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Abstract

Basic intent of this study is to examine the determinants of economic growth in Nepal. Using the time series data spanning the period 1975 to 2020, a per-capita production function including the human capital is estimated and total factor productivity is generated. Further co-integration and error correction model is applied to investigate the determinants of growth in Nepal. Secondary sources of data from NRB, ministry of finance and world banks are used. Capital stock series is generated using the perpetual inventory method. Per-capita physical capital, human capital, per-capita human capital, export, gross fixed capital formation, investment in brain and health of the people are positively driving the growth while trade openness, excess growth of government expenditure over the GDP growth and Maoist insurgency is decelerating economic growth in Nepal. There is both long run and short run equilibrium relation between GDP, gross fixed capital formation, export, trade openness and human capital. This study has made new contribution by estimating the series stock of capital, exploring the human capital as major determinant of economic growth, estimating the significant per-capita production function including the human capital, and providing more up dated and fresh information on determinants of economic growth of Nepal.

Key world: Economic growth, total factor productivity, perpetual inventory method, co-integration and error correction model

JEL Classification: F43, D24, G31, C22

1. Introduction

1.1 General Background

The federal democratic republic of Nepal situated in the lap of Himalaya and surrounded by China in the north and India in east, south and west. It is a landlocked country and its nearest sea point is 500 km far from its border. Country is totally dependent on import of petroleum product, machinery and equipment, vehicles, electronic goods etc. By structure it is an agrarian economy, its contribution to GDP is still 24 percent and 60.4 percent population is employed (dependent) in Agriculture (MOF, 2022). Often it is classified as high cost economy as compared to its neighbors. The average annual growth of GDP (factor cost) over the period 1975-2020 is just 4.02 percent and its growth is fluctuating with in the upper bound of 8.9 percent and lower bound of 0.3 percent. It is classified as developing country and current per-capita income is just 1220 US dollar for and its neighbors India and China has 2150 and 11880 US $ for 2021. The per-capita income in 1975 was 110, 190 and 200 US $ of Nepal, India and China respectively (World Bank, 2022). Very recently these neighbors are one of the largest economies of the world in term of GDP. These countries are also considered as Asian growth tigers but Nepal is stagnating in low level of growth and income. It is natural to think about possible growth drivers which may push and boost the Nepalese economy in high level of growth and income path as its close neighbors.

Macroeconomic literature in economic growth has been popular since the publications of Harrod's paper in 1939. Basic sources of growth in Harrod's model were the capital, labor and technological change. Labour was assumed to be exogenous variable. Steady state growth in Harrod model was unstable due to the assumption of fixed coefficient production function. It might be the outcome of 1930s great depression. However, the instability of steady state growth was addressed by Solow (1953). The model was developed in neoclassical frame work. It explored the stable steady state equilibrium growth. The importance of technological change, and its greater drive towards the economic growth was scientifically analyzed by Solow (1957). Thus the basic sources of growth in this model were physical capital, labour force and technological change. Labour force is still an exogenesis variable. Romer(1994) advocating the endogenous growth theory states that investment in

human capital, innovation and knowledge enhance the economic growth. He does not deny the physical capital and labour force as the sources of Economic growth. Economic growth is the outcome of endogenous forces. Endogenous growth theorists' prime focus was on human capital which has spillover effect on the economy. Human capital is helpful to reduce the diminishing return to capital accumulation.

Very recently economists have concerned on economic institution as a source of economic growth. Acemoglu et al. (2005) states that economic institutions influence investments in physical and human capital, technology and the organization of production. Hence economic institution affects the economic growth. The poor institutional qualities discourage the investors because economic environments are unpredictable. The instability and corruption increases the cost of transaction and hence adversely affects the economic growth (Zouhair, 2012).

Ferrini (2012) states that economic institution can affect the economic growth through four channels- reducing the transaction cost, insuring rerun investment through the provision of rule of law, proving equal opportunity in exploration of natural recourses and determining co-operative behavior in wealth creation.

Existing empirical literatures on the Nepalese context are found up to the explanation of Solow model. A comprehensive empirical study including the explanation of endogenous growth theory and institutional factors to explore the determinants of growth is lacking in Nepal. This study attempts to bridge this gap. Further it is also necessary know basic growth drivers that may boot the Nepalese economy in high level of growth and income. An updated and fresh study on growth is also lacking in Nepal. It is in this connection; this study has raised the following research questions.

- How and why was the historical fluctuation in economic growth in Nepal?
- What are the basic determinants of economic growth in Nepal?

1.2 Objective of the Study

General objective of this study is to analyze the economic growth in Nepal. However, its specific objectives are as follows

- To analyze the historical fluctuation in economic growth in Nepal.
- To examine major determinants of economic growth in Nepal.

1.3 Significance of the study

A comprehensive empirical study including the endogenous growth theory and institutional factors as the sources of economic growth is lacking in Nepal. This study attempts to bridge this gap. This study contributes in the following areas. This is a single country study focusing on human and physical capital as a major determinant of economic growth for Nepal. Secondly it estimate initial stock of capital following the method of Berlemann, .& Wesselhoft (2014) and Harberger (1978) and publish the data series of capital stock spanning the period 1975-2020 for public use. Thirdly it provides more updated and fresh information on determinants of economic growth using the data series 1975-2020. Hence its significance is obvious. This study will be helpful policy makers, planners and researchers.

1.4 Methodology

Descriptive and econometric method has been used in this study. First objective will be achieved through descriptive analysis of historical data. to achieve the second objective a per- capita production function that is per-capita output as a function of per-capita physical capital and per-capita human capital has been estimated. Data of capital stock are lacking in Nepal so they are generated using perpetual inventory method. Total factor productivity is estimated from production function and its determinants are explored. Time series econometric method particularly co-integration and error correction model (Granger) is used to find the sources of growth from alternative approach. It is used to obtain more rigorous finding and cross verifications of scourers of growth for Nepal to examine the effects of institutional development on growth a composite index is developed using weighted average of sub -indicators, to capture the institutional factors. Detail of the methodology is in order.

1.4.1 Estimation of Stock of Capital

Data for stock of capital is not available in Nepal so it is derived from gross fixed capital formation (GFCF) using the Perpetual Inventory Method. Firstly, GFCF are converted into real figure using the GDP deflator. GFCF is also known as gross investment. The capital stock for any time t can be constructed as,

$K_t = K_{t-1} + In_t$ …… (1)

Where,

K_t = Net stock of capital at period t

K_{t-1} = Net stock of capital at period t-1

In_t = Net investment in period t

Part of gross investment is used to replace the depreciated stock of capital and the rest add to the stock of capital. Part of the gross investment which is used to replace the depreciated stock of capital is known as replacement investment (Dt) and the rest which adds to the net stock of capital is known as net investment (In). Thus Gross Investment (I_{gt}) is the sum of net investment (I_{nt}) and replacement investment(Dt). So equation (1) can be written as

$K_t = K_{t-1} + Ig_t - D$…… (2)

Let us assume that Depreciation or replacement investment is constant proportion (δ) to last year's stock of capital.

So,

$K_t = K_{t-1} + Ig_t - \delta K_{t-1}$

Or, $K_t = Igt + (1- \delta) K_{t-1}$…….(3)

Capital series is derived from equation (3) given the value K_{t-1} and δ. More clearly δ is the depreciation rate. The δ is assumed to five percent.

1.4.2 Estimation of initial stock of capital

The initial stock of capital for Nepal is calculated using Harberger (1978) approach. This method is based on Neoclassical growth theory. Formally it can be written as

$$K_{t-1} = \frac{I_t}{g + \delta} \text{ ……(4)}$$

where

K_{t-1} = Stock of capital in period t-1.

I_t= Investment in period t

g= Long run growth rate of output

δ = Depreciation rate

Berlemann and Wesselhöft (2014) also argue that if the economy is in equilibrium, given the value of initial level of investment, depreciation rate and growth rate of output, initial level of stock of capital can be calculated.

1.4.3 Generation of Capital Stock Series: Initial stock of capital is estimated using equation (4) and capital stocks are generated using equation (3). Such generated series, for few initial

years may be unstable, however, after some time it will produces a stable series. Therefore, capital stock series is generated for the period 1965 to 2020 but used only the data of the period 1975-2020 in estimation of growth equations.

1.4.4 Per-capita Production Function

The estimated per-capita production function is as follows

$$\mathbf{lnpcy_t = \alpha + \beta_1 lnpck_t + \beta_2 lnpchk_t + u_t} \ldots\ldots\ldots\ldots (5)$$

Where,

$lnpcy_t$ = Log of per capita output

$lnpck_t$ = Log of per-capita physical capital

$lnhk_t$ = Log of per-capita human capital

ut = Random disturbances

α, β_1, β_2 = Parameters

The model is estimated by OLS method. Once the model is estimated the total factor productivity growth is estimated as follows

$$\mathbf{Tfpg_t = \Delta lnpcy_t - \hat{\beta}_1 \Delta lnpck_t - \hat{\beta}_2 \Delta lnpchk_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Determinants of total factor productivity growth is examined using the following equation -

$$\mathbf{TFPgt = \alpha + \beta_1 \Delta lnrx + \beta_2 \Delta lnlifex + \beta_3 \Delta lntopen + \beta_4 \Delta lnsav(-1) + \beta_5 \Delta lngovexy + u} \ldots (7)$$

Where

TFPgt = Total Factor Productivity Growth (Δ tfp); Δ lnsav =Δ (log of domestic saving)

Δ lntopen= Δ(log of Trade openness) Δ lnrx=Δ(log real export)

Δ lnlife= Δ(log of Life expectancy) Δ lngovexy= Δ(log of gov. expenditure to GDP ratio)

α, β_1, β_2 , β_3, β_4, β_5 = Parameters

1.4.5 Co-integration and Error Correction Model

Unit root test of all the variables have been done using Dickey Fuller test. Engle –Granger approach to co-integration and error correction model has been adopted. If the variables are integrated of order one i.e., I(1) and if the liner combination of such variables are I(0) then

the variables in question is said to be co-integrated. Once the co-integration is established, Error Correction Model (ECM) is estimated using the lagged residual of co-integrated series as explanatory variables growth equation as given below. ECM is known as short run relation.

Model I

Co-integration relation is examined from equation (8).

$$\mathbf{lnrgdpfc = \alpha + \beta_1 lnrgfcf + \beta_2 lnrx + \beta_3 lntopen + \beta_4 lnrheal + \beta_5 lnredu + ut \ldots\ldots (8)}$$

Where,

lnrgdpfc = log real GDP at factor cost lnrgfcf=log real gross fixed capital formation

lnrx = log real export lnheal= log real expenditure in health

lnredu= log of real expenditure on education

lntopen= log of trade openness

Equation (8) is estimated by OLS method and it is examined for co-integrated relation.. Residual of (8) is examined for stationary as suggested by Engle and Granger ( )and it is also examined for the violations of OLS assumptions using Jarque & Bera (JB) test, Breusch-Pagan-Godfrey(BPG), and DW(Durbin- Watson) test .

The Error Correction Model is shown in equation (9) and it is estimated by OLS method .

$$\mathbf{\Delta lnrgdpfc = \alpha + \theta ECt\text{-}1 + \beta_1 \Delta lnrgfcf + \beta_2 \Delta lnrx + \beta_3 \Delta lnrx_{t-1} + \beta_4 \Delta lntopen + \beta_5 \Delta lnrheal + \beta_6 \Delta lnredu + ut \ldots\ldots\ldots\ldots (9)}$$

Where

Dlnrgdpfc= Δ (log real GDP); ECt = Error correction term

Dlnrgfcf= Δ(log real gross fixed capital formation) Dlntopen= Δ(log Trade openness)

Dlnrx =Δ(log real export) Dlnrheal= Δ(log real expenditure in health)

Dlnredu= Δ(log real expenditure in education)

The equation is also examined for the violations of OLS assumptions. Residual of (9) is also examined for white noise process using Jarque & Bera (JB) test for normality, Breusch-Pagan-Godfrey(BPG) for Hetroskedasticty and DW(Durbin- Watson) test for auto correlation.

Model II

In search of better model, an alternative model i.e, equation (10) is estimated to examine the co-integration relation among the basic five variables.

$$\mathbf{lnrgdpfc = \alpha + \beta_1 lnrgfcf + \beta_2 lnrx + \beta_3 lntopen + \beta_4 lnhumcap + ut \ldots\ldots\ldots (10)}$$

The residual of equation (10) is examined for stationarity in the similar way as the equation (9).

Error Correction Model

$$\mathbf{\Delta lnrgdpfc = \alpha + \theta EC_{t-1} + \beta_1 \Delta lnrgfcf + \beta_2 \Delta lnrx + \beta_3 \Delta lnrx_{t-1} + \beta_4 \Delta lntopen + \beta_5 \Delta lnrhumcap + ut \ldots\ldots} \ldots\ldots\ldots (11)$$

Where

Dlnrgdpfc= Δ (log real GDP); ECt = Error correction term

Dlnrgfcf= Δ(log real gross fixed capital formation) Dlntopen= Δ(log Trade openness)

Dlnrx =Δ(log real export) Dlnrhumcap= Δ(log real human capital)

The equation is also examined for the violations of OLS assumptions. Residual of (11) is also examined for white noise process using Jarque & Bera (JB) test for normality, Breusch-Pagan-Godfrey (BPG) and White test for Hetroskedasticty and DW (Durbin- Watson) test for auto correlation.

1.4.6 Sources of Data

Secondary data are used in this study. Sources and variables are as follows

Economic survey (2010, 2011, 2020,2021,2022), Ministry of Finance, Nepal: Gross domestic product at factor cost(GDPfc), Gross fixed capital formation(GFCF), Government expenditure in education(EDU), Government expenditure in health(HEAL), Total government expenditure (GOVEXP), Government consumption(GCON) Domestic saving(SAV).

Quarterly Economic Bulletin (2022), NRB, Nepal: Export(X), Import (M), CPI, Narrow money(M1), Broad money(M2).

National Population Census (2071, 2081, 2091, 2001,2011),CBS, Nepal: Economically active population.

World Bank: GDP deflator, Life expectancy, Secondary school enrolment, Indicators of governance.

1.4.7 Operational Definition of Variables

Labour Force: Economically active population is considered as labour force. Economically active population are taken from Population census of 2071,2081,2091,2001 and 2011. Gaps are filled by interpolation. These data are smoothed using Hodric Prescott filter.

Human capital: Government spending on education and health is considered as human capital.

Trade openness: Sum of export and income is taken as total trade. The ratio of total trade to GDP is known as trade openness.

1.5 Organization of the Study

First chapter "Introduction" includes focus of the study, objective, and significance of the study, research methodology and organization of the study. Second chapter "Review of Literature" explores the theoretical and empirical study in this area. Third chapter will be "Fluctuation in economic growth in Nepal". Fourth chapter "Determinants of economic growth in Nepal" will explore the major divers of economic growth. Final chapter will be "Summary, Findings and Conclusion".

2. Reviews of Literatures

2.1 National Context

Gyanwaly (2014a) made a study on financial sector development and economic growth in Nepal. Basic objective of this study was to examine the relationship between financial development and economic growth in Nepal .He developed the composite index of financial development and examine its effect on economic growth. He used the both Production function and time series approach to examine the relationship between financial development and economic growth. Sample period was taken as 1975-2012. Basic variables of the study were GDP, gross investment, physical capital, export, trade openness, government consumption, working age labour force, and inflation. Secondary data sources were used. The paper concluded that. Financial development, real export, real stock of capital, working age labour force are positively affecting the economic growth in Nepal while the inflation and trade openness are negatively affecting the economic growth in Nepal.

The paper is good but could not address the issue of human capital which is the center focus variable in endogenous growth theory. Paper was focusing on financial sector development and sources of growth were only the passing attention. Thirdly it estimates Initial stock of capital using the estimated accelerator coefficient of investment and assuming ACOR is equal to ICOR at steady state equilibrium. Generally, this method overestimates the initial stock of capital

Gyanwaly (2014b) made a study on population and economic development. Prime focus of this study was economic development. One of the objectives was to examine the relationship between economically active population and economic growth in Nepal. It used production function approach to economic growth and estimates the TFP. It used the same methodology of estimating the stock of capital as Gyanwaly (2014a). Sample period was 1971-2011. Basic variables were GDP, capital stock, consumer price index, government consumption to GDP ratio, government expenditure to GDP ratio, export, trade openness, fertility rate, life expectancy at birth, and literacy rate. The paper concluded that per-capita physical capital, export, literacy rate, government expenditure to GDP ratios are positively driving the growth process while inflation and life expectancy are negatively driving the growth process in Nepal. This paper is also subject to same criticism as the Gyanwaly (2014a).

2.2 International context

Anaman (2004) analyzed factors affecting the economic growth in Brunei Darussalam using the data series of the period 1971-2001. Variables taken in this study were growth rate of real GDP, size of government proxy by government expenditure to GDP ratios (simple, square and cubic size of government), growth rate total export, growth rate of labour force, growth rate of capital and dummy for Asian crisis. The major factors affecting the economic growth in Brunei were the size of government and exports. Large government size was impeding the economic growth while moderate size was enhancing it. Estimated coefficient of size of government and export variables were statistically significant while the coefficients investment to GDP ratio, labour force and dummy for Asian crisis variables were statistically insignificant. Time series properties were not consistent for ARDL co-integration though author claimed it. Theoretically co-integration should be observed in level variables but author claim it in growth variables. However, regression analysis in growth and ratio variables can be considered as a good model.

Adu,G.(2013) had examined the determinants of economic growth in Ghana . The prime objective of this paper was to look for determinants of economic growth in Ghana. Using the time series data of spanning the period 1961 to 2009, researcher estimated the ARDL model from parametric time series approach and local linear Kernel regression from nonparametric approach. GDP, investment, labour, financial development, inflation, terms of trade, trade openers were the major variables of analysis. The labour force, investment, financial development, terms of trade and trade openness were the key drivers of economic growth in Ghana. Private sector credit was taken as indicator of financial development. Coefficient of these variables were statistically significant but inflation was found to be insignificant. Labour force, investment, financial development, terms of trade were positively affecting the economic growth in Ghana while trade openness was negatively affecting the growth. Ghana's major exports were primary products and import were the manufacturing products, the terms of trade were worsening so the impact of trade openness was negative. These results were supported by local linear Kernel regression model too. A major drawback of the paper is that it uses inflation as level variable rather than the general level of price.

Rioja and Valev (2014) explored the effects of institutional factors on sources of economic growth, productivity, and capital accumulation in low income and high income countries by employing panel data. The generalized moment method was used to evaluate the sources of economic growth. Capital growth was proxy for growth, and production growth, bank credit, bank deposits, private credit, and turnover ratio, value traded, market capitalization, schooling, government size, inflation openness, and initial income were sources of economic growth. The panel dynamic model found that bank made the positive and significant impact on capital accumulation on low income countries whereas capital market did not effect on productivity growth or capital accumulation in these countries. In high income countries, capital market made the positive impact on both productivity and capital accumulation but bank only effects on capital accumulation.

Chirwa and Odhiambo (2017) autoregressive distributed model of bound test was used to examine the sources of economic growth in Zambia with the help of time series data of 1970-2013. Volume of investment was the dependent variable and human capital, population growth, government consumption as share of gross domestic product, inflation, exchange rate depreciation, international trade, and foreign aid were the explanatory variables. This study found that development of human capital, foreign trade; foreign aid and government consumption were positively associated with economic growth in Zambia.

Feng et al. (2017) explored the sources of economic growth in China from 2000-2013. The data envelopment analysis method was used to examine the total factor productivity growth in China. The traditional parametric method found that the technological change, industrial structure, regional balance development, management improvement, and production factors made positive impact on sustainable economic growth in China.

Blazejowski, Kwiatkowski, and Gazda (2019) determined the factors affecting on economic growth of 168 countries by employing time series data of 2002-2013. Bayesian model averaging approach was used to explore the potential sources of economic growth at the global economy. Gross domestic product (GDP) was used as explained variable and total investment as percent of GDP, gross saving percentage of GDP, military expenditure as percentage of GDP, infant mortality rate, government revenue as percentage of GDP, per capita GDP, current account balance as percentage of GDP, government final consumption

as percentage of GDP, unemployment rate, years of schooling, expenditure on education etc. were as explanatory variables. This study found that per capita income at 2003 and low unemployment rate were the potential determinants sustainable growth whereas gross national saving and gross capital formation were moderate effects on economic growth at global economy. Furthermore, this study found that location, expenditure on education also positively influenced on economic growth.

Paksi (2020) examined the determinants of economic growth of Indonesia using the time series data spanning the period 1991-2019. Regression model in growth variables was estimated using the OLS method. Major variables of analysis were the GDP growth rate, consumption growth rate, export growth rate, labour force growth rate and Inflation. All the explanatory variables were statistically significant except the labour force. Consumption and export were positively driving the growth process while inflation is negatively. Residual of regression model was white noise.

Wajeetongratana (2020) identified the key factors that effects on economic growth through time series data of 2010-2018. Energy used, financial factors, and labour factors were used as independent variables and GDP growth as dependent variables in the model. Stimulating impact index method was used to explore the contribution of explanatory variables to economic growth. This study found that financial factors, energy used, and labour factors were the significant determinants of growth.

Busu (2020) analysed the impact of renewable energy sources on economic growth in European countries by employing time series data of 2004-2017.Autoregressive distributed lag model to cointegration was used to examine the short run and long run relationship between GDP growth per capita as dependent variable and eight explanatory variables (Hydropower, Wind power, Solar, Biomass, Geothermal, The ratio between GDP and domestic material consumption, Labor force, Research and development expenditures as a % of GDP). This study revealed that renewable energy made the positive and significant impact on sustainable growth in European countries.

Li et al. (2021) examined the relationship between economic growth and renewable energy used in south Asian countries by employing the data sets of 1995-2018. Fixed effect test and panel vector error correction model were applied to explore the impact of available energy

on economic growth in SAARC region countries. This study found that three resources (geothermal, hydro, and wind) made the positive and significant impact on sustainable growth in south Asian region. Furthermore, this study found that hydropower was the more valuable sources of economic growth in SAARC countries.

2.3 Research Gap

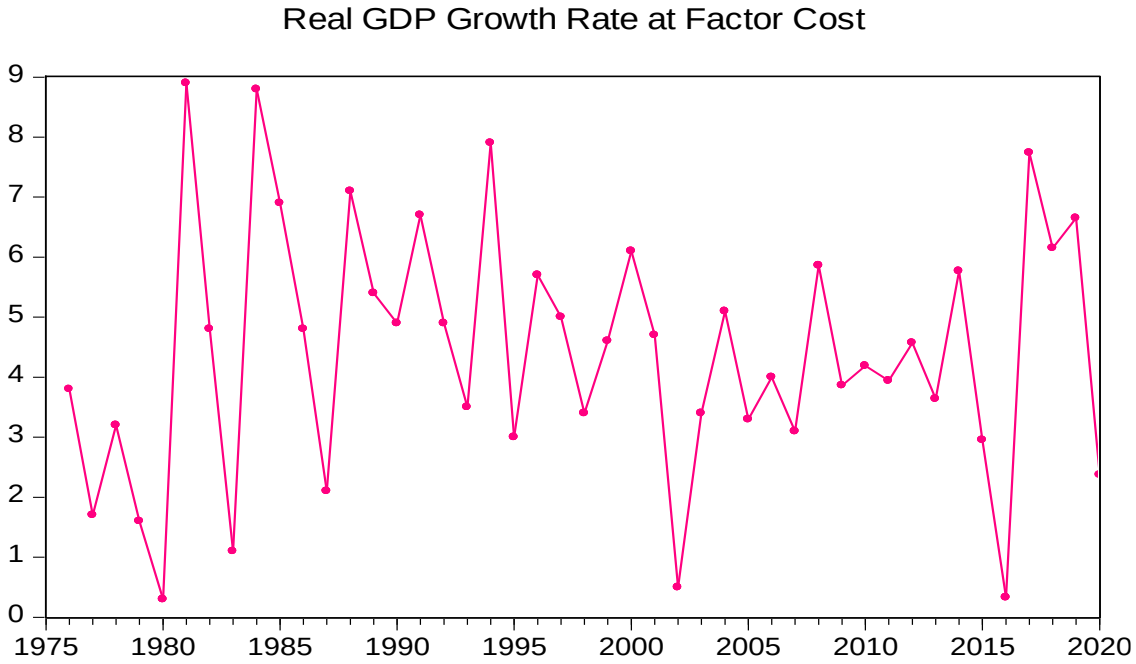
Most of the previous studies were cross country studies. A few studies were in single country study. Previous studies of Nepal did not incorporate the contribution of human capital to economic growth. Endogenous growth theory gives emphasis on human capital so this study examine the effects of human capital in economic growth. Secondly, estimation of initial stock of capital in Nepalese context by previous studies was over estimated so it re-estimate initial stock of capital and generates the series of stock of capital following the method of Berlemann, .& Wesselhoft (2014) and Harberger (1978) and publish the data of capital stock series for public use. Thirdly previous studies were limited to data series up to 2012 but it provides more updated and fresh information on determinants of economic growth using the data series 1975-2020.

3. Historical Fluctuation of Economic Growth in Nepal

3.1 Aggregate Economic Growth during 1975-2020

This section analysis the historical pattern of economic growth and performance of different political regime in achieving the higher level of growth. The average annual growth rate during the Panchayat System (1975-1989) was 4.32 percent. The average annual growth rate during the constitutional monarchy (1990-2008) was 4.50 percent and in Federal Democratic Republic of Nepal (FDRN) (2009-2020) was 4.34 percent.

Figure 3.1 Real GDP Growth Rate at Factor Cost



Source: Authors construction based on data of *Economic Survey* 2011, 2015 and 2020
Note: These figures are reported growth rate in Economic Survey but not computed by authors.

The growth rate during Panchayat and FDRN period was almost the same. If we consider the case of Economic Survey of 2021, economic growth in 2019/20 was -2.01 percent (negative growth). The growth rate in FDRN period would be lower than the Panchayat era .During the Maoist Period (1996-2006) average annual growth rate was just 4.16 percent. It is the historical minimum in comparison to three different regimes. Constitutional monarchy had the highest level of growth in spite of the fact that Maoist insurgency was occurring during this period. At an individual data basis, first highest growth rate appearing in 1981, which

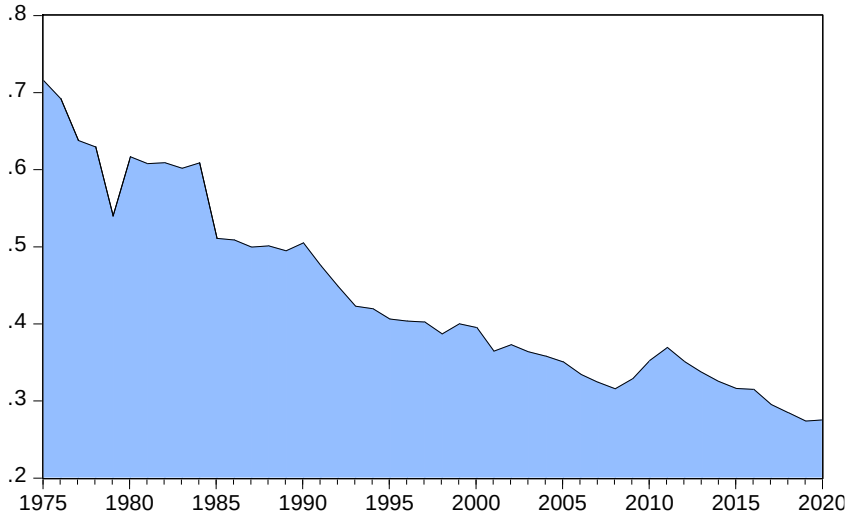
was 8.9 percent. Second highest growth rate was appearing in 1984 where the growth rate was 8.8 percent. Third highest growth rate was appearing in 1994, where the growth rate was 7.9 percent. It was the period of constitutional monarchy. Panchayat period was success to achieve the historical first and second highest level of growth in Nepal. Fourth highest level of growth was appeared in FDRN period, particularly in 2017. To make the comparison, a common and consistent definition of GDP is necessary. So GDP at factor cost is taken as output variable because this data was consistently available during the period 1975-2020. Note that GDP at basic prices was not available for the year 1985, 1986 1nd 1987 (MOF, 2011). Minimum level of growth was appeared in 1980 and 2016 where the growth rate just 0.3 percent in both the years.

3.2 Agriculture and Non-Agriculture Sector Growth in Nepal

Share of Agriculture in Total GDP in Nepal:

The share of agriculture sector in total GDP has been dominating in Nepal. it has been shown in figure 3.2.The share of Agriculture GDP in total GDP was 72 percent in 1975, it reached to the level 51 percent in at the end of Panchayat system that is in 1990; it further declined to 40 percent at the beginning period of Maoist movement(1996); deckling trend was continued and reached to 34 percent at the end of Maoist period (2006); and currently i.e. in 2020 it's share is near to 28 percent.

Figure 3.2 Share of Agriculture GDP in Total GDPfc



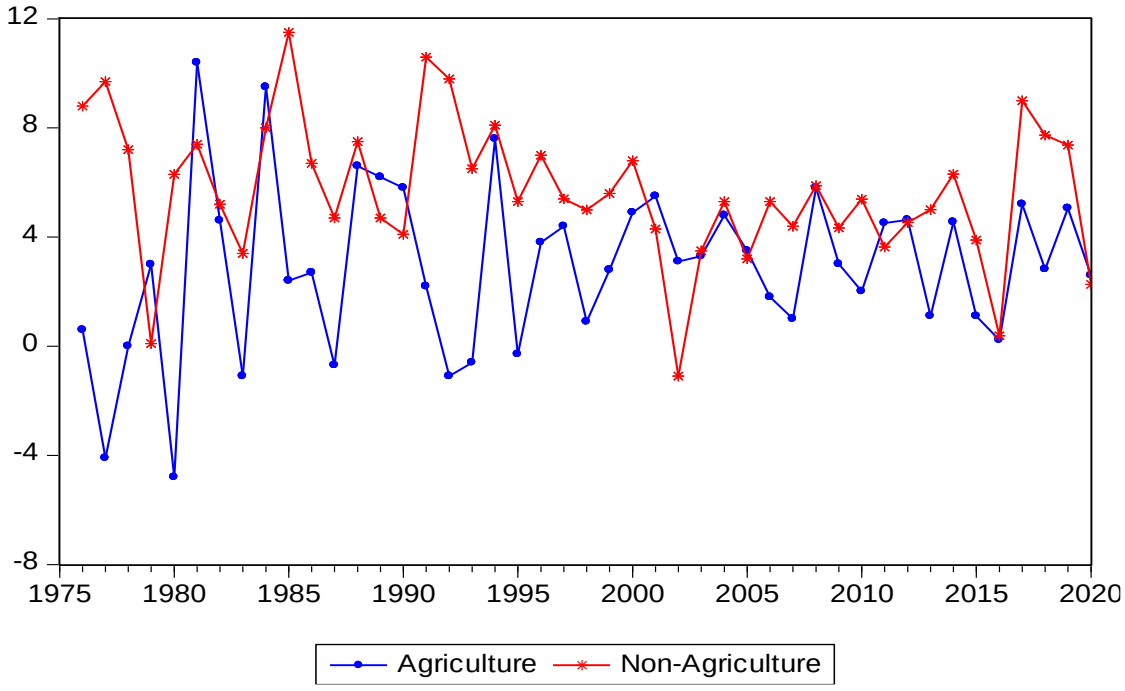
Source: Author's Construction

Generally, it is the trend of growing economy that economic activities are transferring from agriculture sector to non-agriculture sector. Nepal's agriculture sector was, historically characterized by disguised unemployment so the economic activities were shifting towards non-agriculture sector such as industry and service sector. Note that it is the share of agriculture setor in GDP at factor cost, if we take the case of GDP basic prices the share will further declined.The overall scenario of declining phase of agriculture's share could be easily envisaged from figure 3.2 The implication for growth analysis is that the mere decline agriculture growth has had been significant impact in overall growth rate.

Growth Scenario of Agriculture and Non- agriculture Sector in Nepal

The movement of growth scenario of agriculture and non-agriculture GDP has been demonstrated in figure 3.3.

Figure 3.3. Growth Rate of Agricultural and Non-agricultural Sector



Source: Author's Construction based on data of *Economic survey*

The growth scenario of agriculture and non-agriculture sector reveals that agriculture sector growth, in most of the cases, remained sluggish than the non-agricultural sector growth in Nepal the figure 3.3 shows the growth rate of 45 years. In 37 years growth rate of agriculture

sector was lower than non-agriculture sectors. Only in eight years that is 1979, 1981,1984,1989,1990, 2001, 2002 and 2011 growth rate of agriculture sector was higher than non-agriculture sectors. Contribution of agriculture sector in total GDP is higher, it is more than or equal to 28 percent over the period of 46 years. But the growth rate of agriculture sector has had been relatively lower than non-agriculture sector. Thus one of basic technical reasons, for not attaining the higher level of growth in Nepal, was the low rate of growth in agriculture sector. If Nepal boost up the growth rate of agriculture sector by any means, the overall growth rate economy would be higher. The growth rate can be triggered up by boosting and modernizing the agriculture sector. The avenues of boosting the agriculture sector are to be explored. Largely Nepal's agriculture is based on monsoon. Favorable monsoon will generate larger growth and unfavorable monsoon will generate lower growth. There are series of examples of negative growth in agricultural sector such as 1977, 1980, 1983, 1987, 1992, 1993, and 1995. After 1995 the growth rates were lower but not negative.

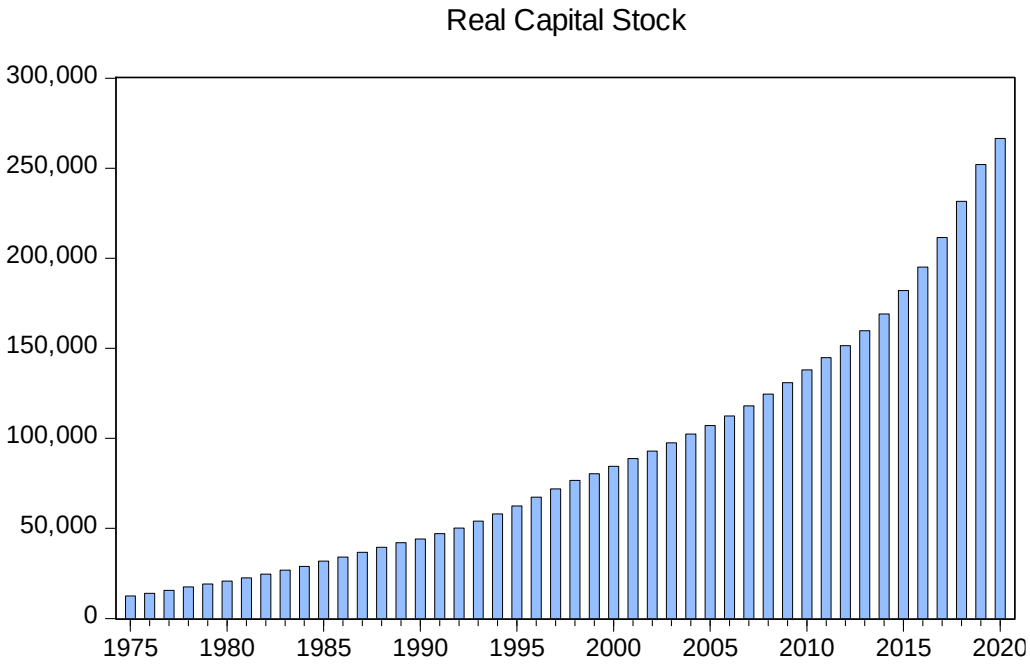
4. Determinants of Economic Growth in Nepal

4.1 Status of Capital Stock in Nepal

Real capital stock was generated from gross fixed capital formation using perpetual inventory method. The status of real capital stock is presented in figure 4.1. This figure shows that the real capital stock is growing over the time. Investment is a flow concept and capital is stock concept, It is an addition to stock of capital. Investment could be classified as gross investment and net investment. Data published by the CBS namely "Gross fixed capital formation" is the data of gross investment .Every year net investment adds to stock of capital so stock of capital growing rapidly over the time. It is the data of author's estimation. Estimation technique is given in methodology. Central Bureau of Statistics has not published and estimated the data of capital stock till date. So to make consistent analysis with theory of growth, data of capital stock is estimated. Note that figure 4.1 demonstrate the data of real stock of capital.

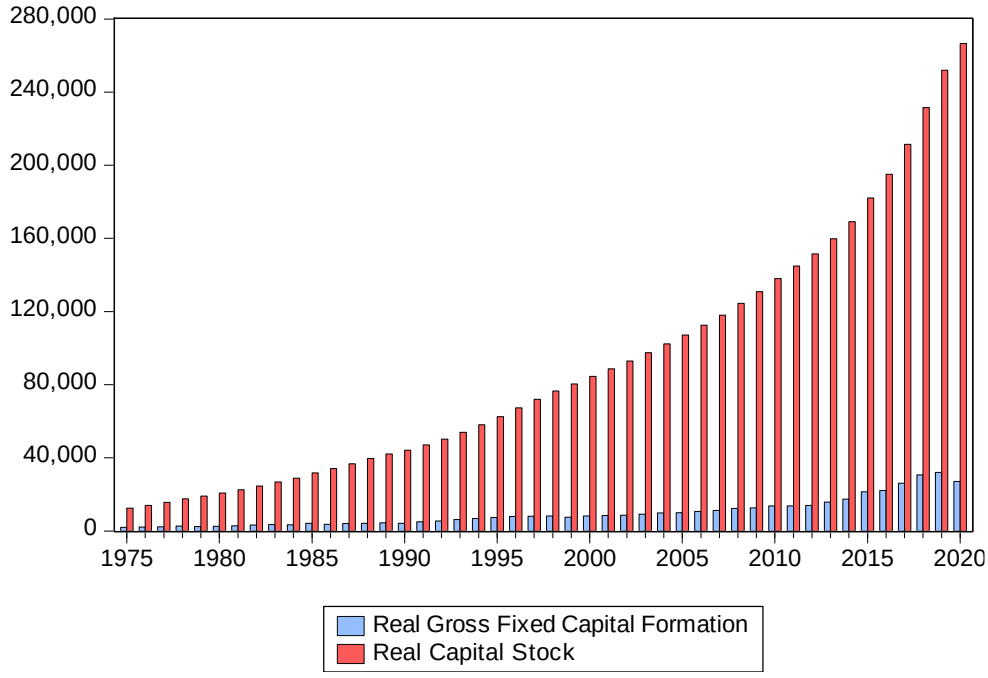
Fundamental sources of growth are capital, labour and technology. Others are the allied factors. Thus to explain the growth, capital is inevitable. Without capital stock explanation of sources of growth is fruitless. Hence one of the major findings of this research is data for real stock of capital. The data of capital stock is shown in Appendix I. The relation between real gross fixed capital formation and real capital stock is shown in figure 4.2.

Figure 4.1 Real Capital Stock in Nepal



Source: Author's Estimation

Figure 4.2 Real Gross Fixed Capital Formation and Real Stock of Capital



Source: Authors' Construction based on Data of Estimated Capital and Data of CBS

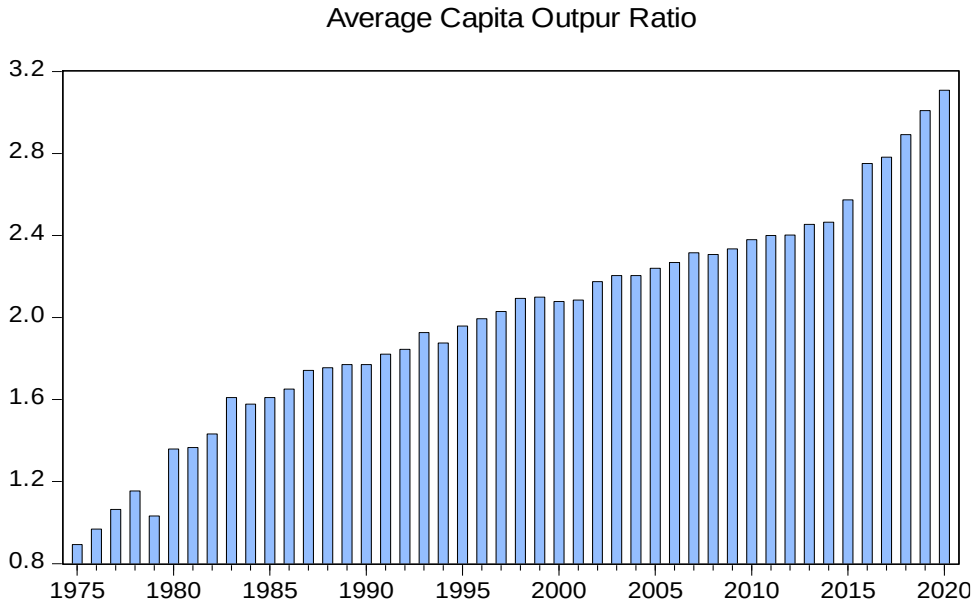
Average Capital Output Ratio

Capital output ratio is defined as

$$\text{ACOR} = \frac{K}{Y}$$

Where, K= Real Capital Stock ; Y= Real Output; COR= average capital output ratio. Thus it is the ratio of capital to output. It is the amount of capital needed to produce one unit of output. Higher the COR higher amount of capital needed to produce one unit output, and lower the value of COR lower amount of capital needed to produce one unit of output. It shows the extent of capital incentive economy. Figure 4.3 shows the nature of average capital output ratio over the period 1975-2020.

Figure 4.3 Average Capital Output Ratio



Source: Authors' construction based on data of estimated capital and GDP

Figure 4.3 demonstrates that COR is growing over the time. In the graph, 1979 is an exceptional case because of high value of GDP in 1979 and the consequences of single GDP deflator for the period 1975 to 2020 having base year 200l. In 1979 the nominal value of GDPfc was 2469.2 crore but in 1980 it was 2188.6 crore (Economic Survey 2011). Thus the real value of GDP also will be remarkably higher in 1979 than in 1980. Relationship between average capital output ratio and GDP is negative. So ACOR in 1979 is low. Thus it is the

case of data limitation of Nepal. So it can be consider as exceptional case. However in other cases, COR is growing over the time. It means the amount of capital needed to produce the given level of output is increasing over the time. This means that country is moving towards capital intensive technology. Thus to achieve the higher level of growth higher doses of capital is essential. Higher capital stock will be ensured through higher rate of investment. This result is consistent with the theory of growth. As more and more capital are used, given the other resources constant, both marginal and average productivity of capital are declining. This is the case diminishing return to factor input

Average Productivity of Capital

The average productivity of capital is defined as

$$APK = \frac{Y}{K}$$

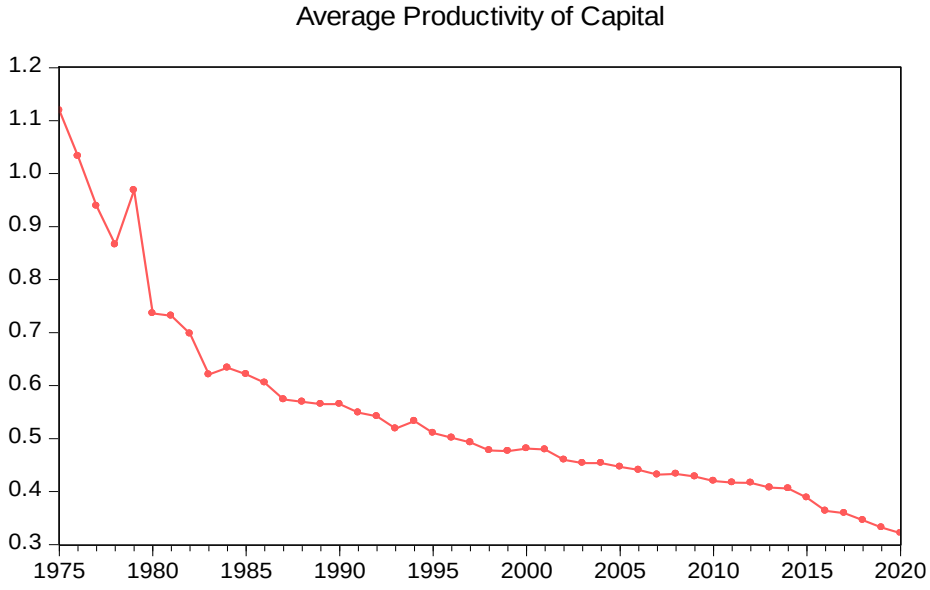
Where,

APK= Average Productivity of Capital;

Y= Output K= Stock of capital

By definition APK shows the amount of output can be produced by one unit of capital. How much output can be produced by one unit of capital? The answer is APK. The nature and trend of APK is shown figure 4.4.

Figure 4.4 Average Productivity of Capital of Nepal



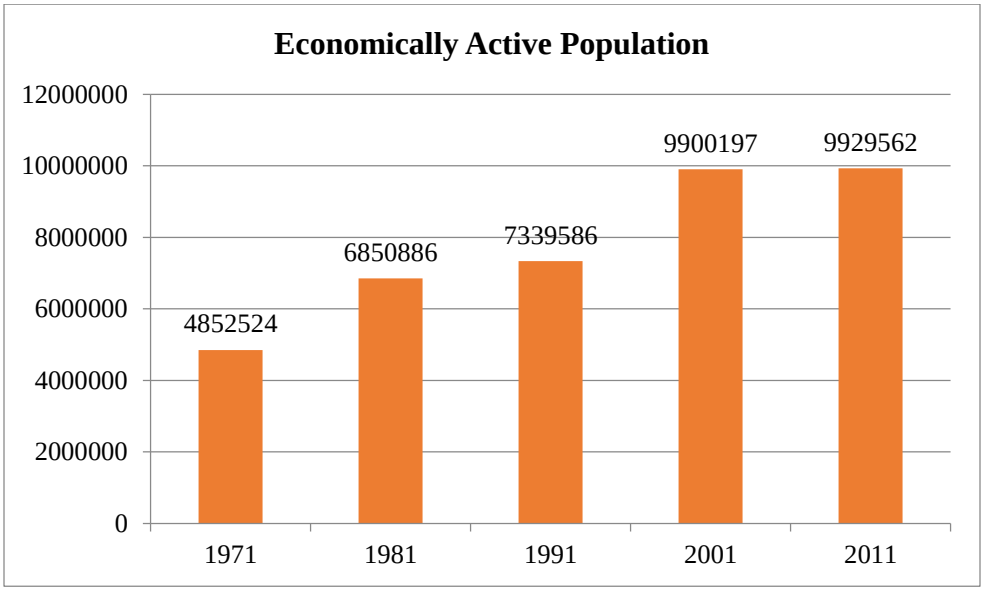
Source: Authors' Estimation

Figure 4.4 shows the average productivity of capital for the period 1975-2020. The average productivity of capital is gradually declining because of diminishing return in capital. APK for the period 1979 has increased as compared to the year 1978 because of high value of GDP in 1979 as compared to the value in 1978 and 1980. It looks as outlier but it is the case of data reality. The declining value of APK is consistent with the theory of growth and theory of capital.

4.2 Status of Labour in Nepal

There is no explicit data on labour force in Nepal for the period 1975(that is 1974/75) to 2020. Thus researcher has considered economically active population as a proxy for labour force in Nepal. A major characteristic of labor force is economically active. CBS has compiled the economically active population in each census. The number of economically active population is shown in figure 4.5. It shows the economically active population in population census of 1971, 1981, 1991, 2001 and 2011. The population census 2021 is in operation but the result is not published yet. There was gradual increment of economically active population from 1971 to 2001. But the growth rate of such population is very small in Nepal. The difference in economically active population between 2001 and 2011 is just 29 thousand. Economic reasons are to be explored for this case.

Figure 4.5 Economically Active Population of Nepal



Source : Population Census 1971, 1981, 1991, and 2011 (CBS)

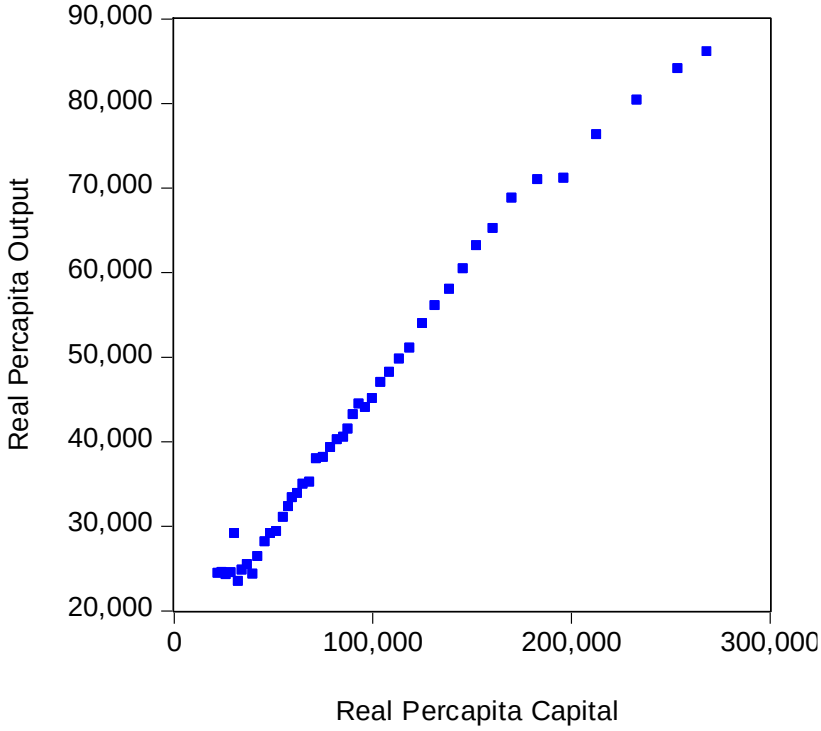
4.3 Per-capita Production Function as per Physical Capital

Standard economic theories such as Solow -Swan models explain the growth process using per-capita production function. The standard neoclassical theory is based on assumption of declining marginal productivity of factors inputs. To perceive this behavior the relationship between per-capita physical capital and per-capita output is shown in figure no 4.6.

Per-capita production function shown in figure 4.6 seems consistent with theoretical per-capita production function. The scatter diagram shown in figure 4.6 demonstrates the per-capita production function. The slope of that production function is gradually declining. It states that marginal productivity of per-capita capital declining. This result supports the theoretical notion of Solow-swan models. The graph shows that as per-capita physical capital increases, per-capita output also increases but at diminishing rate.

Figure No. 4.6

Real Per-capita Physical Capital and Real Per-capita Output

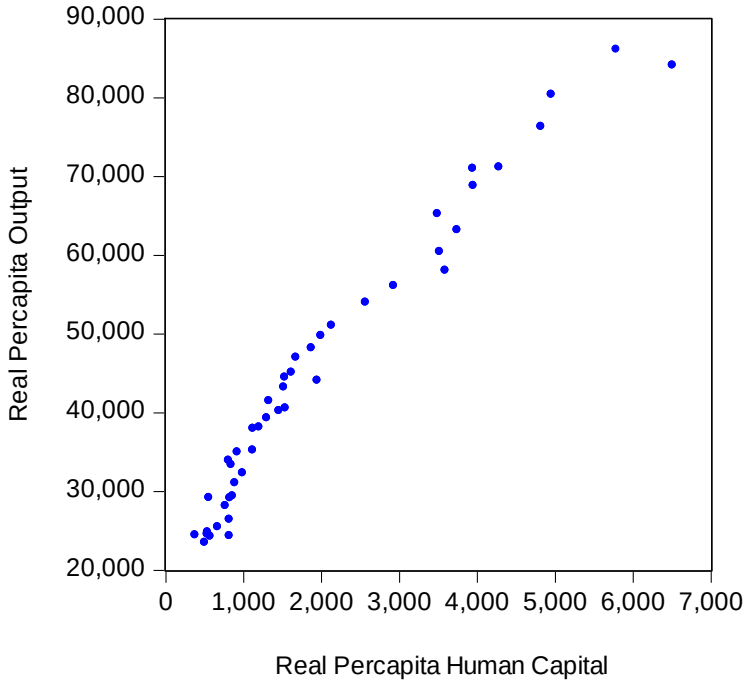


Source: Authors construction based on data of per-capita capital and per-capita output

4.4 Per-capita Production Function as per Human Capital

The endogenous growth theory gives emphasis on the human capital as a source of growth. Data of human capital is not available in Nepal. CBS has not made any attempt to estimate the human capital in Nepal till date. So government expenditure on education and health has been taken as proxy variable for human capital. Education, health, trainings, skills etc are considered as human capital. There is no alternate option of using the proxy variables. An educated healthy and skill full man can produce more than the general people. Thus the role of human capital seems important in growth analysis.

Figure 4.7: Graphical Relationship between Per-capita Human Capital and Per-capita Output (1975-2020)



Source: Authors construction based on data of per-capita capital and per-capita output

Figure 4.7 presents scatter diagram of the real per-capita human capital and real per-capita output. The scatter diagram shows the positive relationship between real per-capital human capital and real per-capita output. It seems similar to production function. As per-capita human capital increases per-capita output increases. It gives the impression that human capital is one of the major determinant of per-capita output. Government expenditure in education and health is considered as human capital variable. The stochastic relation presented in that figure almost looks like a production function. Thus there is positive

relationship between per-capita human capital and per-capita output. Higher the human capital higher will be the economic growth in Nepal.

4.5 Empirical Per-capita Production Function and TFP

Empirical Relationship between Per-capita physical capital, Per-capita human capital and Per-capita output (real variables) is shown below. Before to estimate the per-capita production function unit root test of the variables is performed and shown in table no 4.1.

Table No. 4.1 Unit Root Test

S.N	Variables	ADF at Lag		
		0	1	2
1	lnrgdpfc	-0.223	-0.056	-0.091
2	lnrgfcf	-0.426	-0.088	-0.101
3	lnrpcy	0.693	1.509	2.042
4	lnrpck	-1.22	0.222	0.508
5	lnrpchk	-0.508	0.353	0.591
6	lnrx	-1.548	-1.269	-1.305
7	lntopen	-1.972	-1.647	-1.642
8	lnredu	-1.367	-0.618	-0.341
9	lnrheal	-0.111	0.511	0.519
10	lnrhumcap	-0.902	-0.099	0.113
11	lngcony	-1.348	-0.948	-1.186
12	lngovexpy	-2.172	-1.570	-0.729
13	Dlnrgdpfc	-11.048***	-8.041***	-4.781***
14	Dlnrgfcf	-7.507***	-3.990***	-3.970***
15	Dlnrx	-6.049***	-5456***	-3.702***
16	Dlntopen	-6.050***	-5.945***	-3.783***
17	Dlngcony	-8.303***	-4.745***	-4.943***
18	Dlnredu	-6.176***	-6.121***	-5.544***
19	Dlnrheal	-7.698***	-4.831***	-4.357***
20	Dlnrhumcap	-7.939***	-5.657***	-586***

21	Dlngovexpy	-6.136***	-5.105***	-3.989***
22	Dlnrpcy	-10.403***	-7.149***	-4.190***
23	Dlnrpck	-2.478	-2.246	-2555
24	Dlnrpchk	-7.844***	-5.111***	-5.433***

Source: Author's calculation

The Augmented Dickey Fuller test presented in table 4.1 shows that all the variables in level are nonstationary while in first differences are stationary except the real per-capita capital. The real per-capita capital is nonstationary even at first differences. Estimated per-capita production function is shown in equation 4.1.

LNRPCY = 5.626 +0.269 LNRPCK +0.269 LNRPCHK ……(4.1)
St.Error (0.363) (0.070) (0.061)
Pvalue (0.00) (0.00) (0.00)

R^2=0.975; F= 857.03 (0.00);DW=0.87 Sample: 1975-2020

Where,

LNRPCY= Log of per-capita real output

LNRPCK= Log of per-capita real capital

LNRPCHK= Log of per-capita real human capital

The per-capita production function is shown in equation (4.1). Estimated coefficients have expected sign and the coefficient of physical capital and human capital are statistically significant at less than one percent level. R^2 is comfortable. DW statistics indicates that the model is auto-correlated. Sample period is taken for 1975- 2020.

To remove the autocorrelation, the model is re-estimated by OLS method in generalized difference form for the period 1975-2020. The result is shown in equation 4.2.

GDLNPCY = 2.529 + 0.4426 GDLNPCK + 0.1389 GDLNPCHK ……(4.2)
St.Error (0.211) (0.069) (0.059)
P-value (0.00) (0.00) (0.02)

R^2=0.9608 ; F= 515.96 (0.00); DW=2.13 Sample 1975-2020

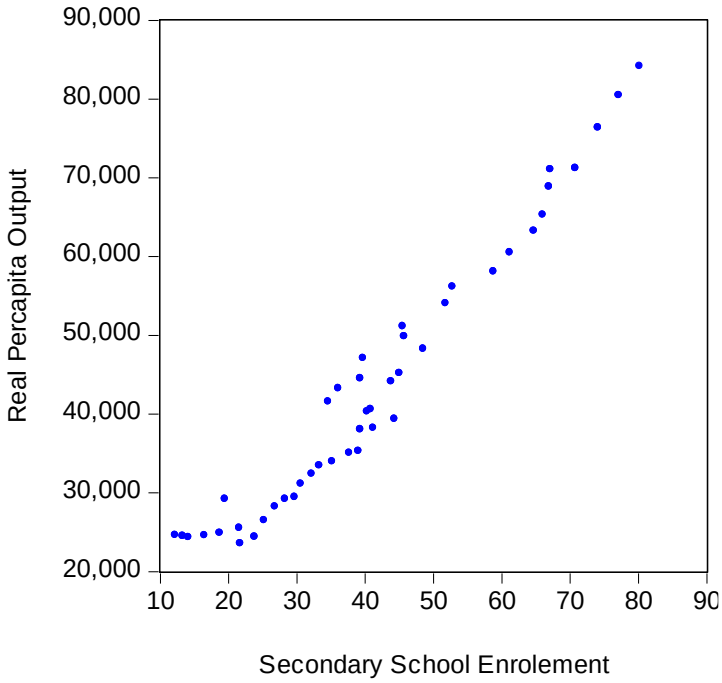
Where,
GDLNPCY= Generalized difference of LNRPCY
GDLNPCK= Generalized difference of LNRPCK
GDLNPCHK= Generalized difference of LNRPCHK

All the estimated coefficients of equation 4.2 are statistically significant. DW statistics states that the model is free from autocorrelation. R^2 is also comfortable. It states that 96.08 percent

variation in dependent variable can be explained by explanatory variables. The elasticity coefficient of per-capita output with respect to per-capita capital for is 0.4426. The elasticity coefficient of per-capita output with respect to for per-capita human capital is 0.1389. Thus both physical and human capital per-capita are important to increase per-capita income in Nepal. The model states that the impact of per-capita human capital on per-capita output is 13.89 percent and the impact of per-capita physical capital on per-capita output is 44.26 percent. In Nepal, impact of physical capital is higher than the human capital. Note that time series properties are not considered in the estimation of per-capita production function because per-capita capital is not stationary even at first differences.

Here spending on health and education has been taken as proxy variable for human capital. Other proxy variable could be the secondary school enrollment. The scatter diagram between real per-capita output and secondary school enrolment is shown in figure 4.8.

Figure 4.8 Secondary School Enrolment and Real Per-capita Output



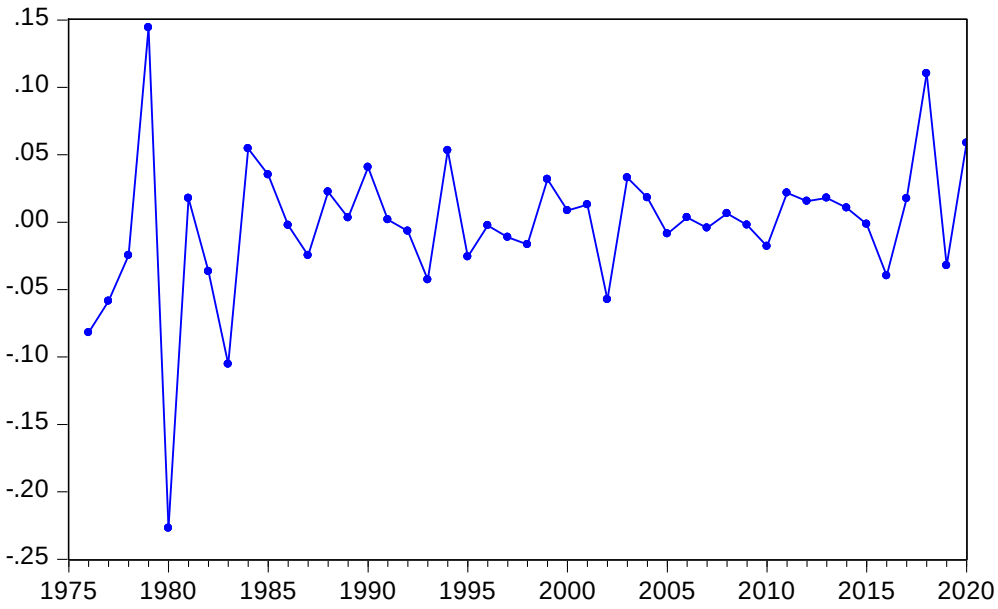
Source: Authors construction based on data of secondary school enrolment and per-capita output.

The graph shows that the stochastic relation between real per-capita output and secondary school enrolment is positive and almost linear. Thus human capital matters for economic growth as stated by endogenous growth theories. It looks like as long run relation.

Total Factor Productivity (TFP)

The graphical and empirical analysis shows that per-capita income is determined by per-capita physical capital and per-capita human capital. The theory of growth suggests that technology is another factor. This is the part of growth which is not explained by physical capital, human capital and labour. The total factor productivity is derived using the estimated coefficient of equation (4. 2). The graph of TFP growth is shown in figure (8.9).

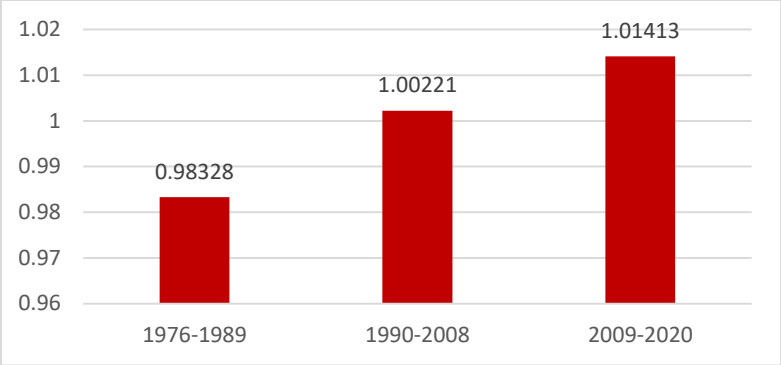
Figure 8.9 TFP growths using both physical and human capital



Source: Authors construction

The graph of the TFP growth rate seems stationary. It gives the notation of conversing time path. The high and low value of TFP in 1979 and 1980 is the consequence of high and low value of GDP in 1979 and 1980 respectively. This is the overall time path. How was the situation of TFP period wise? TFP is growing or decreasing over the time? To answer this question period wise TFP growth situation is depicted in the following graph.

Figure 4.9 Average Value of TFP for Three Regimes



Source: Authors Construction

The graph 4.9 shows the average value of TFP for three broad political regimes. The graph shows that contribution of technology on economic growth increasing. The TFP growth is higher in constitutional monarchy than in ***Panchayat*** regime. TFP growth in "Federal Democratic Republic Era" is higher than in "Constitutional Monarchy". Note that it is the exponential value of TFP growth. So it can be used to interpret the case of either increasing or decreasing.

Determinants of Total Factor Productivity

Tfpg= 0.014+ 0.136Dlnrx – 1.550 Dlnlifex - 0.185 Dlntopen + 0.028Dlnsav(-1)
St.Error (0.012) (0.044) (1.000)) (0.086) (0.021)
Pvalue (0.23) (0.00) (0.12) (0.03) (0.190)

-0.164 Dlngovexy ……(4.3)
(0.091)
(0.081)

R^2=0.537 ; F= 8.832 (0.00); DW=2.180 JB=3.959(0.14) χ^2_{bpg} =4.533(0.47) N=44

Sample 1975-2020

Where

Tfpg= Total Factor Productivity Growth; Dlnsav =Δ(log of domestic saving)

Dlntopen= Δ(log of Trade openness) Dlnrx=Δ(log real export)

Dlnlife= Δ(log of Life expectancy) Dlngovexy= Δ(log of gov. expenditure to GDP ratio)

The estimated total factor productivity growth equation is shown in equation 4.3. A major factor affecting the TFP growth in Nepal real export. The coefficient of the export is positive as expected and it is statistically significant at less than one percent level. Another major

variable affecting the TFP growth is the trade openness. Here coefficient of trade openness has negative sign which seems consistent for Nepal. Nepal's trade deficit has been increasing as we move onward in trade liberalization. Trade deficit negatively impacts the economic growth, thus the sigh is acceptable. Estimated coefficient of trade openness is also statistically significant at three percent level. Hence it is major determinants of TFP growth and hence the economic growth in Nepal. Nepal's trade openness could not invite the technological innovation that could lead towards the path of trade surplus and hence the economic growth. Another factor included in the equation is life expectancy of the people. The coefficient life expectancy has negative sign but it is statistically insignificant at ten percent or better level. Improvement in life expectancy is the sign of wellbeing of the society. But its impacts on TFP and growth is insignificant. Another variable affecting the TFP growth is government expenditure to GDP ratio. The pace government expenditure that exceeds the growth rate of GDP is not friendly for technological innovation and hence the growth. Larger size of government expenditure may produce instability by generating budget deficit and debts in the economy. Economy in expenditure is preferable for Nepal.

R^2 is equal to 0.54 which means that 54 percent variation in TFP growth ban be explained by export, life expectancy, trade openness, domestic saving and government expenditure to GDP ratio, This is the growth equation, all the variables are in growth rate so this value is good. F statistics shows that overall model is statistically significant. DW statistics states that model is free from autocorrelation. The χ^2_{bpg} states that there is no Hetroskedasticicy. The JB statistics states that residual term is normally distributed. It satisfies all the assumption of OLS model. So model is sound in econometric ground.

The major sources of growth, from production function approach, are per-capita capital, per-capita human capital, trade openness, export, and government expenditure to GDP ratio. This finding implies that physical capital, human capital, economically active population, are equally important variables driving growth process in Nepal.

Growth accounting is highly celebrated theory in growth economics. It decomposed total growth in output in to growth in capital, labour and technology. For this we need the data of national income accounting which split the income in to labour income and capita income. But such types of data are not available in Nepal. So researcher could not follow the primal

approach to growth accounting. However, to estimate the contribution of technology in economic growth a Cobb-Douglas type production function was used in sub heading 4.5. It estimated the production function and total factor productivity. There researcher found factors contributing to growth. How much is capital and labour are contributing to total growth? The question is still unanswered. But how is movement of total factor productivity? Is it increasing or decreasing? Weather capital (physical and human) and labour matter or not? What are the factors that affect the TFP? All these questions were answered in above paragraph.

4.6 Time Series Approach to Determinants of Growth

To explore the determinants of growth, to extend and add to previous findings, a time series approach is applied here. It is also highly celebrated time series econometric method that has emerged since 1985. Previous method does not satisfy the time series property for real per-capita capital. So findings from this method needs for cross verification. So to support and extend the previous findings, a method which is consistent with time series property, is necessary, so co-integration and error correction model is applied here. This method satisfies all the desirable time series properties.

The Co-Integrating Relation and ECM

Co-integrating relation is the long run and stable relation among the variables. The concept of co-integration was innovated by Granger. If the variables are I(1) and liner relationship among variables are I(0) and such liner relation is known as co-integrating relation. Thus test of integration is necessary to test the co integrating relation. The result of unit test is shown in in table 4.1. Co-integrating relation can be considered as long run equilibrium relation among the variables. Researcher has found the following co integrating relations.

Model I

Co-integrating Relation

The estimated relation between real GDP, real export and government expenditure in human capital is found to be co-integrating relation in line with Granger.

lnrgdpfc=	**4.536 +**	**0.473 lnrgfcf +**	**0.209 lnrx**	**-0.358 lntopen**	**+0.088 lnrheal +**	**0.119lnredu .(4.4)**
St.Error	**0.225**	**0.064**	**0.022**	**0.079**	**0.047**	**0.062**
Pvalue	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.07)**	**(0.06)**

R^2=0.99; F= 1523.676 (0.00); DW=1.56, JB=0.374(0.82) χ^2_{white}=23.57(0.26), χ^2_{LM}=1.96(0.37)
N=46 Sample 1975-2020

Where,

lnrgdpfc = log real GDP at factor cost lnrgfcf=log real gross fixed capital formation

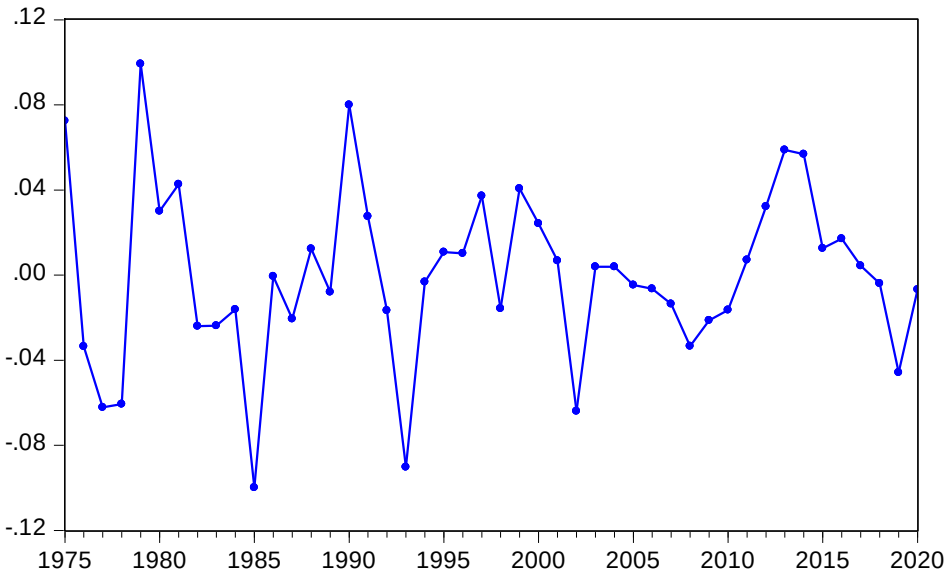
lnrx = log real export lnrheal= log real expenditure in health

lnredu= log of real expenditure on education

lntopen= log of trade openness

The unit root tests of residual obtained from above equation have been done. The ADF statistics at lag zero and one was found -5.63 and -4.347. The critical value or table value of co-integrating test statistics at ten percent level is **-4.34**. So we conclude that the relation 4.4 is co-integrating relation. The LM statistics shows that the model is free from autocorrelation. The JB statistics shows that residual term is normally distributed. The white test indicates the homoscedasticity of residual term. Hence the model satisfies all usual OLS assumptions. The graph of co-integrating relation of model I, is given in figure no 4.10.

Figure 4.10 Co-integrating Relation from Model I



Source: Author's Construction

By inspection the co-integration graph is stationary. It looks like long run equilibrium relation. Time path is conversing towards long run equilibrium.

The corresponding ECM model is as follows

Dlnrgdpfc = 0.034 -0.681EC_{t-1} +0.206 Dlnrgfcf -0.234Dlntopen +0.178Dlnrx

St.Error	**0.0059**	**0.118**	**0.063**	**0.056**	**0.023**
Pvalue	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**

-0.068$lnrx_{t-1}$ + 0.059 Dlnrheal -0.111Dlnredu ……(4.5)

0.021	**0.027**	**0.040**
(0.00)	**(0.03)**	**(0.00)**

R^2=0.76; F= 16.66 (0.00); DW=2.14 JB=1.316(0.55) χ^2_{bpg}=2.64(0.99), χ^2_{white}=8.67(0.27) N=44 Sample 1975-2020 AIC=-4.311

The error correction term is statistically significant at less than one percent level. It states that 68.5.5 percent disequilibrium of last year is corrected by this year. The coefficient of real gross fixed capital formation is positive as expected and it is statistically significant at less than one percent level. The impact of the real gross fixed capital formation on real GDP is 20.6 percent in short run. The coefficient of trade openness is negative and statistically significant at less than one percent level. It states that Nepal's trade openness policy decelerating economic growth in short run also. It looks convincing because Nepal's trade deficit is escalating as the trade openness is increasing. The coefficient of real export is positive as expected it is also statistically significant at nearly zero percent level. Thus growth in export is positively impacting the economic growth in the short run and its impact is 17.8 percent. The coefficient of one year lagged real export is negative and it is also statistically significant at nearly zero percent level. Net effect of current and one year lagged real export is positive. Thus export is positively driving the growth process in the short run.

The coefficient of human capital, proxy by health sector spending, is positive and statistically significant at three percent level. This short run impact is five point nine percent while itas long run impact was near nine percent. The short run effect of education human capital on growth is negative and its impact is 11.1 percent, however its long run effect was positive and larger than short run effect. Spending on education on short run may have negative effect on income, however its long-run effect is positive and larger. The coefficient of determination is 0.71. It is good in growth equation. The DW, JB and χ^2_{bpg} Statistics indicates that t random disturbances is white noise. Thus the model seems good.

Model II
Co-integrating Relation

The estimated relation between real GDP, real export and government expenditure in human capital and trade openness is found to be co-integrating relation in line with Granger. The estimated equation is as follows

lnrgdpfc= 4.443 +0.472 lnrgfcf +0.202 lnrx -0.20 4lntopen+ 0.213lnrhumcap…(4.6)

St.rror	**0.197**	**0.065**	**0.021**	**0.075**	**0.046**
Pvalue	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**

R^2=0.99; F= 1911.2 (0.00); DW=1.49 JB=0.34(0.84) χ^2_{white}=19.56(0.14), χ^2_{LM}=1.25(0.52) N=46 Sample 1975-2020

Where,

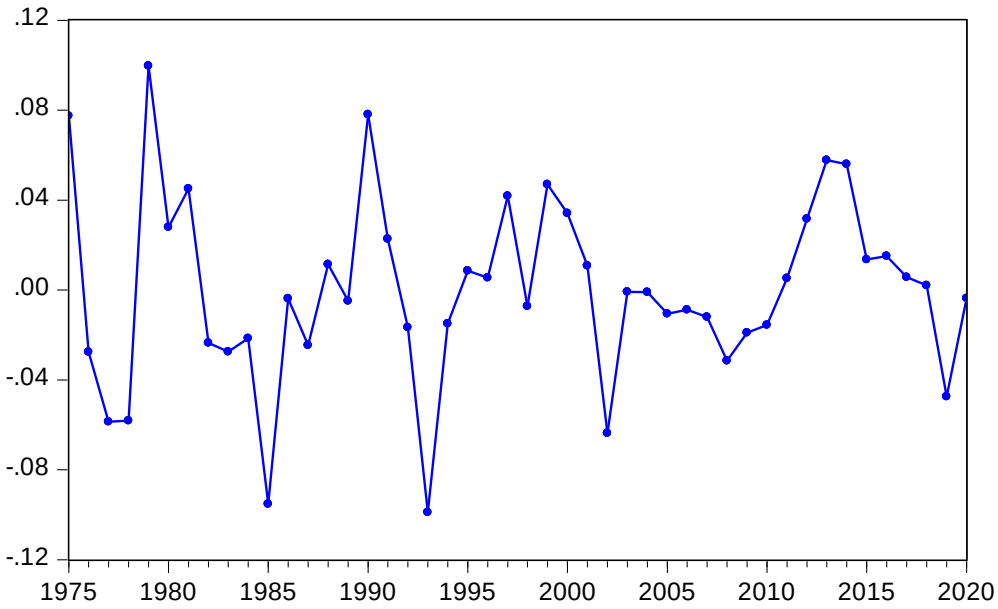
lnrgdpfc = log real GDP at factor cost lnrgfcf=log real gross fixed capital formation

lnrx = log real export lnrhumcap= log real human capital

lntopen= log trade openness

The unit root tests of residual obtained from above equation have been done. The ADF statistics at lag zero and one was found -5.523 and -4.226. The critical value or table value of co-integrating test statistics at five percent level is -4.700. The one percent critical value is -5.41 so this co-integrating relation is significant at one percent level. So we conclude that the relation (4.6) is co-integrating relation. Note that there is no violation of OLS assumptions. The graph of co-integrating relation of model II, is given in figure no 4.11. By inspection the co-integration graph is stationary. It looks like long run equilibrium relation. Time path is conversing towards long run equilibrium.

Figure 4.11 Co-integrating Relation from Model II



Source: Author's Construction

Though the results are similar, significance level of estimated coefficients of model II are near to zero percent level and it is parsimonious also so this co-integrating relation is more preferable. It satisfies all usual OLS assumptions. Thus model two is more preferable.

The corresponding error correction model is given below.

Dlnrgdpfc =0.024 -0.535EC$_{t-1}$ +0.179 Dlnrgfcf$_{t-1}$ -0.242Dlntopen +0.193Dlnrx

St.Error	**0.0059**	**0.116**	**0.064**	**0.059**	**0.025**
Pvalue	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**	**(0.00)**

-0.070Dlnrx$_{t-1}$ + 0.101 Dlnrhumcap ……..(4.7)

0.023	**0.041**
(0.00)	**(0.01)**

R^2=0.71; F= 15.57 (0.00); DW=2.05 JB=1.30(0.52) χ^2_{bpg}=4.061(0.66), χ^2_{white}=8.21(0.22) N=44 Sample 1975-2020

Where ,

Dlnrgdpfc= Δ (log real GDP); ECt = Error correction term

Dlnrgfcf= Δ(log real gross fixed capital formation) Dlntopen= Δ(log Trade openness)

Dlnrx =Δ(log real export) Dlnrhumcap= Δ(log real human capital)

The error correction term is statistically significant at nearly zero percent level. It states that 53.5 percent disequilibrium of last year is corrected by this year. The coefficient of real gross fixed capital formation is positive as expected and it is statistically significant at nearly zero

percent level. The impact of the real gross fixed capital formation on real GDP is 17.9 percent in short run. The coefficient of trade openness is negative and statistically significant at nearly zero percent level. It states that Nepal's trade openness policy decelerating economic growth in short run also. It looks convincing because Nepal's trade deficit is escalating as the trade openness is increasing. The coefficient of export is positive as expected it is also statistically significant at nearly zero percent level. Thus growth in export is positively impacting the economic growth in the short run and its impact is 19.3 percent. The coefficient of lagged export is negative and it is statistically significant at nearly zero percent level. The impact of current export is 19.3 percent and lagged effect is minus 7 percent so the net effect of export is positive (12.3 percent). Thus export is accelerating the economic growth in Nepal. The coefficient of human capital is positive and statistically insignificant at one percent level. The impact of human capital on economic growth is 10.1 percent. Thus government spending on human capital is enhancing the economic growth in Nepal. The coefficient of determination is 0.71. It is good in growth equation. The DW is 2.05 which indicates that model is free from auto correlation. The JB statistics is 1.30 which indicates that random disturbance is normally distributed. The χ^2_{bpg} statistics indicates the presence of homoscedasticity. Thus the random disturbance is white noise. Thus the model seems best fitted. Thus Model II seems better than model I though the R^2 is marginally higher in model I. Thus inference could be made from model II.

Does Maoist insurgency affect the economic growth in Nepal? To look the answer of this question, an augmented error correction model is estimated, and it is shown in Appendix I. The interacting variable of Maoist insurgency dummy (MD) and government consumption to GDP ratio (Gconsy) is found statistically significant at ten percent level. The sign is negative as expected. Moist insurgency is negatively impacting the economic growth through the government consumption channel. This finding is also fits to the historical reality of low level of growth in the period of Maoist insurgency as shown above sub heading 3.1. The broad money growth (Dlnm2) has positive sign as expected but it is statistically insignificant. Real factors are more powerful to explain the growth process in Nepal than the monetary factors.

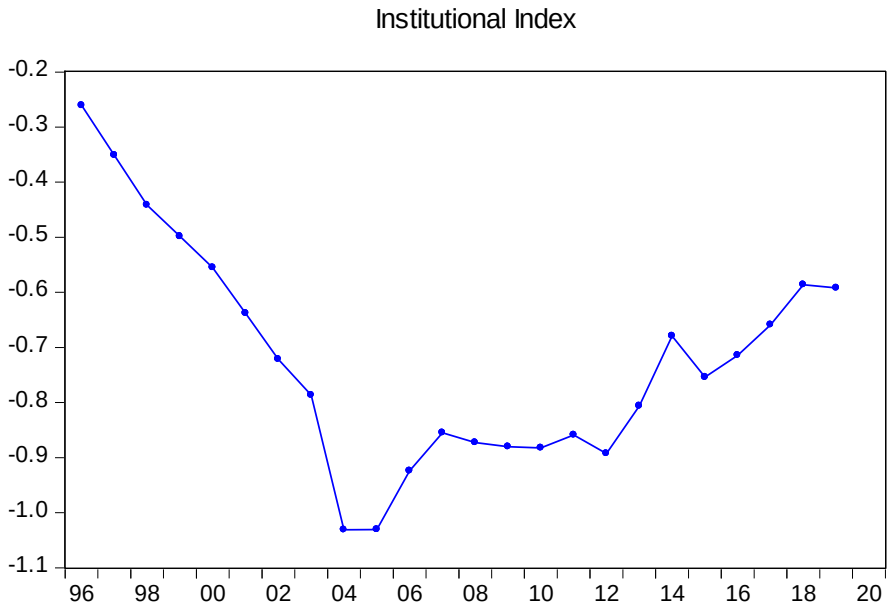
4.7 A Note on Institutional Factors and Economic Growth in Nepal

It is assumed that World Bank governance indicators reflect the institutional development. Governance indicators are of six types they are as follows.

i. Voice and accountability
ii. Political stability and absence of violence
iii. Governance effectiveness
iv. Regulatory quality
v. Rule of law and
vi. Control of corruptions

To capture the above stated six dimensions, a combined institutional development index is developed taking the weighted average of the six indicators. The nature of institutional index which is the weighted average of six indicators is shown in the figure 4.13

Figure 4.13 Institutional index

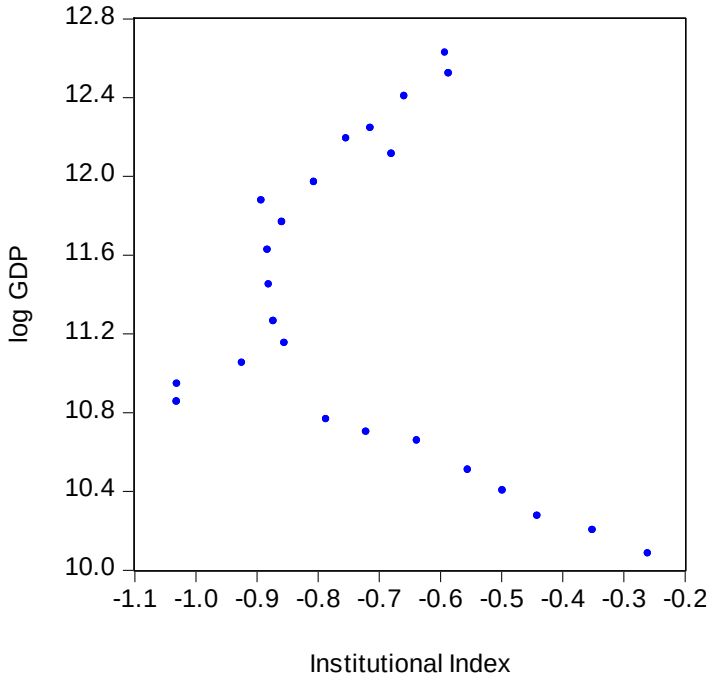


Source: Authors construction based on data of World Bank

The graph shows that Nepal's institutional development was gradually declining from 1996 to 2004. It remains constant during 2004-05. However, after the end of Maoist movement in 2006, it starts to increase gradually. Roughly it looks like U shaped curve. Now the question is whether this development affects the economic growth or not? To explore the answer to the questions a scatter plot is shown in figure 4.14. Figure 14.4 shows the scatter diagram of

the two variables log GDP and combined institutional index. There is no any systematic relation between log GDP and Institutional index.

Figure 4.14 Scatter Diagram between log GDP and Institutional Index



Source: Authors Construction based on data of GDP and Institutional index

It can be concluded that institutional factors may be important for economic development but it has not exert significant effect on economic growth.. It could be observed from following regression equation.

lnGDP = 10.429-1.236 Insindex ……(4.10)
Tstat 17.51 -1.54
Pvalue (0.00) (0.14)

R^2=0.09; F= 2.40 (0.14); DW=0.038

The estimated coefficient of institutional index is negative but statistically insignificant. It shows that there no relation between World Bank based institutional development index and GDP in Nepal. Further intercept coefficient is statistically significant which means that other factors are important for economic growth in Nepal. The R^2 is extremely low that is 0.09. So the model is not better fitted for Nepal. So we conclude that intuitional factors, measured by indicators developed by World Bank, could not capture growth effect in Nepal. An alternative method can be looked to capture the institutional effect on economic growth in Nepal.

5. Findings and Conclusion

5.1 Findings

- The average annual growth rate in the Panchayat System (1975-1989) was 4.32 percent, the constitutional monarchy (1990-2008) was 4.50 percent and in Federal Democratic Republic of Nepal (FDRN) (2009-2020) was 4.34 percent. The growth rate during Panchayat and FDRN period was almost the same. During the Maoist Period (1996-2006) average annual growth rate was just 4.16 percent. It is the historical minimum in comparison to three different regimes. Constitutional monarchy had the highest level of growth in spite of the fact that Maoist insurgency was occurring during this period.
- There exists a statistically significant per-capita production function for Nepal. Per-capita output is the function of per-capita physical capital and per-capita human capital. The elasticity of per-capita physical capital to per-capita output is 0.4436 and per-capita human capital to per-capita output is 0.1389.
- Total factor productivity growth was in highest level in FDRN period, second highest level was in constitutional monarchy and minimum level was in Panchayat era.
- Export growth is positively driving the total factor productivity growth while growth in trade openness and growth in government expenditure to GDP ratio is negatively affecting the TFP growth.
- There exists the long-run equilibrium relation between GDP, gross investment, trade openness, export and human capital. Variables were taken in real term. Thus the long run driving force of equilibrium growth are gross investment, trade openness, export and human capital. The elasticity coefficient of gross investment, trade openness, export and human capital are 0.472, -0.204, 0.202, and 0.213.
- There also exists the short run relation between real GDP, real gross investment, trade openness, real export and real human capital. Equilibrium relation seems stable. The coefficient of error correction term was -0.535. The gross investment, export and human capital are positively driving the short run growth process while the trade openness is decelerating the economic growth in Nepal. The coefficient of explanatory variables in growth forms namely growth in gross investment, export

and human capital and the trade openness are 0.179, 0.193, 0.101 and -0.242 respectively.

- The extended error correction model established negative and significant relation between growth in government consumption to GDP ratio and economic growth during the Maoist period. Government consumption during Maoist insurgency period was not growth friendly.
- Findings are almost similar from both per-capita production function and time series approach of co-integration and error correction modeling.
- Maoist insurgency was negatively impacting the economic growth in Nepal.

5.2 Conclusion

Basic intent of this study is to examine the determinants of economic growth in Nepal. A production function approach and time series econometrics of co-integration and error correction model was used investigate the determinants economic of growth in Nepal. Capital stock series is estimated for Nepal to estimate the per-capita production function for Nepal. Data of capital stock was lacking in Nepal. So it can be considered as contribution of this study. The per-capita production function showing the relation between per-capita outputs, per-capita physical capital and per-capita human capital is found statistically significant. The total factor productivity was marginally increasing from Panchyat regime to Constitutional monarchy to Federal Democratic Republic of Nepal. Major factors, that have been positively driving the growth process of Nepal are, per-capita physical capital, human capital, per-capita human capital, export, and gross investment. Trade openness, excess growth of government expenditure over the GDP growth and Maoist insurgency has been decelerating the economic growth in Nepal. There exists the long-run equilibrium relation between GDP, gross investment, trade openness, export and human capital. Short run relation among these variables is also stable. Government consumption during Maoist insurgency period was not growth friendly. Theoretically Institutional factors are important for growth but this study could not have established statistically significant relation. Estimation of the stock of capital, exploring the human capital as major determinant of economic growth, estimation of per-capita production function including per-capita physical and human capital, and

more up dated and fresh information on determinants of economic growth are new contribution of this study.

5.3 Recommendations

Based on above findings this researcher recommends the following actions to the government of Nepal to enhance economic growth.

- **Increase the capital expenditure**: Gross fixed capital formation is positively driving the growth process of Nepal. Therefore, to accelerate the economic growth in Nepal capital expenditure have to be increased by the government and investment should be increased by private sector.
- **Increase in education expenditure**: Government expenditure in education is enhancing the economic growth in Nepal. This type of expenditure is enhancing the human capital. So it is suggested to increase government expenditure in education.
- **Increase in health expenditure**: Research shows that spending on health is enhancing the economic growth in Nepal. So it is suggested to increase the spending on health by government. Spending on health increases the level of human capital which in-turn increases the productivity of peoples.
- **Increase in export**: Export is positively driving the economic growth in Nepal. Export to GDP ratio is stagnating and marginally decreasing. So it is suggested to direct both fiscal and monetary policy to enhance the export growth in Nepal.
- **Selective measure to control trade openness**: Nepal's trade openness is decelerating the economic growth in Nepal. So it is suggested to decrease the size of trade openness through the import substitution.
- **Sustain and stable government expenditure**: Excess growth in government expenditure over the GDP growth is not enhancing the economic growth in Nepal. Thus stable and sustain government expenditure which could be absorbed or digest by the economy will be helpful for growth. The race of finance minister to increase the size of the budget is not contributing the high level of growth rather decelerating the pace of growth.
- **Per-capita physical capital**: Higher the per-capita physical capital higher will be per-capita output. Per-capita physical can be increased either by increasing the gross fixed capital formation or decreasing the population or the both.

- **Per-capita human capital**: Higher the per-capita human capital higher will be per-capita output. Per-capita human capital can be increased either by improving health condition of the people or decreasing the population or the both. So it is suggested to the government to increase health spending to improve the health condition of the peoples.

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APPENDIX I

Augmented Error Correction Model

Dependent Variable: DLNRGDPFC
Method: Least Squares
Date: 06/01/23 Time: 15:58
Sample (adjusted): 1977 2020
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT5(-1)	-0.536931	0.114088	-4.706303	0.0000
DLNRGFCF	0.184813	0.062717	2.946788	0.0057
DLNTOPEN	-0.227701	0.057581	-3.954444	0.0004
DLNRX	0.188272	0.024333	7.737377	0.0000
DLNRX(-1)	-0.087223	0.023616	-3.693381	0.0008
DLNRHUMCAP	0.104338	0.040200	2.595446	0.0137
C	0.015740	0.007538	2.088228	0.0441
DLNGCONY*MD	-0.347427	0.204997	-1.694791	0.0990
DLNRM2	0.118160	0.079834	1.480060	0.1478

R-squared	0.751851	Mean dependent var	0.040446
Adjusted R-squared	0.695131	S.D. dependent var	0.048666
S.E. of regression	0.026871	Akaike info criterion	-4.215289
Sum squared resid	0.025272	Schwarz criterion	-3.850341
Log likelihood	101.7364	Hannan-Quinn criter.	-4.079948
F-statistic	13.25552	Durbin-Watson stat	1.943903
Prob(F-statistic)	0.000000		

APPENDIX II A: Macroeconomic Data Series in "Crore" Rupees

Year	GDPfc	GFCF	Kstock(real)	GovExp.	GOVcons	Expedu	Exphealth	SSE
1975	1596.6	222.3	12499.23	151.37	125.7	15.42	8.79	13.33
1976	1658.9	244.3	14003.38	191.33	129.4	22.94	12.65	12.18
1977	1625.53	258	15635.74	233.04	126	25.35	12.51	14.05
1978	1842.1	329.4	17575.78	267.49	147.1	27.03	13.78	16.49
1979	2469.2	326.3	19148.57	302.05	188.9	31.53	15.07	19.53
1980	2188.6	368.1	20761.21	347.07	156.5	33.06	12.99	21.74
1981	2546.6	429.9	22503.98	409.23	192.2	38.42	16.29	18.70
1982	2903.7	546.5	24611.65	536.13	263.8	51.91	23.33	21.57
1983	3164.4	657.6	26845.44	697.92	341.6	73.4	31.86	23.78
1984	3700.4	690.7	28923.75	743.73	364.4	81.58	31.76	25.24
1985	4444	938.6	31793.34	839.48	437.1	80.56	39.42	26.81
1986	5321.4	943.1	34137.32	979.71	506.5	108.7	40.59	28.35
1987	6114.1	1182.5	36725.96	1151.32	579.7	127.88	49.17	29.67
1988	7317.1	1341.4	39613.73	1410.5	689.5	148.93	58.93	30.56
1989	8583.2	1639.2	42116.04	1800.5	894.7	174.17	86.71	32.16
1990	9970.2	1700.2	44183.24	1966.93	895.9	179.95	69.04	33.27
1991	11612.7	2278	47040.67	2354.98	1108.5	208.23	66.06	35.17
1992	14493.3	2927.7	50184.18	2641.82	1190.8	286.78	91.81	37.72
1993	16535	3727.8	53991.74	3089.77	1490	415.02	106.10	38.98
1994	19159.6	4203.2	58087.24	3359.74	1598.7	456.4	106.56	39.31
1995	20997.4	4837	62539.09	3906	2026.7	506.57	149.56	41.19
1996	23938.8	5608.1	67322.24	4654.24	2301.8	615.02	171.45	44.33
1997	26957	6079.4	71949.17	5072.37	2498.7	720.32	250.66	40.31
1998	28979.8	6537.5	76607.9	5611.83	2801.5	780.39	312.51	40.82
1999	33001.8	6526.9	80347.56	5957.9	3052.9	768.15	281.46	34.56
2000	36625.1	7332.4	84470.4	6627.25	3396.4	932.85	345.15	36.06
2001	42545.44	8475.06	88721.88	7983.51	3578.504	1104.47	351.97	39.30
2002	44405.19	8988.93	92934.38	8007.22	3858.58	1470.21	483.40	43.80
2003	47354.6	9807.28	97442.58	8400.61	4265.197	1324.16	365.20	45.01
2004	51799.33	10918.13	102354.6	8944.26	4639.718	1438.29	396.86	39.75
2005	56657.86	11753.89	107162.7	10256.04	5245.268	1722.06	468.23	48.54
2006	63033.03	13553.2	112465.2	11088.92	5679.407	1933.94	579.95	45.73
2007	69736.39	15333.69	118050.8	13360.46	6694.871	2158.09	740.40	45.48
2008	77944.18	17844.55	124498.5	16134.99	8066.3	2706.1	987.06	51.80
2009	93889.2	21103.9	130874.9	21966.2	10652.7	3566.2	1316.84	52.79
2010	111857	26488.8	138067.3	25968.9	11918.9	5001.46	1893.17	58.83
2011	129014.1	29273	144862.8	29536.1	13091.71	5498.66	1987.43	61.24
2012	143747.4	31718.5	151539.4	33916.8	16437.04	6205.3	2287.01	64.74
2013	158042.6	38297.2	159732.1	35863.8	16840.7	6242.98	2187.17	65.99
2014	182217.3	46201.3	169142.7	43505.2	20191.5	7782.57	2651.84	66.88
2015	197170.6	59582.3	182064.8	53155.8	23253.2	7984.08	2946.83	67.14
2016	207765.3	64729.4	195048.8	60101.6	25970.4	9068.95	3400.91	70.78
2017	244292.8	84069.3	211451.1	83724.78	29985.2	10859.01	4535.75	74.08
2018	274577.8	105195.7	231551.5	108728	35426.2	11519.13	5356.13	77.12
2019	304946	116493.9	251967.1	111045.6	39999.2	17307.58	6239.19	80.18
2020	334825.6	105996.6	266508.5	109113.4	43494.5	15120.05	7322.02	

Note

GDPfc= Gross Domestic Product at factor cost

GFCF= Gross Fixed Capital formation

Kstock= Estimated Capital Stock in Real Term

Govexp= Government Expenditure

Govcon= Government Consumption

Expedu= Government Expenditure in Education

Exphealth= Government Expenditure in Health

SSE= Secondary School Enrollment (Percent)

APPENDIX II B: Macroeconomic Data Series in "Crore" Rupees

Year	X	M	EAP	Gdpdef*	M1	M2	Lifeexpt**	CPI*
1975	88.96	181.46	0.55703	11.41	133.77	206.44	45.04	11.21
1976	118.58	198.17	0.57658	11.47	145.25	252.4	45.544	11.14
1977	116.47	200.8	0.59681	11.07	185.29	322.3	46.005	11.44
1978	104.62	246.96	0.61775	12.10	206.06	377.21	46.682	12.72
1979	129.68	288.47	0.63943	13.31	250.49	451.14	47.266	13.15
1980	115.05	348.01	0.66186	14.32	283.04	528.53	47.889	14.44
1981	160.87	442.82	0.68509	15.46	320.78	630.77	48.387	16.37
1982	149.15	493.03	0.68983	16.90	361.15	745.8	48.936	18.08
1983	113.2	631.4	0.69460	18.98	434.89	922.24	49.431	20.64
1984	170.39	651.43	0.69940	20.19	493.15	1045.52	50.225	21.93
1985	274.06	774.21	0.70423	22.50	548	1229.66	50.882	22.83
1986	307.88	934.12	0.70910	25.74	702.93	1515.9	51.535	26.45
1987	299.14	1090.52	0.71401	29.00	812.02	1749.82	52.475	29.96
1988	411.45	1386.96	0.71894	32.43	959.66	2142.26	53.071	33.20
1989	419.53	1626.37	0.72391	36.08	1177.54	2660.51	54.127	35.96
1990	515.62	1832.49	0.72892	39.95	1422.3	3155.24	54.833	39.44
1991	738.75	2322.65	0.73396	44.96	1628.36	3771.25	55.712	43.32
1992	1370.65	3194	0.75626	53.27	1945.77	4567.05	56.71	52.43
1993	1726.65	3920.56	0.77923	59.01	2383.3	5832.25	57.619	57.08
1994	1929.34	5157.08	0.80290	61.86	2851.04	6977.71	58.553	62.19
1995	1763.92	6367.95	0.82730	65.75	3298.54	8098.47	59.318	66.95
1996	1988.11	7445.45	0.85243	70.90	3649.8	9265.22	59.981	72.40
1997	2263.65	9355.34	0.87832	76.06	3846.03	10372.06	60.771	78.26
1998	2751.35	8900.2	0.90501	79.18	4516.38	12646.26	61.549	84.77
1999	3567.63	8752.53	0.93250	86.22	5106.25	15280.02	62.113	94.42
2000	4982.27	10850.49	0.96083	90.08	6097.97	18612.08	62.614	97.62
2001	5565.41	11568.72	0.99002	100.00	7057.7	21445.42	63.336	100.00
2002	4694.48	10738.9	0.99031	103.93	7715.62	22398.83	63.264	102.89
2003	4993.06	12435.21	0.99061	107.13	8375.41	24591.12	64.197	107.78
2004	5391.07	13627.71	0.99090	111.59	9397.37	27731.01	64.818	112.05
2005	5870.57	14947.36	0.99119	118.42	10020.58	30044	65.457	117.13
2006	6023.41	17378.03	0.99149	127.13	11438.88	34742.18	65.868	126.46
2007	5938.31	19469.46	0.99178	136.80	12688.8	39551.82	66.329	133.92
2008	5926.65	22193.77	0.99207	144.49	15434.39	49537.71	66.421	142.90
2009	6769.75	28446.96	0.99237	167.47	19645.94	63052.12	66.761	160.88
2010	6082.4	37433.52	0.99266	192.84	21815.9	71959.91	66.814	176.29
2011	6433.85	39617.55	0.99296	213.69	22235.13	92132.01	67.313	193.14
2012	7426.1	46166.77	0.99325	227.87	26370.57	113030.2	67.47	209.20
2013	7691.71	55647.03	0.99354	242.85	30159.02	131537.6	67.965	229.78
2014	9199.14	71436.58	0.99384	265.57	35483	156596.7	68.085	250.64
2015	8531.91	77468.42	0.99413	278.69	42474.46	187780.2	67.456	268.73
2016	7011.72	77359.91	0.99443	293.06	50328.71	224457.9	68.776	295.43
2017	7304.91	99011.32	0.99472	321.43	56940.24	259170.2	68.91	308.58
2018	8135.98	124510.3	0.99502	342.96	66939.5	309446.7	68.979	321.40
2019	9710.95	141853.5	0.99531	364.12	72664.28	358213.8	69.558	336.28
2020	9770.95	119679.9	0.99561	390.56	85626.08	423097	69.246	356.98

Note

X= Export

M= Import

EAP= Economically Active Population

*Gdpdef= GDP deflator (index)

M1= Narrow Money

M2= Broad Money

**Lifeexpt= Total Life Expectancy (years)

*CPI= National Consumer Price Index of Nepal (Index)

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