems to accurately track infant deaths is essential for evidence-based policymaking.Policies aimed at further reducing TFR, through increased access to family planning, maternal education, and adolescent reproductive health can enhance life expectancy. Investments in girls' education, particularly at the secondary level, have been shown to reduce fertility rates and improve child and maternal health.

This finding reinforces the need for resilient health systems that can withstand macroeconomic shocks. Health sector budgeting must be protected during economic downturns through counter-cyclical fiscal policies, donor coordination, and ring-fenced funds for essential health services. Rigorous monitoring and evaluation frameworks must be established for major health reforms. Policies should not only be enacted but also tracked for outputs, outcomes, and impact. The government should consider public expenditure tracking surveys to monitor reform effectiveness. Government policy should focus on improving health outcomes in Nepal by integrating economic and health policies, strengthening healthcare workforce capacity, reducing fertility and infant mortality. Moreover, designing of health reforms with monitoring mechanisms, ensuring fiscal resilience in government health budgeting, and utilizing econometric models for policy dialogues and resource allocation are desirable. This approach is expected to ensure equitable, sustainable, and resilient longevity gains, thereby enhancing Nepal's life expectancy.

The third objectives latter part of this dissertation is to evaluate the extent to which the macroeconomic, socio-economic factors influence the health outcomes, specifically the infant mortality rate in Nepal. In this context, the econometric analysis result demonstrated a long-run relationship between the outcome variable, infant mortality per 1000 live births and the independent variables GDP per capita, squared GDP per capita, life expectancy at birth, interaction terms of health human resources per 10000 populations in government healthcare system and per capita health expenditure, mean years of schooling, and total fertility rate. Almost all independent variables are strong predictors of IMR per 1000 live births.

In other words, the estimated coefficients indicated that a 1percent increase in GDP per capita, life expectancy at birth, interacting term of health human resources density with per capita government healthcare expenditure, mean years of schooling and TFR reduce IMR per 1000 live birth by 3.66 percent, 6.16 percent, 0.075 percent, 0.002 percent, 1.34 percent, and 1.56 percent respectively. Conversely, the squared term of GDP per capita has a positive and statistically significant coefficient (0.171, p = 0.079), reflecting a nonlinear or threshold relationship between changes in national income and change in infant death rate.This indicate that the increase in national income reduces IMR in initial phase, but beyond a certain level, the marginal benefits of income growth on infant mortality may diminish, possibly due to diminishing returns from growth alone.

The analysis result demonstrates that the GDP per capita has a significant and negative correlation with the IMR in Nepal. In general, the result is consistent with existing theories. Similarly, this finding is also supported by previous empirical literature such as Bugelli et al. (2021), Taramsari et al. (2021), Sari and Prasetyani (2021), Kiross et al. (2020), Tang (2019), Mallick et al. (2019), Onambele et al. (2019), Subramaniam et al. (2018), and Monika (2018). However, we can have a discussion to draw practical insights and policy implications from this result as well. Primarily, the significant and inverse correlation between national income growth and infant death rate in both the long-run and short-run, reflects that as the economic conditions of the country improves, infant death rate decrease. Moreover, this negative relationship suggests that higher per capita income is associated with increased health expenditures, improved living conditions, better nutrition, and enhanced healthcare access, all of which contribute to lower IMR. Similarly, the long-run significance of GDP per capita on IMR highlights the impact of economic growth on infant healthcare quality. In other words, over time, higher national income per capita leads to betterment of government healthcare infrastructure, access to essential healthcare services, which collectively contribute to reductions in IMR in the long-term.

In addition, the significance implies that even recent economic reforms have a measurable impact on reducing IMR. Considering these discussions, we can draw some insights for policy perspectives as well. Firstly, the government should prioritize policies that promote equitable and inclusive economic growth, ensuring that increased GDP per capita translates into broader and closer access to healthcare, especially for low-income households. Secondly, the government should ensure that economic growth translates into broader health coverage through the expansion of government health insurance for low-income households to protect them from financial hardship.

The squared term of GDP per capita is positive and significant, confirming a non-linear (U-shaped) relationship. This suggests that the marginal benefit of income in reducing infant mortality declines after a certain threshold and may even reverse. This result supported the earlier work of Deaton (2003), who cautioned against assuming a linear health-income gradient, especially in contexts where income increases without commensurate investments in health systems or social services. Likewise, Preston (1975) found that cross-country variations in infant mortality were largely explained by income differences, but also highlighted diminishing returns. Moreover, Filmer and Pritchett (1999) argued that public expenditure on health is less effective without accountability and efficient governance. Conversely, Wagstaff's (2002) contrasting findings stated that income is a proxy for other underlying factors (education, access to services) and thus may overstate its direct impact on mortality reduction.

The result also demonstrates that per capita government healthcare expenditure has a significant, negative correlation with the IMR in Nepal. Obviously, the result is consistent with the existing theories. Similarly, this finding is also supported by previous empirical literature such as Sari and Prasetyani (2021), Boachie et al. (2020), Kiross et al. (2020), andHu and Mendoza (2013). In this context, we can proceed to some discussion to draw practical insights and policy implications from this result as well. In general, this relationship implies that government investments in healthcare have a beneficial impact on health outcomes, including infant death rate, as increased government funding is likely to better the access and quality of essential health services that contribute to the significant reduction of infant death.

In addition, the long-run significance of per capita government healthcare expenditure on IMR suggests that sustainable government investment in public healthcare infrastructure leads to enduring reductions in infant mortality rate. Similarly, over time, consistent healthcare sector expenditure fosters a robust health system capable of effectively meeting the healthcare needs of infants. Furthermore, the short-run significance of this relationship points to immediate improvements in IMR due to the recent rapid scaling up of healthcare services, emergency interventions, including maternal and child health programs.

Based on these discussions, we can draw some insights into policy perspectives as well. The first policy focuses on ensuring a sustained increase in per capita government healthcare expenditure, specifically for maternal and child healthcare services. Funding targeted toward prenatal and postnatal care, vaccination programs, and neonatal services can directly reduce IMR. This increased healthcare expenditure is expected to reduce IMR by ensuring more infants receive the required care they need during critical stages of development. The next policy focus shouldprioritize healthcare expenditure to expand infrastructure, recruit trend and skilled healthcare personnel, and establish movable healthcare units, particularly in remote and underserved areas where IMR is typically higher.

The result also demonstrates that the health human resources (HR) per 10,000 populations in the government healthcare system hasa significant and negative correlation with the IMR in Nepal in both the long and short run. Generally, this correlation in both the long and short run suggests that a higher density of healthcare personnel in the government healthcare system is associated with a lower infant mortality. This result is consistent with the theories and previous empirical studies ofKrishna (2016), Nguyen et al. (2016), and Ananda and Barnighausen (2004).

However, we discussit in this regard and draw useful insights as well. Firstly, this relationship indicates that increasing the availability of healthcare workers in the government healthcare system, such as doctors, nurses, and midwives, helps to improve the quality and accessibility of healthcare services for both infants and mothers, which eventually leads to fewer infant deaths. Secondly, the long-run significance of HR on IMR suggests that sustainable improvements in healthcare workforce density have a long-lasting positive impact on the lower infant mortality rates. Nevertheless, the short-run significance reflects the immediate benefits of an increased healthcare workforce, helping to address urgent maternal and child health needs and reduce infant mortality rates.

Based on these discussions, we can draw some inferences for policy perspectives too. The first policy focus can be increasing healthcare personnel, particularly in rural and underserved areas where IMR is often higher. This government effort is expected to increase HR in underserved areas and ensure that infants receive necessary healthcare services, thereby reducing IMR. The second policy focus can be on the retention programs to ensure that the healthcare workforce remains stable to meet long-term healthcare needs. It is worth noting that retaining healthcare personnel creates stability in healthcare service delivery, which ultimately supports long-term reductions in IMR.

The estimated result demonstrates that longer life expectancy often reflects higher literacy rates, particularly among mothers, leading to better infant care practices**.** Similarly, longer life expectancy usually indicates better healthcare access, leading to improved prenatal, neonatal, postnatal, and pediatric care.Moreover, in the long-run, this correlation suggests that improvements in healthcare access, general living conditions, nutrition, and sanitation are likely to increase life expectancy, and reduce IMR. Likewise, in the short run, this correlation may be influenced by more immediate factors, such as seasonal health interventions and sudden temporary impact factors to reduce IMR. The previous study of Ray and Linden (2020),Miladino (2020) and Barua et al.(2022) also confirmed the result. Essentially, the significant correlation could be linked to launch the targeted health programs in Nepal for the improvements in maternal healthcare, or economic growth contributing to better health infrastructure. However, based on these discussions, we can draw some inferences for policy perspectives too. The policy focus should be on sustaining increased life expectancy and reduced infant mortality over time, through investments in healthcare infrastructure and quality access.

The result shows that the mean years of schooling has a significant and negative correlation with the IMR in Nepal in both the long and short run. Generally, the tong-run, significant, and negative correlation suggests that an increase in the mean years of schooling is associated with a decrease in IMR over time. In other words, this relationship likely reflects how education, especially for mothers, contributes to better health practices, increased access to healthcare, and reduces IMR. Likewise, the short-run significance suggests that immediate changes in educational access to schooling can affect IMR. However, the short-run effects may not be as stable without sustained efforts for educational improvements. This result is also consistent with the mainstream theories. Likewise, earlier studies such as Aldirawi et al. (2019), Tang (2019), Hossain et al. (2018), Kabir and Maitrot(2017), Barro and Lee (2013), and Mazen et al.(2011). Likewise, Gakidou et al. (2010) highlight maternal education as a key determinant of child mortality reduction globally. Moreover, Glewwe (1999) showed that maternal education improves child health even more than household income in developing countries.

In this context, we can have discussions and draw useful insights as well. Essentially, higher educational attainment is associated with improved nutrition and sanitation, increased awareness of prenatal, neonatal and postnatal care, better immunization, and healthcare access. Eventually, these factors play a crucial role in reducing IMR over time. Considering these things, the government can make a policy focus on tapping the benefits. Firstly, the government should focus on supporting and sustaining educational access, especially for women and young girls, giving maternal education to lower IMR. Secondly, programs should be launched to address maternal health and child nutrition.

The result shows that TFR is inversely and significantly correlated with IMR**,** implying that lower fertility levels are associated with a reduction in the infant mortality rate. This indicates that as societies develop, both IMR and TFR fall together**,** eventually life expectancyincreases progressively through all stages. This result is consistent with Lawson et al. (2012), Bloom et al. (2003), Yamada (1983), Lawson et al. (2012), and Reher (1999). The decline in TFR and IMR is linked to improved child survival, driven by demographic transition and increased access to maternal health services. High fertility often leads to short birth intervals and limited resources, highlighting the need for integrated reproductive and child health policies in developing countries.

This result provides policy insight into investing in reproductive health and family planning to improve child survival outcomes. In other words, policies should prioritize inclusive economic growth, create employment, support rural livelihoods, reduce income inequality, strengthen social protection for the poor, and channel economic gains into public goods such as health, water, and sanitation. To bridge health system gaps, government need to prioritize equitable deployment of doctors and nurses in remote districts, increase budget allocation for primary healthcare and maternal-child health services, and institutionalize health workforce planning according to the WHO Global Strategy on human resources for the healthcare sector.

Policy Implications for Improvement in Health Outcomes

The general observation of long-term trends in LEB and IMR per 1000 live birth alongside critical determinants such as GDP per capita, per capita government healthcare expenditure (PCHE), human health resources density (HR), mean years of schooling (MYS), and total fertility rate (TFR) offers crucial insights for shaping Nepal's future health policy landscape. The observed data shows that over the 28-year period, life expectancy has increased from 57.8 years in FY 1994/95 to 71.3 years in FY 2021/22, while infant mortality fell significantly from 79.5 to 23 per 1,000 live births. These improvements coincide with rising GDP per capita, about 58-fold increase in government healthcare expenditure per capita, and supported by steady progress in education and fertility reduction. However, challenges persist in ensuring equity, sustainability, and continued progress in the healthcare system of Nepal. The following policy implications are drawn from the evolving data trends and econometric analysis and their relevance to key health system objectives in Nepal.

The observed correlation between GDP per capita and both LEB and IMR underlines the role of economic growth in enabling better health outcomes of the population. GDP per capita rose steadily from NPR 10,850 in FY 1994/95 to NPR FY 169,038 in 2021/22. This macroeconomic expansion provided fiscal space for expanded public health sector investments, which positively influenced health status indicators of the country.

This scenario gives valuable insights for policy insight. In this regard, the Government of Nepal must continue to embed health priorities in national economic and development planning. Likewise, mechanisms such as health-sensitive government budgeting and integrating health indicators into national development frameworks can ensure sustained and targeted investment in public health. Apart from this, increased GDP must translate into proportional growth in health sector allocation moving closer to the 5 percent of GDP recommended by the WHO for low-income country like Nepal.

Per capita public healthcare expenditure rose from NPR 71 to NPR 4,096 over the study period. In fact, this investment has coincided with a steady rise in life expectancy and a rapid fall in infant mortality rate, suggesting that improved funding has enabled better service coverage, preventive care and treatment access. This situation provides valuable insights for policy insight such as continued growth in

PCHE must be maintained and strategically targeted. Likewise, budget priorities should focus on expanding primary care services in underserved areas, ensuring continuity of essential maternal, post-natal and neonatal, and child health programs. These need to be followed by scaling up non-communicable disease prevention and elderly care as the population ages. Essentially, investing in quality improvement and digital health innovation is desirable. Finally, efficiency should be ensured by adopting targeted program-based budgeting linked to measurable health outcome indicators such as IMR and LEB.

The data show that health human resources density increased rapidly in the early 2000s but has stagnated and slightly declined since the year 2010 from a high of over 37 to around 30.95 in recent years. This deceleration may hinder service delivery, especially amid rising healthcare demand, as evidenced by the annual OPD visit frequency. This critical scenario gives valuable insights to rethink and improve the health human resource density of Nepal. Therefore, revitalizing the health workforce must be a top national priority. This may involve expanding medical and nursing education through scholarships and decentralized training institutions, followed by offering financial and non-financial incentives for rural area deployment of the health professionals. Likewise, institutionalizing career development pathways and continuous professional education and creating a national health workforce registry to monitor distribution, retention, and service gaps are also essential. Moreover, without addressing the health human resource density bottleneck, further gains in life expectancy and reductions in IMR is almost impossible to achieve.

The evidence shows that the mean years of schooling (MYS) increased from 2.2 years in FY 1994/95 to 5.1 years in FY 2021/22, with marked acceleration visible after 2005. The literature and this dataset consistently show that general and maternal education are closely associated with improved child survival and healthier lifestyles, contributing to both increased LEB and reduced IMR.This scenario also provides policy insight to address the issue of improving population health outcomes. Therefore, education and health policies must be better integrated, particularly giving emphasis to promote female education beyond secondary level, with emphasis on reproductive health literacy, incorporating basic health and nutrition education into school curricula, followed by engaging school health programs as platforms for hygiene promotion and immunization.

The data shows that total fertility rate (TFR) has declined significantly from 4.87 in FY 1994/95 to 2.00 in FY 2021/2022, marking a near achievement of replacement-level fertility. This decline is expected to reduce strain on maternal health services, lower dependency ratios, and facilitate better allocation of household resources toward healthcare, child nutrition, and education. Thus, it is indirectly contributing to reductions in IMR and improvements in life expectancy at birth. This is also perceived as vital for better policy implications. The policy focus on the continued investment in family planning and reproductive health services is essential. In this context, policies should focus on ensuring consistent supply and access to contraceptives, particularly for adolescents and rural women, and expanding community-based family planning through female community health volunteers. Likewise, it is also crucial to promote male involvement in reproductive health decision-making and enhance post-partum family planning services within maternal care packages. Therefore, sustained fertility control is essential not only for population stabilization but also for the overall improvement of maternal and child health outcomes.

To sum up, the substantial improvements in life expectancy and infant mortality in Nepal since 1994 are evidence of the cumulative impact of economic growth, increased public health expenditure, improved education, and fertility reduction. However, the continued progress and sustainability of these gains require a robust, strategic health policy approach.

CHAPTER VII

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATION

7.1 Summary

This chapter presents the majorof findings, conclusions, knowledge contribution and recommendationsfor research, relating to the issues raised in the research question in the introduction. The first focus of the research was on the factors associated with the health expenditure; particularly per capita government health expenditure and OOP payment for the health in Nepal. Likewise, the second focus was on the economic, social, demographic, and institutional factors influencing the key health outcomesin Nepal. The analysis of health outcome is concentrated on longevity and infant death rate.

The dissertation objectives were to assess the factors associated with the per capita government healthcare expenditure and OOP payments for healthcare, and to evaluate the extent to which macroeconomic, socio-demographic, and institutional factors influence variations in population health outcomes, particularly life expectancy and infant mortality in Nepal. In the context of econometric analysis, co-integration analysis was done using the ARDL model as an econometric tool for time series data analysis. Here, it is worth mentioning that having fulfilled all the conditions to use the ARDL model, the researcher has made the choice of this model. Likewise, a bound testing approach to co-integration analysis was done for examining long run relationships among the variables included in the models. After ensuring the long-run relationship based on the co-integration analysis, the error correction model was also estimated to get short-run coefficients. Likewise, the 2SLS approach was also employed to estimate simultaneous equations that specify the determinants of life expectancy at birth and IMR per 1000 live birth. The researcher used Eviews 10 and STATA 17 as data analysis software, widely used by researchers, particularly for the time series nature of data analysis.

7.2 Major Findings

The summary of findings is presented in accordance with the dissertation's thematic structure. The summary of findings adheres to these themes and they are presented subsequently.

7.2.1Factors Associated with the Government Health Expenditure

The study finds that per capita government health expenditure is primarily driven by income growth, health seeking behavior of the population as reflected by OPD visit frequency, health workforce density, and health policy reforms.The econometric analysis found a strong income elasticity indicating a 1 percent increase in GDP per capita leads to a 1.16 percent increase in per capita government healthcare expenditure. The coefficient indicates that healthcare is a luxury good in the context of Nepal. This finding is consistent with standard health economics theory that postulates, in the context of low-income countries, the coefficients are higher than unity, indicating that they are luxury goods.The change in the healthcareworkforce in the government healthcare system (HR) density is also a major determinant of per capita government healthcare expenditure causing a 1 percent increase in health workforce density leads to approximately 0.55 percent rise in per capita government healthcare expenditure, indicating the cost implications of staffing policies.

The analysis included Outpatient (OPD) visit frequency as healthcare demand side proxy variable. The econometric analysis showed that annual OPD visit frequency significantly raises healthcare expenditure, indicating systemic changes in service delivery.The Error Correction Mechanism (ECM) coefficient of -0.75 is negative and significant, confirming a strong speed of adjustment to long-run equilibrium after short-run disturbances.Short-run variability (R^2) explainedby the ECM model is 73 percent of the short-run variation in public healthcare expenditure is explained by changes in GDP per capita, workforce policy, and institutional dummies, validating the robustness of the model.

7.2.2Factors Associated with the Out-of-Pocket Payments for Health

The study finds that per capita OOP payments for health is associated with the GDP per capita, remittance inflow per capita, inflation rate as reflected by consumer price index, and unemployment rate. In the long run, GDP per capita has a strong and statistically significant positive effect on per capita OOP payments for healthcare, indicating a 1 percent rise in GDP per capita leads to a 0.5 percent increase in OOP payments for healthcare.Remittance inflows per capita also positively and significantly influences the long-run OOP payments for healthcare, where a 1 percent increase in remittance inflow per capita causes 0.089 percent increase in per capita OOP payments for healthcare.Consumer Price Index (CPI) appears to have a positive coefficient in the long run; its statistical significance is at the 10 percent level, indicating inflation has an ambiguous and limited effect on per capita OOP payments for healthcare.

The unemployment rate shows a positive but statistically insignificant relationship with OOP payments for health in the long run, suggesting that unemployment may increase OOP as they are likely to be deprived from health insurance schemes. Moreover, it may imply that unemployed people are likely to be deprived of employer-sponsored health insurance due to their unemployment.Interacting terms with structuraldummy variables (for specific policy events or years) were statistically insignificant, implying that long-run macroeconomic fundamentals like income and remittances are more influential in determining healthcare expenditure than policy shocks.The error correction term (ECT) for determinants of OOP payments for health is negative and highly significant (-0.857), indicating a strong speed of adjustment to long-run equilibrium, where about 86 percent of any short-run disequilibrium is corrected within one period.

7.2.3 Factors Influencing Population Health Outcome

The study indicates significant influence of macroeconomic conditions, threshold effect of income, per capita government health expenditure, infant mortality, fertility rate, interaction terms of government health expenditure and health workforce density including health policy reforms on life expectancy at birth. The study result found a positive impact of economic growth on life expectancy at birth (LEB), indicating a 1 percent rise in GDP per capita increases life expectancy by 0.207 percent, confirming the positive link between economic prosperity and health outcomes.The estimated result showsthe negative coefficient of the squared GDP term indicates a diminishing return. It implies that as life expectancy rises with GDP, the rate slows after a certain income level, confirming an inverted-U relationship.The estimated positive and significant interaction between per capita health expenditure and health workforce suggests that greater investment per health worker leads to better health outcomes in terms of life expectancy.The estimated higher total fertility rate (TFR) suggests that when TFR is high life expectancy at birth is low and vice-versa, aligning with demographic transition theory, where reduced fertility accompanies improvements in health including LEB.Life expectancy at birth (LEB) has a negative and statistically significant effect on infant mortality rate (IMR), reflecting that improved longevity is associated with fewer infant deaths as aligned with the established theory.

The study indicates significant influence of macroeconomic conditions, threshold effect of income, per capita government health expenditure, life expectancy at birth, fertility rate, interaction terms of government health expenditure and health workforce density including health policy reforms on infant mortality rate. GDP per capita is negatively correlated with IMR**,** indicating economic growth helps to reduce IMR as income growth contributes to improving the overall public healthcare system. But, the squared term of GDP per capita is positively significant**,** indicating only an increase in GDP per capita will not reduce IMR per 1000 live births if economic growth does not support overall institutional improvement in the health system of the country. It implies a non-linear relationship between economic growth and IMR per 1000 live births.The per capita health expenditure interacting with human resources shows an inverted U-shaped relationship with IMR, indicating initial inefficiencies in health expenditure that later become effective after a certain threshold.The result shows that mean years of schooling (MYS) significantly reduces IMR, suggesting that the education level of the populationstrongly contributes to child survival. In general, increase in the overall education level and in particular women education attainment is instrumental to reduce IMR.

7.3 Conclusion

This dissertation has assessed the factors associated with the government healthcare expenditure, and OOP payments for healthcare in Nepal. Also, analyzed the socio-economic factors influencing key health outcomes viz., life expectancy at birth and infant mortality rate in Nepal. Nepal has made commendable progress in its healthcare system through strategic policy reforms and increased investment, with the current constitutional recognition of health as a fundamental right providing a strong foundation. However, challenges persist in resource allocation and access to healthcare facility. The conclusion of the dissertation is presented subsequently:

Firstly, the dissertation concludes that per capita health expenditure in Nepal is strongly driven by economic growth, health workforce density, healthcare utilization behavior of people or OPD visit frequency, and major policy intervention during the study period. The long-run estimate indicate that income growth plays key role in expanding government healthcare expenditure, reflecting the income elasticity of healthcare demand and the greater fiscal capacity of government to finance health service as the economy grows. The government health expenditure per capita is growing faster than GDP growth during the study period as the effect of massive change in public healthcare expenditure during the period. Moreover, the government health expenditure per capita significantly increased after massive change in public healthcare policy during the study period.

Secondly, the dissertation concludes that economic growth, remittance inflow per capita, and inflation are key long-run drivers of per capita OOP payments for healthcare. However, unemployment does not have a long-run causal effect in statistical significance, except during a specific shock period. Moreover, OOP payments for health in Nepal is income-responsive, strongly supported by remittance inflow, followed by the high inflation sensitivity. Rising incomes may translate into higher private expenditure on health rather than improved financial protection for healthcare.Likewise, the effect of unemployment on OOP payment burden has become significant during economic stress periods only. This pattern indicates weak financial protection in the health system of Nepal, as households are likely to be compelled to rely more on private resources rather than public financing. Moreover, the economic growth alone does not automatically reduce financial burden of households in healthcare, if strong and adequate risk-pooling mechanisms is not established. Overall, income growth and remittance inflows emerge as the key drivers of OOP payments in Nepal, underscoring the need to strengthen these economic channels for risk pooling and health insurance coverage.

Third, the dissertation concludes that the key factors contributing to increase in life expectancy at birth are economic growth, threshold effect of income growth, government health financing system, health workforce density, fertility trend, structural shocks and health policy reforms with the endogenous effect of infant mortality rate. Moreover,economic growth alone is insufficient, and the healthcare institutional capacity and demographic transitions are central to ensure sustainable health outcomes. In this context, it can be concluded that economic growth creates opportunity, but government healthcare systems, demographic management, and the resilience determine whether those opportunities translate into sustainable and health outcome as life expectancy at birth.Overall, it is imperative to improve economic conditions, rationalize health expenditure, and control fertility rates enhance to improve population health outcomes. For Nepal and similar developing economies, these insights are crucial in designing sustainable health policies that foster long-term improvements in human well-being.

Fourth, the dissertation concludes that the key factors contributing to reduce infant mortality are economic growth, threshold effect of income growth, government health financing system, health workforce density, level of education, fertility trend, and health policy reforms with the endogenous effect of life expectancy at birth.Moreover, thereductions in infant mortality is significantly driven by a combination of income growth, health system effectiveness, level of education, and demographic transition, rather than by any single policy lever. Income growth is most effective measure in reducing infant mortality at lower levels of development. Moreover, beyond a certain threshold level, additional income gains alone yield smaller health benefits unless complemented by targeted further health and social investments. Intuitively, this reinforces the need to shift from economic growth-centric to upgrade the quality-of-spending strategies as the development progresses over a time. To sum up, infant survival improves not merely when economies grow over a time, but when the economic growth is translated into capability of health institution framework, education level of households, and resilient health systems.

7.4 Contribution to Knowledge

This dissertation makes several original contributions to knowledge within the realm health economics of Nepal. First, it integrates macro-level evidence for the comprehensive empirical assessments of government healthcare expenditure making association with the macroeconomic condition, magnitude of population healthcare demand and healthcare system capacity as reflected by health workforce density, followed by the policy variables. Moreover, it provides evidence to assess per capita OOP payments for health exploring linkage with macroeconomic, remittance inflow, inflation and unemployment using longitudinal annual data point of about three decades.

Second, it provides evidence to assesses the status of key health outcomes, integrating nearly thirty years of data across the variables relating macroeconomic conditions, socio-demographic dynamics, institutional arrangements and major health policy reforms. Previous studies have rarely combined these variables within a single analytical framework, leaving gaps in understanding the determinants of health outcomes in Nepal.

Third, the dissertation extends to theoretical understanding by applying the Grossman model in a low income country like Nepal and health production function for assessing for health outcomes. In this regard, it extends the public finance theory to assess the short-run and long-run causal linkage between government health expenditure and economic growth, health seeking behavior, health workforce density,and policy reforms. Moreover, it also assesses macroeconomic factors associated with OOP payments for health.

Fourth, it extends health production function to assesses the macroeconomic, socio-demographic, and institutional factors associated with the key health outcomes based on the health production approach, offering theoretical and practical insights beyond the conventional models. These empirical evidences provide methodological clarificationto academia, stakeholders and policymakers seeking to carry out study to improve health outcomes in Nepal.Moreover, the dissertation extends to 2SLS model to assess the macroeconomic, and socio-demographic, institutional arrangements and health policy factors influencing key health outcomes such as life expectancy at birth and infant mortality rate addressing the issues of endogeneity and reverse causality.

7.5 Recommendation for Further Research

This dissertation provides a comprehensive macro-level assessment of per capita government healthcare expenditure, OOP payments of health, followed by the macroeconomic, socio-demographic factors influencing health outcomes in Nepal. Based on this dissertation journey, the researcher intuitively thinks that there remains several issues and directions open for future research to deepen and broaden the evidence base.

First, further research could examine the composition of public health expenditure by function, such as primary care, preventive care, curative services, and capital investment. These types of research would help to identify the comparatively more influential components of government health expenditure are most effective in improving health outcomes.Second, future research may concentrate on the role of institutional quality and governance in greater depth for optimizing government health expenditure. In this regard, the variables such as public financial management for healthcare expenditure, government health system efficiency, and accountability mechanisms could be incorporated to better explain variations in healthcare expenditure effectiveness and health outcomes. This research adopts mixed-method approaches with the combination of econometric analysis. By doing this, qualitative institutional assessments of healthcare delivery would be possible to gain valuable insight for efficiency analysis.Third, future research may concentrate on dynamic and spatial dimensions of government healthcare financial management and healthcare delivery. In this context, future research could employ provincial panel data to assess spatial disparities in the government health expenditure and health outcomes. This would be instrumental for comparing and evaluating intergovernmental fiscal arrangement and their relative performance in public healthcare management, after the transition of Nepal from centralized unitary system of government to Federal Democratic Republic of Nepal.

Appendix A

Data used for the Model Determinants of Per Capita Government Healthcare Expenditure in Nepal

FY	PCHE(NPR)	GDPpc (NPR)	OPD visits	HR
1994/95	71	10850	4170142	13.84
1995/96	79	12025	5167378	14.74
1996/97	113	13232	5933330	34.7
1997/98	138	13928	7115981	35.7
1998/99	122	15477	6983297	35.46
1999/00	149	16792	7036459	36.01
2000/01	149	19031	7846667	35.07
2001/02	159	19551	8642852	35.78
2002/03	147	20682	9576761	36.2
2003/04	157	22272	9800451	37.06
2004/05	181	24156	9552307	37.23
2005/06	222	26374	9699858	36.63
2006/07	281	28997	8797639	36.55
2007/08	370	32113	12137059	36.16
2008/09	490	38305	18947923	35.66
2009/10	620	45700	20894111	35.32
2010/11	701	58969	19708800	31.32
2011/12	817	65367	21670572	34.26
2012/13	772	71665	24053836	34.37
2013/14	925	80889	21649980	33.88
2014/15	966	86559	20326520	27.46
2015/16	1072	93820	18766921	27.79
2016/17	1198	109507	20522191	31.63
2017/18	1630	121688	26325820	31.97
2018/19	2254	134928	28832240	31.8
2019/20	2921	134557	29250520	31.47
2020/21	3432	146483	26843366	30.95
2021/22	4096	169038	33063000	30.958

Note: PCHE, GDPpc, OPD Visit, and HR indicates per capita government health expenditure, annual out-patient department visits frequency in government healthcare system, and above and health human resources density per 10000 populations in government healthcare system of Nepal. Data source from Ministry of Finance, Ministry of Population and Health, Nepal Rastra Bank, World Bank, A handbook of government financial statistics.

Appendix B

Data used for the Model Determinants of Per Capita OOP Payments for Healthcare in Nepal

F/Y	OOPpc (NPR)	GDPpc (NPR)	Remtpc (NPR)	CPI	Unemp
1995/96	365	12025	207.03	7.66	10.56
1996/97	435	13232	264.4	8.13	10.556
1997/98	470	13928	322.88	8.12	10.499
1998/99	504	15477	466.01	8.3	10.545
1999/00	538	16792	559.37	11.39	10.604
2000/01	566	19031	2039.45	3.42	10.566
2001/02	615	19551	2025.77	2.42	10.424
2002/03	642	20682	2278.94	2.9	10.537
2003/04	690	22272	2430.27	4.72	10.558
2004/05	702	24156	2682.29	3.99	10.52
2005/06	672	26374	3944.36	4.52	10.515
2006/07	812	28997	3989.37	7.95	10.514
2007/08	939	32113	5607.75	5.89	10.593
2008/09	1046	38305	8131.21	12.62	10.542
2009/10	1196	45700	8864.93	9.6	10.548
2010/11	1433	58969	9569.97	9.56	10.503
2011/12	1544	65367	13390.14	8.32	10.531
2012/13	2049	71665	15968.65	9.84	10.502
2013/14	2402	80889	19697.36	9.08	10.576
2014/15	2748	86559	22081.6	7.21	10.512
2015/16	2706	93820	23908.62	9.94	10.403
2016/17	2868	109507	24760.87	4.45	10.66
2017/18	3017	121688	26624.82	4.15	10.623
2018/19	3214	134928	30706.95	4.64	10.599
2019/20	3472	135692	30265.15	6.2	13.078
2020/21	3939	150495	32912.83	3.6	12.223
2021/22	4016	169038	34146	6.3	11.119

Note: OOPpc, GDPpc, Rmtpc, MYS, CP and Unemp indicate per capita OOP payments for healthcare, Gross Domestic Product per capita, mean years of schooling, consumer price index, and unemployment percent. Data source from Ministry of Finance, Ministry of Population and Health, Nepal Rastra Bank, World Bank, A handbook of government financial statistics and World Bank.

Appendix C

Data used for the Model Eterminants of Life Expectancy at Birth and IMR in Nepal

FY	LEB	GDP(NPR)	PCHE (NPR)	HR	IMR	MYS	TFR
1994/95	57.8	10850	71	13.84	79.5	2.2	4.869
1995/96	58.6	12024.78	79	14.74	75.7	2.2	4.668
1996/97	59.4	13231.75	113	34.7	72	2.3	4.442
1997/98	60.1	13928.01	138	35.7	68.5	2.3	4.275
1998/99	60.9	15476.74	122	35.46	65.1	2.3	4.13
1999/00	61.6	16791.5	149	36.01	61.8	2.3	3.984
2000/01	62.3	19030.99	149	35.07	58.7	2.4	3.793
2001/02	63	19550.77	159	35.78	55.8	2.5	3.604
2002/03	63.6	20681.97	147	36.2	53.1	2.5	3.439
2003/04	64.2	22271.74	157	37.06	50.6	2.6	3.279
2004/05	64.7	24156.23	181	37.23	48.2	2.7	3.115
2005/06	65.3	26374.36	222	36.63	45.9	2.8	2.967
2006/07	65.8	28997.09	281	36.55	43.8	2.9	2.857
2007/08	66.3	32112.52	370	36.16	41.9	3	2.737
2008/09	66.7	38305.12	490	35.66	40.1	3.1	2.63
2009/10	67.2	45700.15	620	35.32	38.3	3.2	2.541
2010/11	67.6	58969.09	701	31.32	36.6	3.3	2.462
2011/12	68	65367.26	817	34.26	35	3.3	2.42
2012/13	68.4	71665.25	772	34.37	33.5	4	2.36
2013/14	68.8	80888.6	925	33.88	32	4.2	2.319
2014/15	69.2	86558.52	966	27.46	30.5	4.5	2.273
2015/16	69.5	93819.59	1072	27.79	29.2	4.7	2.226
2016/17	69.9	109506.9	1198	31.63	27.8	4.9	2.173
2017/18	70.2	121688.4	1630	31.97	26.6	4.9	2.12
2018/19	70.3	134927.6	2254	31.8	25.5	4.98	2.08
2019/20	70.9	134557.2	2921	31.47	24.5	5	2.051
2020/21	71.2	146482.9	3432	30.95	23.6	5.1	2.025
2021/22	71.3	169038	4096	30.958	23	5.1	2.002

Note: LEB, GDPpc, PCHE, HR, IMR, MYS, and TFR indicate life expectancy at birth, Gross Domestic Product per capita, per capita government health expenditure, infant mortality rate per 1000 live births, mean years of schooling, and total fertility rate. Data source from Ministry of Finance, Ministry of Population and Health, Nepal Rastra Bank, World Bank, A handbook of government financial statistics.

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