National College of Business Administration & Economics Lahore

DETERMINANTS OF LABOR PRODUCTIVITY AND ITS ROLE IN PROMOTING ECONOMIC GROWTH: A COMPARATIVE STUDY OF PAKISTAN AND INDIA

BY

ASMA YAQOOB

MASTER OF PHILOSOPHY
IN
ECONOMICS

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NATIONAL COLLEGE OF BUSINESS ADMINISTRATION & ECONOMICS

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A dissertation submitted to
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In Partial Fulfillment oft he
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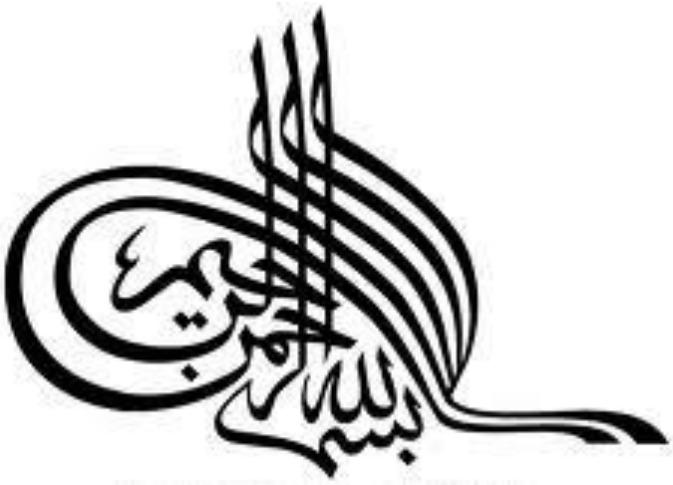
February, 2023



In the name of ALLAH,
The Most Beneficial,
The Most Merciful,

NATIONAL COLLEGE OF BUSINESS ADMINISTRATION & ECONOMICS LAHORE

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MASTER OF PHILOSOPHY IN ECONOMICS

Dissertation Committee:

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Chairman

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Member

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Member

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Director Research
National College of Business Administration & Economics

DECLARATION

It is to declare that this research work has not been submitted for obtaining similar degree from any other university/college.

ASMA YAQOOB
February, 2023

DEDICATED
TO

My Mother and Father whose affection love, encouragement and prayers of day and night make me able to get such success, along with my hard working and respected supervisor

Prof. Dr. Muhammad Abdul Quddus.

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All praises and thanks to ALLAH Who blessed me with enough ability and competency to complete this dissertation. I feel the deepest and heartiest gratitude for different personalities who have been very cooperative and helpful during the writing of this thesis. I owe a debt of gratitude to my kind supervisor Prof. Dr. Muhammad Abdul Quddus for his sympathetic attitude and knowledge suggestions during my entire research work.

I would like to acknowledge the role of I acknowledge the valuable efforts of my supervisor throughout the duration of my research work as I always got the knowledge, guidance, and support required at each stage of my work. Moreover, the cooperation of the Head of The Department, Dr. Mussarrat Khadija Khan and Program Coordinator Mr. Akmal Younas is also appreciated as they were always available for assistance. I acknowledge the selfless support of my teachers and colleagues throughout the duration of my coursework and research work as they were always contributing and supportive in my hour of need.

RESEARCH COMPLETION CERTIFICATE

Certified that the research work contained in this thesis entitled **"Determinants of Labor Productivity and its Role in Promoting Economic Growth: A Comparative Study of Pakistan and India"** has been carried out and completed by **Ms. Asma Yaqoob** under my supervision during her **M.Phil. Economics** Programme.

(Dr. Muhammad Abdul Quddus)
Supervisor

SUMMARY

This study aims to first identify the key determinants of labor productivity and economic growth relevant to Pakistani and Indian economies; second to understand the role of Labor Productivity Growth in promoting Economic Growth in Pakistan; third to compare the same role in the economy of Pakistan with the economy of India, and; fourth to develop strategies for Labor Productivity Growth leading to improved Economic Growth in Pakistan.

An essential review of previous literature based on the determinants of labor productivity and economic growth relevant to Pakistani and Indian economies is presented under categories as per the components of the concepts of Economic Growth and Economic Development, as well as Labor Productivity and Total Factor Productivity.

A comprehensive review of previous literature based on the role of Labor Productivity Growth in promoting Economic Growth; and gap analysis are utilized to develop hypotheses statements; theoretical and econometric models and equations. An elaborative research design and methodology are prepared for the research process of the entire study. Mainly, time-series regression analyses based on different regression analysis techniques for Pakistan and India are implemented for econometric analyses of the data (presented in separate chapters).

For Pakistan Stationarity check shows the presence of unit root for variables at level. Hence, Ordinary Least Squares (OLS) regression analysis technique is applicable. The OLS regression analysis results proved the existence of a "significant and positive causal relationship" between "Labor Productivity Growth" and "Economic Growth" in Pakistan.

For India Stationarity check shows the presence of unit root for variables at first difference. Hence, Vector Autoregressive (VAR) regression analysis technique is applicable. Optimal lag order is chosen using optimal lag order selection criteria. Co-integration check using Engle-Granger Cointegration test shows that co-integration does not exist among variables. The VAR regression analysis proved the existence of a "significant and negative" causal relationship between "Labor Productivity Growth" and "Economic Growth" in India.

Consequently, the hypotheses in the case of Pakistan and India are fully supported.

Causality analysis done using the Granger causality test suggests that Granger causality does not exist in any direction for Pakistan and Granger causality exists in both directions for India."

Pearson Correlation analysis is also applied to prove the existence of a strong and positive Correlation between both variables of the model in the case of both countries.

Later, the comparison of findings from Long Run Analyses; Short Run Analyses; and Causality Analyses was given. As per comparison Regression analyses results are in the same direction although these are different from each other due to the use of different regression analysis techniques in the case of Pakistan and India. Correlation analyses results are similar and close to each other in the case of both Pakistan and India. Granger causality test results are opposite to each other in the case of Pakistan and India.

The policy recommendations for the development of strategies for Labor Productivity improvement are provided for the concerned economic and financial decision-makers in the country.

KEYWORDS

Productivity, Total Factor Productivity, Labor Productivity, Labor Productivity Growth, Economic Growth, Economic Development, Time-series Regression, ARDL Bounds Testing Approach, Causality Analysis

LIST OF ABBREVIATIONS

OECD	Organisation for Economic Co-operation and Development
SDGs	Sustainable Development Goals
UNDP	United Nations Development Programme
WDI	World Development Indicators
PPPs	Purchasing Power Parities
GG	GDP Growth
GPPE	GDP Per Person Employed
VAR	Vector Autoregressive or Vector Autoregression
ARDL	Auto-Regressive Distributed Lag
ADF	Augmented Dickey-Fuller
FPE	Final Prediction Error
AIC	Akaike Information Criterion
SC/SIC	Schwarz Criterion or Schwarz Information Criterion
BIC	Bayesian Information Criterion
HQ	Hannan-Quinn Information Criterion
CEC	Conditional Error Correction
ECM	Error Correction Model or Error Correction Regression
ECT	Error Correction Term
LM	Lagrange Multiplier
ARCH	Autoregressive Conditional Heteroscedasticity
RESET	Regression Specification Error Test
CUSUM	Cumulative Sum of Recursive Residuals
CUSUMSQ	Cumulative Sum of Squares of Recursive Residuals

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CHAPTER 1

INTRODUCTION

The first chapter is based on the introduction of the overall study that is presented in terms of "the background of study; statement and importance of problem; the research questions and objectives; the significance of the study, the novelty and originality; the limitations and future research directions".

1.1 BACKGROUND OF THE STUDY

Modern day economists believe that economic growth and development are inevitable for survival and sustainability of communities in countries. The research in the area of economic growth is generally based on some generally accepted theory or model within the framework of economic growth. There are many such theories of which a few play vital roles in the existing research on the concept of economic growth. These include "*Neoclassical Theory of Economic Growth"* and *"Endogenous Theory of Economic Growth"*. The "Neoclassical theory" is attributed mainly to Solow (1956, 1957) & Swan (1956). The Endogenous growth theory is attributed mainly to the works attributed to Arrow (1962); Lucas Jr (1988); Romer (1986). "Solow-Swan Growth Model" is the most popular and simplest version of the Neoclassical Growth Model.

OECD (2008), "The Organization for Economic Co-operation and Development" states "*Economic growth* is the most powerful instrument for reducing poverty and improving the quality of life in developing countries." Moreover, "Developing economies are generally low on capital and need a substantial inflow of funds from foreign investors to avoid the potential problems of low growth and squat savings" (Hayami & Godo, 2005). Often in challenging situations, many economies are bound to depend on foreign aid, foreign loans, and foreign direct investments, which presents many challenges in different countries at government and business levels. Therefore, such economies need to gradually lower their dependence on these inefficient and costly sources and substitute these with efficient and affordable alternatives such as technology transfer and labor productivity.

Concepts of "*productivity*" in the context of "*economic growth*" are well established according to the research available in this area. "*Productivity* is a

ratio of total volumes of input and output of an activity or a project." "*Total factor productivity* is an aggregated form of productivity that includes weighted averages of both capital productivity and labor productivity." "*Productivity growth* is a rate of change in overall productivity."

"Measure of *labor productivity* (*growth*) is based on hourly output of a country's workforce employed." "The OECD uses GDP per hour worked as a measure of labor productivity that gauges how efficiently labor input is combined with other factors of production and used in the production process."

"Level of *labor productivity* is clearly understandable in terms of rates of hourly productivity." Its trends keep changing upon changing situations of various economies. In recent years, most productive economies are from European, North American and East Asian regions. According to the recently available data from the OECD (2017), "Romania, an eastern European nation, recorded the highest GDP per hour rate of any OECD country in 2017, at $142.1 (converted to US dollars based on 2010 PPP), closely followed by Ireland, with Turkey in third place. With a few exceptions, the productivity of most OECD countries has been on an upward trajectory in recent years. Emerging economies, especially Eastern European nations like Romania, Poland, Latvia and Bulgaria, have experienced a sharp rise in their productivity trend over time. Developed economies like the UK, Sweden and the US show a more gradual increase in productivity levels more in line with the OECD average."

Research on "the role of *labor productivity* in *economic growth*" has been carried out in developed countries by many researchers, for instance Korkmaz and Korkmaz (2017) based on data from multiple countries "(Belgium, Germany, Spain, France, Italy, Finland and UK)"; by Auzina-Emsina (2014) based on data from multiple countries "(Latvia, Lithuania and Estonia)"; by Rudolf and Zurlinden (2010) based on data from Switzerland.

Research on "the role of *labor productivity* in *economic growth*" has been carried out in developing countries by Su and Heshmati (2011) based on data from China; by Alani (2012) based on data from Uganda.

Research on "the role of *total factor productivity* in *economic growth*" has been carried out in developing countries by Arısoy (2012) based on data from Turkey; by Nachega and Fontaine (2006) based on data from Niger; by Saleem, Shahzad, Khan, and Khilji (2019) based on data from Pakistan.

The present status of research in the area of "labor *productivity (growth)* and *economic growth*" shows that "researchers have limited focus on finding

out the role of *labor productivity growth* as an individual segregated source of *economic growth and development*". This study is an effort to emphasize "the essential role of *labor productivity growth* in *economic growth and development*".

1.2 STATEMENT OF THE PROBLEM

A desirable level of economic growth and development depends on the availability and utilization of sufficient levels of both capital and labor and accomplishing that usually proves to be challenging for the majority of countries. The foremost challenge facing most countries, especially those with developing economies, is to ever reach an ideal situation of capital that further generates serious productivity obstructions leading to lags in economic growth. The most feasible resolution to this problem lies in an alternative approach of improvement of labor that would definitely lead countries to a less challenging path to economic growth and development. Research should be directed toward "developing an understanding regarding the significant contribution of labor productivity in the improvement of growth and development of economies".

Alani (2012) emphasized that many researchers have highlighted the issue of measurement of labor productivity that exists because "labor productivity" and other factors of "total factor productivity" are not measured directly. This study attempts to solve the issue of measurement of "labor productivity" by taking segregated measures of "total factor productivity" and to further identify the effect of "labor productivity" on the outcome of "economic growth". This solution will help policy makers "to identify and realize the true value of labor productivity" and "utilize it more than capital productivity", which can prove to be less costly for their efforts toward having better economic growth and development.

1.3 IMPORTANCE OF THE PROBLEM

Today's world economies, whether developed, developing, or emerging, are often facing challenges in achieving the goals of their anticipated growth and development. Technological advancement, capital, and labor are the chief architects of any economy. The most affordable one for any economy has always been labor but the appropriate role of labor in the growth and development of economies in the short run or long run is still to be fully uncovered. The realization and exploitation of the potential value of improved labor can prove to be a vast source of infinite levels of growth and

development in economies. Therefore, it is essential to conduct suitable research for finding the relevant role of labor in the growth and development of economies.

1.4 RESEARCH QUESTIONS

1. "What are the key determinants of labor productivity and economic growth relevant to Pakistani and Indian economies?"

2. "Does any level of causal association exist between 'Labor Productivity Growth' and 'Economic Growth' in Pakistan?"
   a. "Does any short run causality exist between 'Labor Productivity Growth' and 'Economic Growth' in Pakistan?"
   b. "Does any long run causality exist between 'Labor Productivity Growth' and 'Economic Growth' in Pakistan?"

3. "Does any level of similarity exist between causal association of Labor Productivity with Economic Growth of Pakistan and India?"

4. "How to improve 'Labor Productivity Growth' that may lead to better 'Economic Growth' in Pakistan?"

1.5 RESEARCH OBJECTIVES

1. "To identify the key determinants of labor productivity and economic growth relevant to Pakistani and Indian economies"

2. "To understand the role of 'Labor Productivity Growth' in improving 'Economic Growth' in Pakistan"

3. "To compare the role of Labor Productivity growth in improving Economic Growth in Pakistan with India"

4. "To develop strategies for 'Labor Productivity Growth' leading to improved 'Economic Growth' in Pakistan"

1.6 SIGNIFICANCE OF THE STUDY

The current research intends to "work for better understanding the role of Labor Productivity Growth in improving Economic Growth" and further "develop strategies for Labor Productivity growth leading to improved Economic Growth for economies in emerging countries as well as developing countries, specifically Pakistan". Additionally, it aims to compare "the role of Labor Productivity growth in improving Economic Growth in Pakistan" with "the role of Labor Productivity growth in improving Economic Growth in India".

The current research shall have theoretical significance, as it will contribute to the literature with an empirical investigation that will be useful for readers, researchers, and practitioners. The current research study shall have practical significance, as it will be useful for practitioners in different industries and governments in different countries who can relate to our findings and apply our strategies to improve Labor Productivity Growth that might lead to better Economic Growth in their economies.

1.7 NOVELTY AND ORIGINALITY

The current research has novelty, as it is among the pioneer empirical studies based on a model using together the Labor Productivity Growth and Economic Growth in Pakistan.

The current research has originality, as it is among the pioneer empirical studies based on data for Labor Productivity Growth and Economic Growth in Pakistan.

1.8 LIMITATIONS OF THE STUDY

The current research is based on certain data sets because data were not available for a longer time period. Therefore, the presently available data sets were considered depending on the outcome of the analyses.

In the current research, the scope of data analysis was not broad as it was based on a single country in the region. Therefore, the presently provided results should be considered relevant to the economies of similar countries only.

1.9 FUTURE RESEARCH DIRECTIONS

The current research recommends addressing the issue of limited data availability. In the future researchers shall look for solutions by focusing on perspectives of alternative data sources and modern data analysis procedures.

The current research recommends addressing the issue of a narrow scope of data analysis. In the future researchers shall opt for diversity in statistical analysis strategies by applying alternative and modern data analysis procedures such as panel data and generalized regressions.

1.10 ORGANIZATION OF THESIS

The thesis document will be organized into different sections as mentioned below

The prefatory section will mainly include preliminary parts i.e., "*Title Page, Table of Contents, List of Tables, List of Figures,* List of *Abbreviations*, and *Abstract*"; whereas the body section will consist of main chapters of "*Introduction, Determinants of Labor Productivity and Economic Growth, Role of Labor Productivity in Promoting Economic Growth, Research Design and Methodology, Empirical Results and Discussion – Economy of Pakistan, Empirical Results and Discussion – Comparison of Pakistan and India, Conclusions and Recommendations*"; whereas, the appended section will mainly include supplementary parts i.e., "*References* and *Appendix*".

CHAPTER 2

DETERMINANTS OF LABOR PRODUCTIVITY AND ECONOMIC GROWTH

The second chapter is composed of a literature review based on the determinants of labor productivity and economic growth.

A review of Previous Literature is categorized as per the components of the concepts of "Economic Growth and Economic Development", as well as "Labor Productivity and Total Factor Productivity".

2.1 ECONOMIC GROWTH AND ECONOMIC DEVELOPMENT

2.1.1 Background of Economic Growth and Development

The UN highlights "*inclusive and sustainable economic growth, employment and decent work for all*" as one of their "*Sustainable Development Goals*". "The Sustainable Development Goals (SDGs) aim to encourage sustained economic growth by achieving higher levels of productivity and through technological innovation. Promoting policies that encourage entrepreneurship and job creation are key to this, as are effective measures to eradicate forced labour, slavery and human trafficking. With these targets in mind, the goal is to achieve full and productive employment, and decent work, for all women and men by 2030" (World Bank, 2015).

2.1.2 Determinants and Outcomes of Economic Growth and Development

The key determinants of economic growth and economic development have been researched frequently by many researchers in different regions of the world. Some of the analytical methodologies used in these studies are cross-country, panel, and single-country regressions.

Generally, many empirical studies are available that highlight and identify the important determinants (macroeconomic determinants) of economic growth in countries having developing economies. The significant studies in this regard are mentioned "(Anyanwu, 2014; Barro, 1999, 2003; Burnside & Dollar, 2000; Chang & Mendy, 2012; Chen & Feng, 2000; Dollar,

1992; Easterly & Levine, 1997; Fischer, 1992; Hamilton & Monteagudo, 1998; Knight, Loayza, & Villanueva, 1993; Most & De Berg, 1996; Radelet, Sachs, & Lee, 2001; Rao & Hassan, 2011)".

Generally, many empirical studies are available that highlight and identify key determinants (macroeconomic determinants) of economic growth in countries having developed economies. The significant studies in this regard are mentioned "(Acikgoz & Mert, 2014; Anaman, 2004; Asheghian, 2009; Bayraktar, 2006; Bleaney, Gemmell, & Kneller, 2001; Checherita-Westphal & Rother, 2012; Freire-Seren, 2002)".

Specifically, "the role of foreign direct investment (FDI) in economic growth" has been researched. Many pieces of research on China show that along with many other factors, "inward foreign direct investment is a fundamental factor promoting sustainability of economic growth in China" (L. F.-Y. Ng & Tuan, 2006; Whalley & Xian, 2010; Yao & Wei, 2007). Other researches focus on "the role of FDI and exports in economic growth" (Yao, 2006); and "trade, foreign direct investment and economic growth in Asian economies" (X. Liu, Shu, & Sinclair, 2009).

Whalley and Xian (2010) studied the "role of inward FDI to China's recent rapid economic growth using a two stage growth accounting approach". According to their results, "40% of China's economic growth in 2003 and 2004 was contributed by Foreign Invested Enterprises, besides, China's overall GDP growth rate could have been lowered (by 3.4%)" without such contribution. It is claimed that if the inward FDI of China plateaus in times to come then the sustainability of export and economic growth may be disturbed.

L. F.-Y. Ng and Tuan (2006) studied "the effects of spatial agglomeration and FDI on regional output growth as well as their structural relations with endogenous FDI in China's economy". According to the results not only institutional forces but spatial agglomeration, synergies and gravity also promote inward FDI and in turn induce the regional GDP growth in China.

Yao and Wei (2007) studied "the role of FDI in economic growth from the perspective of a newly industrializing economy". According to the results "the FDI plays a dual role as a mover of production efficiency and a shifter of production frontier". It is claimed that this dual role drives economic growth for such an economy that further helps to get ahead like advanced countries. An ideal example for testing this is China's economic success in recent times.

Yao (2006) studied "the effect of FDI and exports on the economic performance in multiple Chinese provinces". The analysis was based on a large panel data set for the period from 1978-2000. According to the results "the FDI and exports showed a significant effect on economic growth". The results show that "China's two development policies are favorable for other economies that are in the development and transitional mode".

X. Liu et al. (2009) studied "the role of FDI, trade, exports and imports, and economic growth in nine Asian countries using multivariate causality tests". The results indicated "two-way causal connections between FDI (inward), merger and acquisitions (inward), trade, and growth (for most countries)". A vital role of "FDI inflows, inward M&As expansion of export, and liberalization of import in the growth process in Asian economies" is evident from the results.

Specifically, "the role of human capital in economic growth" has been researched. Some of the studies are on "the role of human capital and foreign direct investment in promoting economic growth in ten countries from Commonwealth of Independent States (CIS)" (Azam & Ahmed, 2015); "human capital causes economic growth in India" (Haldar & Mallik, 2010).

Azam and Ahmed (2015) studied "the impact of Human Capital Development and FDI on economic growth in ten countries from the Commonwealth of Independent States". The analysis was based on panel data for the period from 1993-2011 using a fixed effects model. The results showed "Human Capital Development and FDI facilitate economic growth".

Haldar and Mallik (2010) studied "the behavior of investment in human capital, physical capital on the growth of primary gross enrolment rate and openness in India from 1960-2006". According to the results "no effect for physical capital investment on per capita GNP exists but the significant long-run effect of human capital investment on per capita GNP exists. Moreover, a significant effect of stock of human capital (in terms of primary gross enrolment rate) and openness on the growth of per capita GNP exists. Further, results of innovation were also satisfactory". Therefore, their study is important for India's policy modeling of economic growth in terms of endogenous growth.

2.2 LABOR PRODUCTIVITY AND TOTAL FACTOR PRODUCTIVITY

2.2.1 Background of Labor Productivity and Total Factor Productivity

The World Bank explains the "World Development Indicators" (WDI) very well and states that "Labor productivity assesses a country's economic ability to create and sustain decent employment opportunities with fair and equitable remuneration. Productivity increases obtained through investment, trade, technological progress, or changes in work organization can increase social protection and reduce poverty, which in turn reduces vulnerable employment (contributing family workers and own-account workers) and working poverty. Productivity increases do not guarantee these improvements, but without them—and the economic growth they bring—improvements are highly unlikely" (World Bank, 2020).

2.2.2 Determinants and Outcomes of Labor Productivity and Total Factor Productivity

The determinants of "labor productivity and total factor productivity" have been researched frequently by many researchers in different regions of the world. These researches vary across certain business industries and certain general and specific determinant factors.

Generally, many empirical studies are available that highlight and identify "the key determinants of labor productivity and total factor productivity in countries having developing and developed economies".

Papadogonas and Voulgaris (2005) analyzed "the firm-level determinants of labor productivity growth in Greek manufacturing industries based on a sample of more than three thousand firms". Their findings indicated a positive relationship between labor productivity growth and "growth of net fixed assets per employee, export orientation and R&D activity" whereas, a negative relation between labor productivity growth and "firm size, employment growth and industry age".

Velucchi and Viviani (2011) examined "the firm-level impact of characteristics of firms on the dynamics of labor productivity for Italian firms during 1998-2004". The findings indicated that labor productivity is quite diverse. Further, the association between labor productivity and the characteristics of firms also varies across quantiles.

Naoum (2016) examined previous productivity research and further investigated "factors impairing productivity on site through an interview survey-based study". Initially, a total of 46 determinants were identified from a review of literature based on construction productivity research. Afterward, these were evaluated by a total of 36 contractors considered to be main contractors that excluded other members of the building team. The findings of the survey ranked the relative importance of factors influencing the on-site construction labor productivity (CLP).

Samargandi (2018) explored "the determinants of labor productivity during 1980-2014 in the context of Middle East and North African countries (MENA region)" which included "compensation, human capital, oil rent, trade, financial development, innovation, and industrialization".

Dua and Garg (2019) "explored trends in labor productivity and analyzed its determinants for developing and developed economies of the Asia-Pacific region during 1980-2014". The potential determinants of productivity including "capital deepening, human capital, technology, share of agriculture in GDP, financial development, institutional quality, inflation" were analyzed. Moreover, "a comparison was done between the impact of these determinants on the productivity of developing and developed countries".

Specifically, many empirical studies are available where "labor productivity and total factor productivity" have been researched in certain business industries.

Labor productivity is frequently researched in "the construction industry from the perspectives of activities and projects". The key research areas of construction labor productivity (CLP) include

"Factors affecting CLP; CLP modeling and evaluation; method and technology for CLP improvement; CLP trends and comparisons; effect of change/variation on CLP; and baseline or benchmarking CLP".

Many pieces of research on "the factors affecting or influencing CLP" are available "(Dai & Goodrum, 2011; Dai, Goodrum, & Maloney, 2009; Dai, Goodrum, Maloney, & Srinivasan, 2009; Maloney, 1983)". Some research on "CLP modeling and evaluation" is also available "(Thomas et al., 1990; Yeung, Chan, Chan, Chiang, & Yang, 2013)". Some research on "baseline or benchmarking CLP" is also available "(Yeung et al., 2013)". Some research on "change/variation in timely completion of jobs affecting CLP" is available "(Hanna & Gunduz, 2004; M. Liu, Ballard, & Ibbs, 2011; Thomas & Raynar,

1997)". A widely used "conceptual CLP benchmarking model" was developed by "Thomas and Završki (1999)". Several important "benchmarking indicators are used for construction projects" such as those used by "Yeung et al. (2013)".

"Labor productivity factors or determinants of Labor productivity" in many other industries have also been researched. "Foreign direct investment (FDI)" is an important one that leads to the labor productivity of domestic firms. The key research on "FDI as a cause of productivity" is mentioned "(Anderson Jr, 2000; Djankov & Hoekman, 2000; D. Liu & Zhao, 2006; Piscitello & Rabbiosi, 2005)".

Specifically, "the key determinants of labor productivity and total factor productivity" have also been researched by many researchers across different regions.

"Human Capital" has been researched as one of the key determinants of labor productivity by many researchers.

Rukumnuaykit and Pholphirul (2016) examined "the human capital in terms of workers' skill levels as well as education and training levels and their effects on labor productivity at firm-level for the Thai manufacturing sector". The human capital components showed positive effects on labor productivity.

Marchante and Ortega (2012) examined "the association of human capital and labor productivity by estimating a production function for linked employer-employee data set based on Spanish hotels". This study identified major determinants of labor productivity, labor productivity and found that better levels of human capital show strong effects on labor productivity and vice versa.

Sabatini (2008) investigated "the association between social capital in terms of its components and labor productivity" using Structural Equations Models (SEMs) for data based on Small and Medium Enterprises (SMEs) in Italy.

(Corvers, 1997) studied "the effects of human capital on the level as well as the growth of labor productivity in manufacturing sectors using data sets from seven European Union countries". The human capital was used in terms of four components ("worker, allocative, diffusion and research") and manufacturing sectors were also divided into classes depending on levels of labor. The findings indicated a significant and positive association with the labor productivity for highly-skilled labor, and a significant and positive

association with the growth in sectoral labor productivity for intermediate-skilled labor.

"Education and Training" has been researched as one of the key determinants of labor productivity by many researchers.

Arshad and Ab Malik (2015) examined "the quality of human capital and its effects on labor productivity in Malaysia". The quality of human capital is considered in terms of "educational levels and health status". Whereas, analysis is based on panel data of Malaysian states during 2009-2012. The findings indicated both components of human capital quality show significant and positive roles in the enhancement of labor productivity levels in Malaysian states.

Colombo and Stanca (2014) studied "the effects of training activity on labor productivity in Italian firms using panel data based on individual firms' level that was intended for results in terms of segregated data to avoid biases of results in terms of industry-level aggregated data". As per the overall results of this study, training showed a significant and positive impact on productivity.

"Innovation" has been researched as one of the key determinants of labor productivity by many researchers.

Brown and Guzmán (2014) analyzed "the innovation and productivity relationship using data from 2004-2006 from a database of more than two thousand manufacturing firms in Mexico". The overall empirical results indicated a positive role of innovation propensity and innovation efforts toward improving labor productivity.

Apergis, Economidou, and Filippidis (2008) examined "associations among innovation, technology transfer and labor productivity". "Multiple factors were considered to stimulate innovation and facilitate technology transfer". The results of panel data analysis showed a long-run association between labor productivity, innovation and technology transfer.

Crépon, Duguet, and Mairessec (1998) examined "associations among research, innovation, and productivity". Their study confirmed the positive associations of firm productivity with research and innovation.

"Financial Development" has been researched as one of the key determinants of labor productivity by many researchers.

Lu, Fausten, and Smyth (2007) examined "the role of financial development in capital accumulation and productivity improvement which are considered as alternative drivers of economic growth". They analyzed "the association of financial development with capital accumulation and productivity improvement using annual data from 1952-2005 in China". The findings showed a strong association between financial development and capital accumulation, whereas a weak association between financial development and productivity.

Guillaumont Jeanneney, Hua, and Liang (2006) studied "the role of Financial development in productivity improvement in developing countries". They measured "China's total factor productivity change and the components which were efficiency change and technical progress, utilizing the Malmquist index under the Data Envelopment Analysis approach". It showed increased total factor productivity mainly due to technical progress as compared to efficiency change. Further, an analysis of data from 29 provinces of China during 1993-2001 was conducted. The findings indicated that financial development showed a significant effect on productivity growth mainly due to efficiency change.

"Trade Openness" has been researched as one of the key determinants of labor productivity by many researchers.

Kacou, Kassouri, Evrard, and Altuntaş (2022) examined "the association between trade openness and labor productivity where level of openness and structure of exports is considered for trade openness". The analysis was based on panel data from 61 developing countries during 1999-2018. Results showed that higher levels of openness in some countries exhibited essential improvement in labor productivity. This study also handled hypotheses of export-led productivity and productivity-driven export.

Amirkhalkhali and Dar (2019) studied "the role of trade openness in total factor productivity and individual factor productivity growth during 2000-2015 in 27 countries from OECD". The analysis was conducted under group-wise and period-wise categories of data. Overall results indicated that trade openness played a positive role in total factor productivity growth and economic growth.

Föllmi, Fuest, Micheli, Schmidt, and Zwick (2018) examined "the association between trade openness and economic performance of productivity in Switzerland". They stated that the Swiss economy is classified as "relatively open" according to different dimensions of openness. They further described

the potential factors that can play a vital role in the further improvement of higher productivity in the future.

Jiang (2011) examined "the impact of regional openness on the regional productivity growth in the context of China (Chinese provinces)". The impact is measured in two ways that are the "direct growth effect" and the "convergence effect". As per the findings, the direct growth effect of openness is found to be significant whereas the convergence effect is found to be insignificant. These findings support the idea that the economic growth of China can be promoted by regional openness.

Cecchini and Lai-Tong (2008) analyzed "an association between international trade; FDI; and TFP of seven European Mediterranean countries". Findings indicated that generally, international trade openness usually leads to an improvement in total factor productivity only through indirect effects of the transfer of technology.

CHAPTER 3

ROLE OF LABOR PRODUCTIVITY IN PROMOTING ECONOMIC GROWTH

The third chapter is composed of a literature review based on the total factor productivity, labor productivity, and economic growth. Moreover, gap analysis, hypotheses statements, theoretical and econometric modeling and equations are presented.

3.1 TOTAL FACTOR PRODUCTIVITY AND ECONOMIC GROWTH

The majority of the research in the area of productivity focuses on many aspects but its role as a determinant of economic growth. Most research on productivity and economic growth are presented below

Measurement of Productivity Growth has been researched in the past.

OECD (2001) published the research on "*Measurement of Aggregate and Industry-Level Productivity Growth*".

Owyong (2001) studied "productivity in terms of what exactly productivity is and how to measure it in order to highlight the importance of technology and productivity in economic growth". According to the results it is claimed that upon becoming more developed and gaining too much factor accumulation countries tend to increase productivity levels in order to sustain their economic growth process.

"Innovation, foreign direct investment (FDI), and total factor productivity (TFP)" are the most important determinants of economic growth.

Arısoy (2012) studied "the casual linkage of FDI, aggregate growth, and total factor productivity (TFP) in Turkey from 1960-2005 period using aggregate production function". According to the results, FDI positively affects growth and TFP through the chosen channels of FDI i.e., technology spillovers and physical capital accumulation.

Saleem et al. (2019) studied "the factors of total factor productivity (TFP) and economic growth in Pakistan using time series data from 1972-2016". According to the results, the majority of factors had significant effects. In addition to that innovation also significantly affected economic growth and production level in Pakistan. These results may be important for policy making for sustainable growth in emerging economies and Pakistan.

Nachega and Fontaine (2006) studied "determinants of total factor productivity (TFP) and sources of aggregate output growth in Niger based on data from 1963-2003". As per results, negative growth of both physical capital per capita and TFP created the erosion in output per capita. In order to raise TFP growth it is essential to make strong economic policies and to get official development assistance and structural reforms in Niger.

3.2 LABOR PRODUCTIVITY AND ECONOMIC GROWTH

"Labor Productivity and Economic Growth" have been researched by a few researchers.

Korkmaz and Korkmaz (2017) studied "the relationship between labor productivity (a part of factor productivity) and economic growth in seven countries from the OECD using panel data from a period from 2008-2014". According to the results a unidirectional causality relationship exists from economic growth towards labor productivity.

Auzina-Emsina (2014) studied "the relationship of labor productivity and economic growth in a set of European Union countries". Specifically, "the focus is on the role of changes in labor productivity and its consequence for country's global competitiveness in post-crisis period in comparison with pre-crisis and crisis periods in the European Union countries (Latvia, Lithuania, and Estonia) which first had an intense crisis and then had swift recovery". According to the results, "in the pre-crisis period as well as the first phase of the post-crisis period there are weak or no association between the rise in productivity levels and economic growth; on the other hand, during the crisis the rise in productivity levels becomes a significant driver of the economic growth after a period of time".

Alani (2012) studied "the impact of productivity growth on capital accumulation, employment, and economic growth in Uganda from a period from 1972-2008". As per the results, "productivity growth might have reduced the economic growth", and also "productivity growth might have triggered unemployment and depleted capital stock". Moreover, growth of both "capital

productivity and labor productivity" might have triggered unemployment as well as a fall in capital accumulation and economic growth. Further, technical progress might have contributed to employment, capital accumulation and economic growth.

Su and Heshmati (2011) studied "the source and the development of labor productivity in terms of levels and growth rate in multiple Chinese provinces from a period of 2000-2009". Initially, "in order to define several possible determinants a production function was tested for measuring the contribution of labor and other production factors (at levels and growth rate) towards the gross domestic product". According to the results, "regional breakdown exhibits a severe disparity in the economy in cities with highest labor productivity in regions".

Jajri and Ismail (2010) studied "the extent of benefit to the Malaysian economy from the educational expansion". They considered "productivity" in terms of "quality of labor and capital stock", and further considered "effective labor and level of education obtained" as indicators for "quality of labor". The analysis was based on the data from 1981-2007. According to the results, the capital stock has a significant contribution towards economic growth and the capital-labor ratio has a significant contribution towards labor productivity in Malaysia. The contribution of effective labor is positive in economic growth but it is less as compared to physical labor. They suggested the role of the education system in producing a workforce for their efficient use in the labor market in Malaysia.

Rudolf and Zurlinden (2010) studied "the sources of economic growth in Switzerland during a period from 1991-2006". According to the results, both labor input and capital input exhibited a 65% contribution to the annual GDP growth. Whereas, 35% represents growth in multi-factor productivity considered as residual. "As this study also considers the changes in labor quality in the measure of labor input, therefore the estimate of growth in multi-factor productivity is lower" as compared to older studies.

3.4 GAP ANALYSIS

The review of recent literature in the area of "total factor productivity" and "labor productivity" highlights the limited research work done on proper measurement of "labor productivity" as an individual segregated cause or determinant of "economic growth and development".

The issue of measurement of "labor productivity" exists due to certain reasons in the practice of researchers in this area of research. "Total factor productivity" (TFP) is found to be the common measure for all the key factors of productivity joined together which include "capital productivity, labor productivity, and technological progress", etc.

Generally, economists find it difficult to believe that "an increase in productivity results in output growth". Economists commonly use TFP for productivity that is included in it "which cannot be used by policy makers to affect economic growth because TFP is an outcome not a cause of anything". Economists frequently interpret TFP "as a measure of technological progress and promoter of economic growth" because "many factors of TFP are not measured directly"; instead "it is lumped together as residual and thus kept aggregated within pure TFP framework".

The issue of measurement of labor productivity must be essentially attended to by "adopting the proper segregated measures of all the key factors of productivity to determine the accurate effect of each factor on the outcome of economic growth". It will help policy makers "to identify and realize the true value of labor productivity" and "utilize it more than capital productivity", which can prove to be less costly for their efforts toward having better economic growth and development.

3.5 DEVELOPMENT OF HYPOTHESES STATEMENTS

The hypotheses statements were developed for statistical and empirical testing according to the research model developed. These hypothesis statements are listed below

$H1_0$ Statistically significant causal association does not exist between "Labor Productivity Growth" and "Economic Growth" in Pakistan.

$H1_A$ Statistically significant causal association does exist between "Labor Productivity Growth" and "Economic Growth" in Pakistan.

$H2_0$ Statistically significant causal association does not exist between "Labor Productivity Growth" and "Economic Growth" in India.

$H2_A$ Statistically significant causal association does exist between "Labor Productivity Growth" and "Economic Growth" in India.

3.6 THEORETICAL AND ECONOMETRIC MODELING AND EQUATIONS

The theoretical model for the current study is developed according to the selection of variables from the hypotheses "Labor Productivity growth" (based on "GDP per person employed") and "Economic Growth" (based on "GDP growth").

In the theoretical model, "Labor Productivity growth" is an independent variable & "Economic Growth" is a dependent variable in this model. In the econometric model, "GDP per person employed" (used as "Labor Productivity growth") is an independent variable & "GDP growth" (used as "Economic Growth") is a dependent variable. The theoretical model is illustrated in the Figure 1.

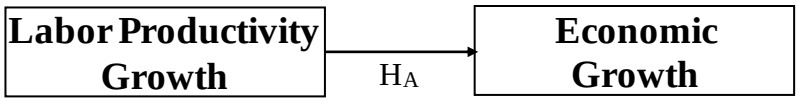

Figure 1: Theoretical Model

A data transformation process was used to convert "Labor Productivity" into "Labor Productivity growth" by transforming GDP per person employed. It was transformed from non-percentage annual data into growth rate annual data (annual %) to attain its Growth rate form.

Based on the theoretical model, the econometric model is devised and further the econometric equations are developed according to the applicable procedures for statistical analyses from the appropriately adopted econometric methodology.

General Time Series Regression Model

$Y_t = \alpha + \beta X_t + \varepsilon_t$ (time series)

General ARDL Time Series regression Model (ARDL time series "1, 1")

$Y_t = \alpha + \beta 0 X_t + \beta 1 X_{t-1} + \gamma 1 Y_{t-1} + \varepsilon_t$

Specific ARDL Time Series regression Model (ARDL time series "1, 1")

$GG_t = \alpha + \beta 0\ (GPPE)_t + \beta 1\ (GPPE)_{t-1} + \gamma 1\ (GG)_{t-1} + \varepsilon_t$

where,

Y or GG = Dependent / Response variable

X or GPPE = Independent / Explanatory variable (Predictor or Regressor)

α = Constant or Intercept

β and γ = Coefficients

ϵ = Error term

t = time period

t-1 = lagged time period

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

The fourth chapter consists of an overall design and methodology of the entire research process being carried out during the study that is presented in terms of research design; population and sampling; data measurement, sources, and collection; design and methodology of econometric analyses (procedures, techniques, and tools).

4.1 RESEARCH DESIGN

This study is an observational and field study. This study uses Longitudinal Time-series data. This study is Applied, Descriptive, and Empirical research.

The Methodology of this study is built on a Deductive Research Approach. The Method of this study is built on a Multivariate Quantitative Research Approach.

4.2 POPULATION AND SAMPLING

The Population and sampling are designed as mentioned below

4.2.1 Sampling Approach and Technique

A Non-probability sampling approach is selected as a suitable approach and further a Convenience sampling technique is selected as a suitable sampling technique for taking a sample in this study.

4.2.2 Sampling Frame and Sources of Sample

The focus of the research is two countries i.e., Pakistan and India. The reason for this selection is that Pakistan is the country of origin for the current study which makes it relevant to the researcher, whereas, India is the neighboring country of Pakistan due to which it is a common practice to use these countries for comparison studies. Pakistan and India have different sizes

of populations and economies but are considered relevant for comparison studies since both became independent states at the same time.

This study considered electronic or online databases for economic and/or financial data sets and visualizations as the sampling frame. This study utilized "The United Nations Development Programme (UNDP)" and the World Bank's "World Development Indicators (WDI)" as sources of the sample.

4.2.3 Population and Sample Size

The annual data sets for a period of 30 years (1991-2020) for Pakistan were taken as a sample from the available data from the population. The same data sets for India were also taken as a sample for comparative analysis.

4.3 DATA MEASUREMENT, SOURCES AND COLLECTION

The available data were evaluated for collection of the data sets from those certain sources as mentioned below

4.3.1 Data Measurement Tool and Scale

Data sets for a variety of economic and financial indicators existing within the databases, based on the ratio scale of measurement, were considered as data measures of this study.

4.3.2 Data Type and Format

Quantitative (Numerical-Continuous) data type was considered for this study. Longitudinal (Time series) data format (secondary sourced data from electronic databases) was considered for this study.

Annual time-period ranged (Time series) data sets of each variable for a single country level were considered for this study. These data sets were based on the following

- "GDP per person employed" (constant 2017 PPP $), Equivalent to the "*Labor Productivity Growth*" variable
- "GDP Growth" (annual %), Equivalent to the "*Economic Growth*" variable

A data transformation process was used to convert "Labor Productivity" into "Labor Productivity growth" by transforming GDP per person employed. It was transformed from non-percentage annual data into growth rate annual data (annual %) to attain its Growth rate form. See the ***Appendix*** section for the complete data tables.

4.3.3 Data Sources and Collection

Secondary sources of data for accessing external data of any type for multiple purposes were used for this study.

Collection of previous research material for review (literature and methodology) was carried out from offline and online resources (databases and publishers) in the form of books, journals, and reports of non-government and government organizations.

Collection of data sets for empirical analyses (time series data sets ranging a period of 1991 to 2020) was carried out from the electronic databases of economic and financial nature ("the UNDP and the World Bank"). See the ***Appendix*** section for the complete data tables.

4.3.4 Validity and Reliability

Certain tests (diagnostics) for the validity and reliability of models based on time series data were applied.

4.3.5 Data Transformation

Data Transformation shall be performed for smoothing and normalization of time series data for different variables that might serve certain purposes for econometric modeling and also lead to improvement in regression analysis results. Such transformation has been applied and described where necessary.

"GDP Growth" (Equivalent to "Economic Growth" variable) was available in the form of annual %, whereas, "GDP per person employed" (Equivalent to "Labor Productivity Growth" variable) was not in a similar form of annual %, as a result, these variables presented dissimilar data formats and thus required normalization for improvement in analysis results. For this purpose, "GDP per person employed" was transformed by converting non-

percentage annual data into growth rate annual data (annual %) to make it similar to "GDP Growth".

Moreover, the data transformation process also resulted in the conversion of "Labor Productivity" into "Labor Productivity growth" by transforming "GDP per person employed" from non-percentage annual data into growth rate annual data (annual %) to attain its Growth rate form.

4.4 DESIGN AND METHODOLOGY OF ECONOMETRIC ANALYSES (PROCEDURES, TECHNIQUES AND TOOLS)

The econometric analyses of the data are conducted according to procedures, techniques, and tools. The detailed design and methodology of econometric analyses in terms of procedures, techniques, and tools have been presented next

4.4.1 Procedures of Model Specification and Estimation

The design of procedures for model specification and estimation shall be adopted on the basis of the nature of the econometric data utilized.

Model specification and Estimation stages of time series regression analysis will take the following procedural steps

- Checking the order of stationarity using the most suitable test(s) selected from appropriate tests for unit root.
- Checking the level of co-integration using the most suitable test(s) selected from appropriate tests for co-integration.
- Specifying the regression approach of the time series model applicable according to the output of previous steps.
- Estimating the specified model by utilizing the presently specified regression approach to get the output of regression in the most applicable form.

4.4.2 Techniques for Statistical Analyses

The selection of multiple statistical analyses techniques done depending on outcomes (results) at each stage of the analyses procedures is described below

4.4.2.1 Descriptive Statistics

Descriptive Statistics are measures useful to determine the normality or normal distribution of a data series. There are many sets of test statistics included as listed below

1. "Mean and Median"
2. "Maximum and Minimum"
3. "Std. Dev."
4. "Skewness and Kurtosis"
5. "Jarque-Bera and Probability"
6. "Sum and Sum Sq. Dev."

4.4.2.2 Correlation Analysis

The "Correlation Analysis" is used for the identification and quantification of the relationship between several variables in the model. Pearson Correlation Analysis is a simple and common method used to detect whether multiple time series are correlated.

4.4.2.3 Time Series Regression Analyses

As per the model and data, the time series regression analysis technique is required in this study. The time series regression analysis techniques which can be best suitable for the data being used in the current research are the following

1. "Ordinary Least Squares (OLS)" regression technique for the estimation of the regression relationship between the variables in the model
2. "Vector Auto-Regressive (VAR)" regression technique for the estimation of the regression relationship between the variables in the model

Such regression analysis process can be carried out in multiple stages having various methods to be applied which are chosen depending on the

outcomes. The entire process has been carried out using statistical analysis programs. The stages and methods are presented and discussed thoroughly in the next part of this chapter.

4.4.2.4 Stationarity Check with Unit Root Tests

In general, regular inference procedures are not applicable to the cointegrating regressions (regression model based upon integrated dependent variable or integrated regressor). Hence, "it must be determined whether a series is stationary or not before it is considered for a regression". Here, "unit root testing" is a well-recognized method used to test the "stationarity of a time series data set". There are a variety of "unit root tests" for the purpose of testing a series for the presence of a unit root

1. "ADF (1979) by Dickey and Fuller (1979)"
2. "PP (1988) by Phillips and Perron (1988)"
3. "KPSS (1992) by Kwiatkowski, Phillips, Schmidt, and Shin (1992)"
4. "The GLS-detrended Dickey-Fuller (1992, 1996) by Elliott, Rothenberg, and Stock (1996); Elliott, Rothenberg, and Stock (1992)"
5. "ERS Point Optimal (1992, 1996) by Elliott et al. (1996); Elliott et al. (1992)"
6. "NP (2001) by S. Ng and Perron (2001)"

4.4.2.5 Optimal Lag Order Selection and Model Selection Criteria

"Lag length criteria" or "Lag Order Selection Criteria" indicates "a definite way of selecting the optimal lags for applying any regression technique to a time series model".

"The Model Selection Summary shows the model selection value for the best models" using the criteria of "Akaike Information Criterion (AIC), the Schwarz Criterion (SC/SIC/BIC), or the Hannan-Quinn (HQ) criterion".

4.4.2.6 Co-integration Check with Engle-Granger, Phillips-Ouliaris, or Johansen tests

In 1987, Engle and Granger "developed the concept of cointegration of non-stationary time series for the purpose of determining correlations between them". Their work helped to establish the fact that "two or more non-stationary time series can be found cointegrating in a way that they can move considerably apart from equilibrium".

"Cointegration is a statistical property of a collection of time series variables. Economic theory suggests that many time series datasets will move together, fluctuating around a long-run equilibrium. Two sets of variables are cointegrated if a linear combination of those variables has a lower order of integration."

"Cointegration test is a technique used to determine a possible correlation between time series processes in a long-term period of time". There are a few traditional methods for checking cointegration whereas some modern methods also exist. These Cointegration testing methods are listed below

1. "Engle-Granger Two-Step Method by Engle and Granger (1987)"
2. "Johansen Test by Johansen (1991, 1995)"
3. "Philip-Ouliaris Test by Phillips and Ouliaris (1990)"
4. "ARDL bounds test by Pesaran and Shin (1999); Pesaran, Shin, and Smith (2001)"

4.4.2.7 "Ordinary Least Squares (OLS)" and Vector Auto-Regressive (VAR)" regression Analyses

The time series regression analysis techniques which can be best suitable for the data being used in the current research are the following

1. "Ordinary Least Squares (OLS)" regression technique for the estimation of the regression relationship between the variables in the model
2. "Vector Auto-Regressive (VAR)" regression technique for the estimation of the regression relationship between the variables in the model

OLS and VAR models can be appropriate to analyze the relationship when all the variables of interest are stationary because in this case, these can provide unbiased estimates.

4.4.2.8 Causality Analysis

Causality analysis is different from regression analysis as it is not intended for cause and effect relationships but in fact, it is related to correlation. "Causality is based on a prediction of one time series through another and it is used to check the direction of movement among multiple time series".

The "*Granger causality*" test is "a statistical hypothesis test for determining whether single time series is useful in forecasting another, first proposed in 1969 and later reintroduced in 1980 by Clive Granger (Granger, 1969, 1980)". "The *Granger causality* test is commonly used for causality analysis". Its hypothesis states that "a variable does not Granger Cause another variable and this hypothesis is used for bidirectional causality."

4.4.2.9 Tools for Statistical Analyses

"EViews" software (Version 10) and "*Microfit*" software (Version 5).

CHAPTER 5

EMPIRICAL RESULTS AND DISCUSSION ECONOMY OF PAKISTAN

The fifth chapter is based on the overall outcomes of the econometric analyses of the data performed during the research process of the study, and the discussion is presented in terms of descriptive statistics; time series regression analyses; causality analysis; residual and stability diagnostics; results of hypotheses testing. It includes a discussion of the results as well.

5.1 DESCRIPTIVE STATISTICS

The "descriptive statistics" for the available data are presented in the Table-1.

Table 1
Descriptive Statistics Table (Pakistan)

Statistics	GG	GPPE
Mean	4.027440	0.012726
Median	4.328272	0.010274
Maximum	7.705898	0.050207
Minimum	0.525527	-0.033690
Std. Dev.	1.913416	0.021253
Skewness	-0.052077	-0.089506
Kurtosis	2.246793	2.174350
Jarque-Bera	0.722710	0.892179
Probability	0.696732	0.640127
Sum	120.8232	0.381773
Sum Sq. Dev.	106.1736	0.013099
Observations	**30**	**30**

As shown in the results for "descriptive statistics", the overall descriptive statistics are satisfactory. For both variables GG and GPPE, "Skewness and Kurtosis" are within normal limits; and insignificant levels of "Jarque-Bera and its Probability" also prove that there is no abnormality in data distribution as it is a normal data distribution.

The "descriptive statistics Histogram" for GG is presented in the Figure-2.

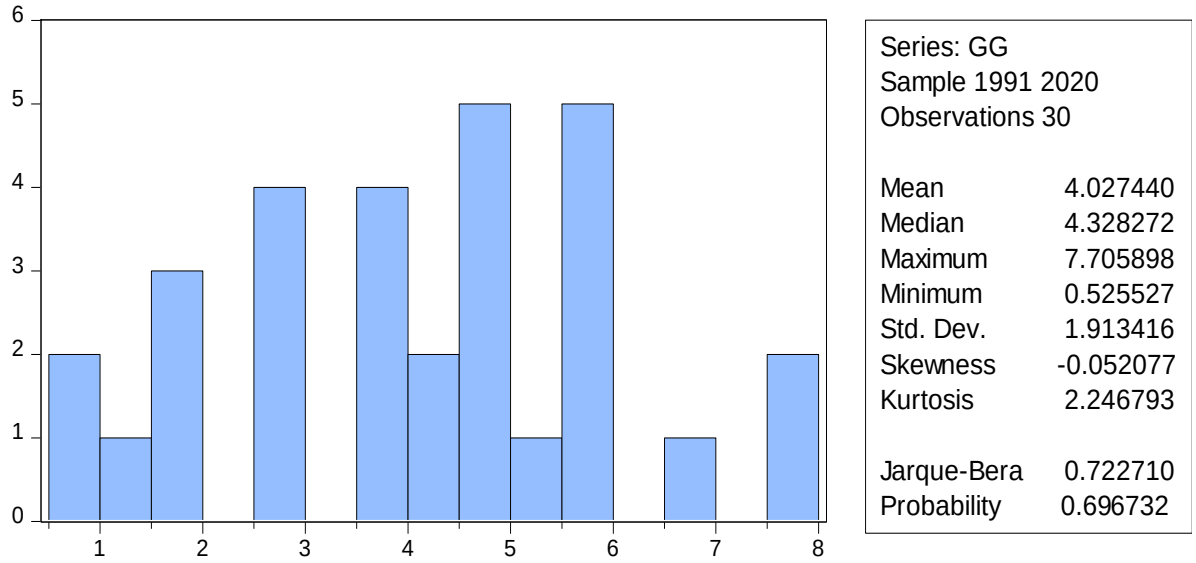

Figure 2: Descriptive Statistics Histogram – GG (Pakistan)

The "descriptive statistics Histogram" for GPPE is presented in the Figure-3.

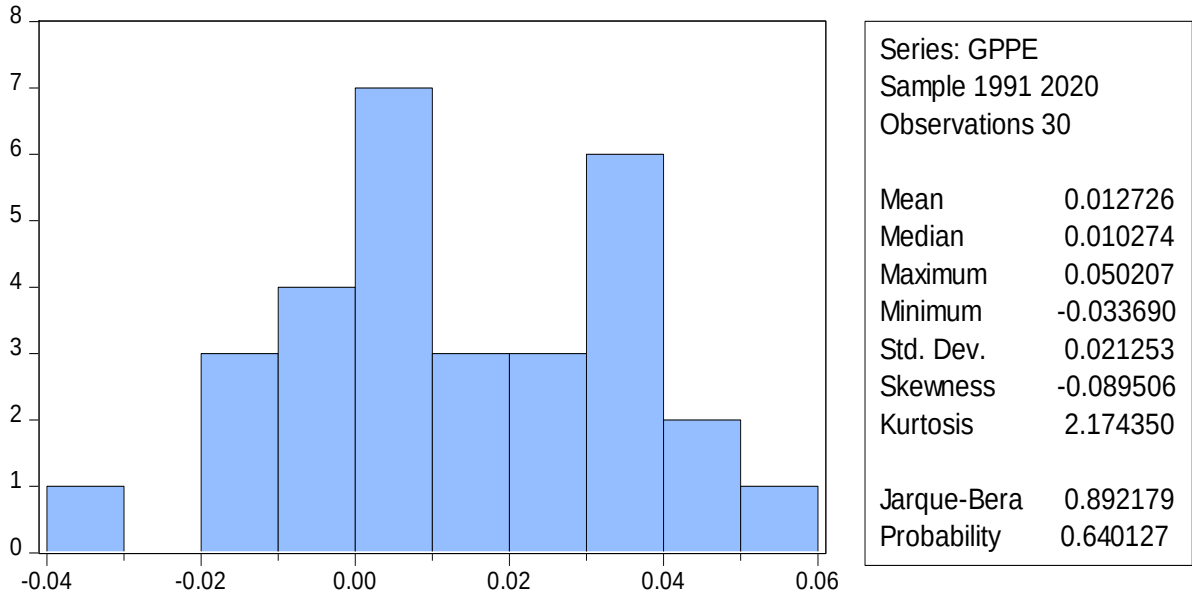

Figure 3: Descriptive Statistics Histogram – GPPE (Pakistan)

5.2 CORRELATION ANALYSIS

The "Correlation Analysis" is used for the identification and quantification of the relationship between several variables in the model. Pearson Correlation Analysis is a simple and common method used to detect whether multiple time series are correlated.

The "Correlation Analysis" for the available data is presented in the Table-2.

Table 2
Correlation Analysis Table (Pakistan)

	GG	**GPPE**
GG	1	0.772039
GPPE	0.772039	1

The result of "Correlation Analysis" in the form of a Correlation matrix, shows the value of the Correlation coefficient (0.772) that indicates a strong and positive association between both variables GG and GPPE. These results prove that there is a strong and positive Correlation between both variables of the model.

5.3 TIME SERIES REGRESSION ANALYSES

As per the model and data, the time series regression analysis technique is required in this study. The process of such regression analysis has multiple stages having various methods to be applied which are chosen depending on the outcomes. The entire process has been carried out using statistical analysis programs. The results are presented and discussed thoroughly in the next part of this chapter.

5.3.1 Stationarity Check with Unit Root Tests

The "Augmented Dickey-Fuller (ADF)" was applied to the series of data for both GG and GPPE. The results of "Unit Root Tests" (ADF test) are presented in the Table-3.

Table 3
Unit Root Tests-ADF (Pakistan)

Null Hypothesis the Variable has a Unit Root			
At Level			
		GG	**GPPE**
With Constant	t-Statistic	***-3.1696***	***-3.6427***
	Prob.	***0.0324***	***0.0109***
		**	**
With Constant & Trend	t-Statistic	-3.1435	-3.6488
	Prob.	0.1155	0.0429
		n0	**
Without Constant & Trend	t-Statistic	-1.5172	-2.9666
	Prob.	0.1190	0.0044
		n0	***
At First Difference			
		d(GG)	**d(GPPE)**
With Constant	*t-Statistic*	-6.6217	-6.6395
	Prob.	0.0000	0.0000
		***	***
With Constant & Trend	*t-Statistic*	-6.4809	-6.5341
	Prob.	0.0001	0.0001
		***	***
Without Constant & Trend	*t-Statistic*	-6.6413	-6.7578
	Prob.	0.0000	0.0000
		***	***

a "(*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%; (no) Not Significant"
b "Lag Length based on SIC"
c "Probability based on MacKinnon (1996) one-sided p-values"

In this study, an "Augmented Dickey-Fuller test (ADF test)" has been estimated by applying certain settings to the data on the GG and GPPE "The regression has a constant and it employs an automatic lag length selection utilizing SIC (Schwarz Information Criterion) along with maximum lag length". The results are described below.

The results indicate that GG has a "unit root at level" because the ADF statistic value (-3.1696) and associated p-value (0.0324) are significant at 5% significance level. The results indicate that GPPE has a "unit root at level" because the ADF statistic value (-3.6427) and associated p-value (0.0109) both are significant at 5% significance level. Consequently, the presence of "unit root" for both variables is confirmed.

5.3.2 OLS Regression

The "Ordinary Least Squares (OLS)" regression analysis technique was applied to the model based on time series data for both GG and GPPE. The results of "OLS regression analysis" are presented in the Table-4

Table 4
OLS Regression Analysis (Pakistan)

"Dependent Variable GG
Method Least Squares Sample 1991 2020
Included observations 30"

OLS Regression				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
GPPE	69.5064	10.8136	6.4276	0.0000
C	3.1429	0.2645	11.8794	0.0000
R-squared	0.5960	Mean dependent var		4.0274
Adjusted R-squared	0.5816	S.D. dependent var		1.9134
S.E. of regression	1.2376	Akaike info criterion		3.3286
Sum squared resid	42.889	Schwarz criterion		3.4220
Log likelihood	-47.929	Hannan-Quinn criter.		3.3585
F-statistic	41.314	Durbin-Watson stat		1.1678
Prob(F-statistic)	0.000001			

The "OLS regression analysis" results indicate that "the Coefficient value (69.5064) for GPPE is positive and very high" which shows that 1 unit change (increase) in GPPE causes 6950% change (increase) in GG. Moreover, "the t-statistic value (6.4276) and p-value (0.0000) are positive and highly significant at 5% level of significance for GPPE" which shows that there is a statistically significant and positive relationship between GG and GPPE. Further, results of the whole model indicate that "R-squared (0.5960) and Adjusted R-squared (0.5816) are also satisfactory" which shows that about 59% of changes in GG are explained by the changes in GPPE. Moreover, "the F-statistic value (41.314) and p-value (0.000001) are positive and highly significant at 5% level of significance for the model" which shows the overall significance of the model and that the independent variable in the model (GPPE) significantly affects the dependent variable in the model (GG).

The overall results of "OLS regression analysis" proved the existence of a statistically significant and positive relationship between GG and GPPE.

5.4 RESULTS OF HYPOTHESIS TESTING (PAKISTAN)

The results of Hypothesis Testing are presented in the Table-5

Table 5
Results of Hypothesis Testing (Pakistan)

No.	Statements	Result
$H1_0$	Statistically significant causal association does not exist between "Labor Productivity Growth" and "Economic Growth" in Pakistan.	**Supported**
$H1_A$	Statistically significant causal association does exist between "Labor Productivity Growth" and "Economic Growth" in Pakistan.	

The hypothesis was developed to test the causal association between "Labor Productivity Growth" and "Economic Growth" in Pakistan. This Hypothesis testing was based on testing, regression relation between "Labor Productivity Growth" and "Economic Growth" in Pakistan. For this purpose, the "Ordinary Least Squares (OLS)" based time series regression analysis was conducted.

The OLS regression analysis results highlighted the "significant and positive causal relationship" between "Labor Productivity Growth" and "Economic Growth" in Pakistan.

The overall analysis proved the existence of a causal association between "Labor Productivity Growth" and "Economic Growth" in Pakistan. The satisfactory results proved that this hypothesis is fully supported in this study.

5.5 DISCUSSION ON THE RESULTS – ECONOMY OF PAKISTAN

The results presented earlier are discussed thoroughly in this section.

The "descriptive statistics" highlight normal data distribution for both variables GG and GPPE as values for "Skewness and Kurtosis" are within normal limits; and "Jarque-Bera" and its Probability are insignificant.

The "Pearson Correlation Analysis" was also applied to confirm the relationship between both variables in the model. The results proved the

existence of a strong and positive Correlation between both variables of the model.

"Stationarity Check" was applied with "Unit Root Test". Unit root testing has been carried out using "The Augmented Dickey-Fuller (ADF)" test for both GG and GPPE with a constant for regression and an automatic lag length selection utilizing "SIC (Schwarz Information Criterion)" along with maximum lag length. The presence of a "unit root" in the data for both variables is confirmed as both GG and GPPE have a unit root "at level".

The "Ordinary Least Squares (OLS)" regression analysis was selected for this model for testing the causal association between GG and GPPE. The OLS regression analysis results proved the existence of a "significant and positive causal relationship" between "Labor Productivity Growth" and "Economic Growth" in Pakistan.

"Causality Analysis" was also carried out to test the causality between both variables of the model using the "Granger causality test" It is evident from the results that GPPE does not Granger Cause GG, and GG does not Granger Cause GPPE. Thus, "Granger causality" does not exist in any direction in the current model.

All the results of the statistical analyses discussed above demonstrated that the expected relationships as proposed in the hypothesized statements based on theoretical and econometric modeling of the current study were fully supported.

CHAPTER 6

EMPIRICAL RESULTS AND DISCUSSION COMPARISON OF PAKISTAN AND INDIA

The sixth chapter is based on the overall outcomes of the econometric analyses of the data performed during the research process of the study, and the discussion is presented in terms of descriptive statistics; time series regression analyses; causality analysis; residual and stability diagnostics; results of hypotheses testing. It includes a discussion of the results as well.

6.1 DESCRIPTIVE STATISTICS

The "descriptive statistics" for the available data are presented in the Table-6.

Table 6
Descriptive Statistics Table (India)

Statistics	GG	GPPE
Mean	5.812037	0.047050
Median	6.595957	0.052752
Maximum	8.845756	0.080881
Minimum	-7.251755	0.002255
Std. Dev.	3.117367	0.022936
Skewness	-2.597284	-0.434637
Kurtosis	11.36188	2.028109
Jarque-Bera	121.1308	2.125264
Probability	0.000000	0.345545
Sum	174.3611	1.411486
Sum Sq. Dev.	281.8214	0.015256
Observations	30	30

As shown in the results for "descriptive statistics", the overall descriptive statistics are varied. For variable GPPE, "Skewness and Kurtosis" are within normal limits; and insignificant levels of "Jarque-Bera and its Probability" also prove that there is no abnormality in data distribution as it is a normal data distribution. Whereas, for variable GG, "Skewness and Kurtosis" are not within normal limits; and significant levels of "Jarque-Bera and its Probability" also prove that there is some abnormality in data distribution as it is an abnormal data distribution.

The "descriptive statistics Histogram" for GG is presented in the Figure-4.

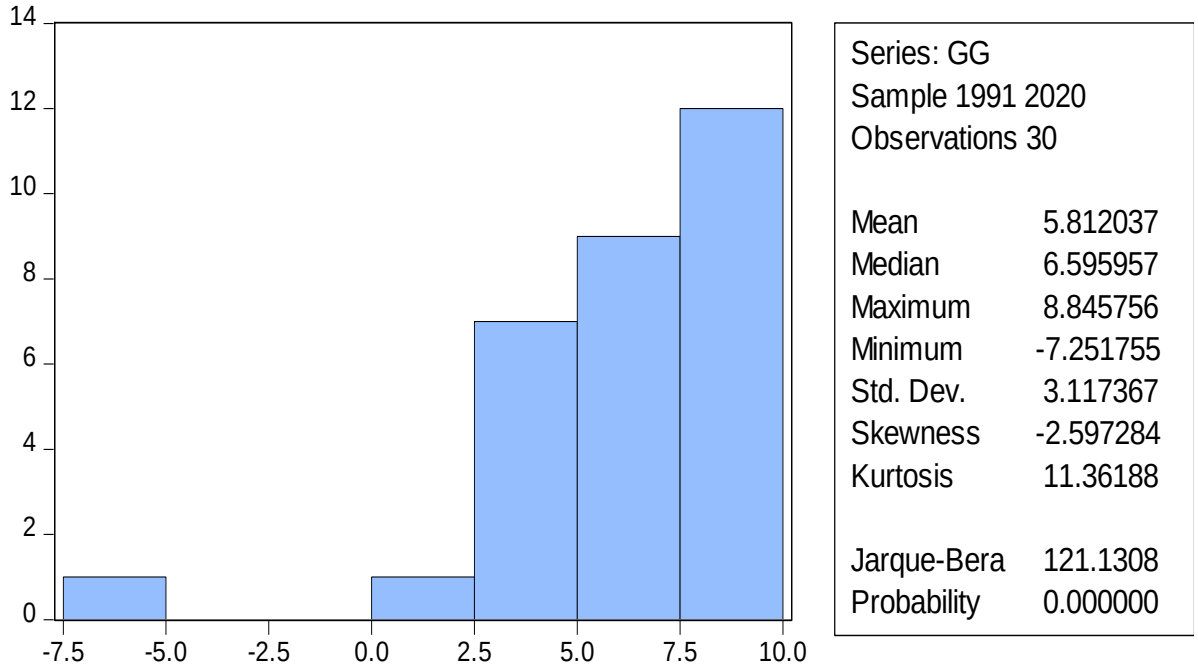

Figure 4: Descriptive Statistics Histogram – GG (India)

The "descriptive statistics Histogram" for GPPE are presented in the Figure-5.

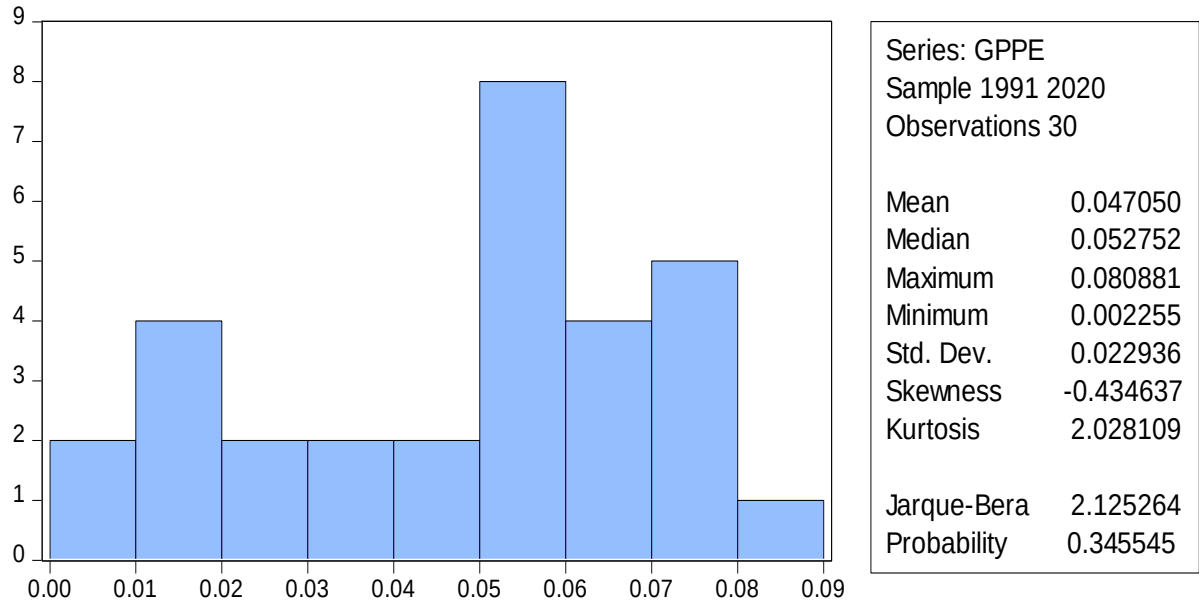

Figure 5: Descriptive Statistics Histogram – GPPE (India)

6.2 CORRELATION ANALYSIS

The "Correlation Analysis" is used for the identification and quantification of the relationship between several variables in the model. Pearson Correlation Analysis is a simple and common method used to detect whether multiple time series are correlated.

The "Correlation Analysis" for the available data is presented in the Table-7.

Table 7
Correlation Analysis Table (India)

	GG	GPPE
GG	1	0.699487
GPPE	0.699487	1

The result of "Correlation Analysis" in the form of a Correlation matrix, shows the value of the Correlation coefficient (0. 699) that indicates a strong and positive association between both variables GG and GPPE. These results prove that there is a strong and positive Correlation between both variables of the model.

6.3 TIME SERIES REGRESSION ANALYSES

As per the model and data, the time series regression analysis technique is required in this study. The process of such regression analysis has multiple stages having various methods to be applied which are chosen depending on the outcomes. The entire process has been carried out using statistical analysis programs. The results are presented and discussed thoroughly in the next part of this chapter.

6.3.1 Stationarity Check with Unit Root Tests

The "Augmented Dickey-Fuller (ADF)" was applied to the series of data for both GG and GPPE. The results of "Unit Root Tests" (ADF test) are presented in the Table-8

Table 8
Unit Root Tests – ADF (India)

Null Hypothesis the variable has a unit root			
At Level			
		GG	**GPPE**
With Constant	*t-Statistic*	-2.1072	-2.9161
	Prob.	0.2434	0.0557
		n0	*
With Constant & Trend	*t-Statistic*	-1.6682	-2.8903
	Prob.	0.7394	0.1799
		n0	n0
Without Constant & Trend	*t-Statistic*	-1.0595	-1.3741
	Prob.	0.2545	0.1536
		n0	n0
At First Difference			
		d(GG)	**d(GPPE)**
With Constant	*t-Statistic*	***-4.3714***	***-6.0252***
	Prob.	***0.0019***	***0.0000***
		*****	*****
With Constant & Trend	*t-Statistic*	-4.7479	-6.1187
	Prob.	0.0037	0.0002
		***	***
Without Constant & Trend	*t-Statistic*	-4.4461	-6.1487
	Prob.	0.0001	0.0000
		***	***

a "(*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%; (no) Not Significant"
b "Lag Length based on SIC"
c "Probability based on MacKinnon (1996) one-sided p-values"

In this study, an "Augmented Dickey-Fuller test (ADF test)" has been estimated by applying certain settings to the data on the GG and GPPE "The regression has a constant and it employs an automatic lag length selection utilizing SIC (Schwarz Information Criterion) along with maximum lag length". The results are described below.

The results indicate that GG has a "unit root at first difference" because the ADF statistic value (-4.3714) and associated p-value (0.0019) are significant at 1% significance level. The results indicate that GPPE has a "unit root at first difference" because the ADF statistic value (-6.0252) and associated p-value (0.0000) are significant at 1% significance level. Consequently, the presence of "unit root" for both variables is confirmed.

6.3.2 Optimal Lag Order Selection

"Lag length criteria" or "Lag Order Selection Criteria" indicates a definite way of selecting the optimal lags for applying any regression technique to a time series model. The "Lag Order Selection Criteria" is employed after an initial "VAR model" is applied to the variables "at level" with the default settings. The results of "Optimal Lag Order Selection" are presented in the Table-9

Table 9
Optimal Lag Order Selection (India)

VAR Lag Order Selection Criteria
"Endogenous variables GG GPPE
Exogenous variables C
Sample 1991 2020
Included observations 26"

Lag	LogL	LR	FPE	AIC	SC	HQ
0	4.079437	NA*	0.002922	-0.159957	**-0.063180***	-0.132089
1	9.434396	9.474158	0.002638	-0.264184	0.026146	-0.180580
2	**15.00050**	**8.991392**	**0.002356***	**-0.384654***	**0.099230**	**-0.245313***
3	16.08018	1.577997	0.003002	-0.160014	0.517423	0.035064
4	20.42569	5.682591	0.003019	-0.186591	0.684398	0.064222

* indicates lag order selected by the criterion
"LR sequential modified LR test statistic (each test at 5% level)"
"FPE Final prediction error"
"AIC Akaike information criterion"
"SC Schwarz information criterion"
"HQ Hannan-Quinn information criterion"

As per the results, most of the available criteria ("FPE, AIC, HQ") produced the lowest values for the model at the same lag order (2). As per the results, one available criterion ("SC") produced the lowest values for the model at different lag order (0). Consequently, based on all the criteria, it is quite easy to decide that the "optimal lag" for the model is lag order 2. This lag order 2 is now selected as the best possible lag order for the further regression analysis procedure.

6.3.3 Co-Integration Check with Engle-Granger Cointegration Test

The "Engle-Granger Cointegration Test" is a commonly used approach towards cointegration tests being used for the confirmation of the potential presence of cointegration in time series data and also the potential long-run relationship between variables.

The results of "Cointegration Test - Engle-Granger" are presented in the Table-10.

Table 10
Cointegration Test - Engle-Granger (India)

"Cointegration Test - Engle-Granger
Equation Untitled
Specification GG GPPE C
Cointegrating equation deterministic C
Null hypothesis Series are not cointegrated
Automatic lag specification (lag=1 based on Schwarz Info Criterion, maxlag=6)"

	Value	**Prob.***
Engle-Granger tau-statistic	-0.922729	0.9158
Engle-Granger z-statistic	-6.975343	0.5275
*MacKinnon (1996) p-values.		
Intermediate Results		
Rho - 1	-0.323159	
Rho S.E.	0.350221	
Residual variance	4.055950	
Long-run residual variance	2.410324	
Number of lags	1	
Number of observations	28	
Number of stochastic trends**	2	

**Number of stochastic trends in asymptotic distribution.
Engle-Granger Test Equation
Dependent Variable D(RESID)
Method Least Squares
Sample (adjusted) 1993 2020
Included observations 28 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.323159	0.350221	-0.922729	0.3646
D(RESID(-1))	-0.297205	0.309602	-0.959958	0.3459
R-squared	0.059477	Mean dependent var		-0.367815
Adjusted R-squared	0.023303	S.D. dependent var		2.037822
S.E. of regression	2.013939	Akaike info criterion		4.306811
Sum squared resid	105.4547	Schwarz criterion		4.401969
Log likelihood	-58.29536	Hannan-Quinn criter.		4.335902
Durbin-Watson stat	1.272679			

The "Engle-Granger Cointegration Test" results indicate that "the Engle-Granger tau-statistic value (-0.922729) and p-value (0.9158) are insignificant at 5% level of significance; and "the Engle-Granger z-statistic value (-6.975343) and p-value (0.5275) are also insignificant at 5% level of significance. These results for Engle-Granger tau-statistic and Engle-Granger z-statistic indicate the absence of Cointegration between the variables GG and GPPE in the model.

The "Engle-Granger Test Equation" results also indicate that "the t-statistic value (-0.922729) and p-value (0.3646) are insignificant at 5% level of significance for RESID (-1); and "the t-statistic value (-0.959958) and p-value (0.3459) are also insignificant at 5% level of significance for D(RESID(-1)). These results for Engle-Granger Test Equation also indicate the absence of Cointegration between the variables GG and GPPE in the model.

6.3.4 VAR Regression

The "Vector Autoregressive" model based regression is a commonly used approach towards time series based regression analysis being used for the testing of the causal relationship between variables of a regression model. According to the results of Cointegration testing the absence of Cointegration between the variables GG and GPPE in the model is confirmed. Therefore, the "Standard or Unrestricted" VAR Regression analysis option is selected.

The results of "Vector Autoregression" are presented in the Table-11.

Table 11
Vector Autoregression (India)

"Vector Autoregression Estimates		
Sample (adjusted) 1993 2020		
Included observations 28 after adjustments		
Standard errors in ( ) & t-statistics in [ ]"		
	GG	GPPE
GG(-1)	-0.955414	-0.014794
	(0.83077)	(0.00575)
	[-1.15003]	[-2.57276]
GG(-2)	0.556809	0.003581
	(0.44960)	(0.00311)
	[1.23845]	[1.15068]
GPPE(-1)	131.4841	1.662109
	(67.7609)	(0.46902)
	[1.94041]	[3.54378]
GPPE(-2)	-116.3206	-0.790069
	(48.5609)	(0.33612)
	[-2.39536]	[-2.35053]
C	7.996538	0.078724
	(3.51506)	(0.02433)
	[2.27493]	[3.23564]
R-squared	0.276220	0.404621
Adj. R-squared	0.150345	0.301077
Sum sq. resids	186.8636	0.008953
S.E. equation	2.850352	0.019729
F-statistic	2.194400	3.907712
Log likelihood	-66.30472	72.94188
Akaike AIC	5.093195	-4.852991
Schwarz SC	5.331088	-4.615097
Mean dependent	5.993638	0.047604
S.D. dependent	3.092268	0.023599
Determinant resid covariance (dof adj.)		0.001681
Determinant resid covariance		0.001134
Log likelihood		15.48748
Akaike information criterion		-0.391963
Schwarz criterion		0.083825
Number of coefficients		10

The "VAR regression analysis" results indicate that "the Coefficient value (-0.014794) and further t-statistic value (-2.57276) for GPPE with reference to GG(-1) is negative and significant at 5% level of significance for

GPPE" which shows that there is a statistically significant and negative relationship between GG and GPPE.

Further, results of the whole model indicate that "R-squared (0.4046) and Adjusted R-squared (0.3010) are also satisfactory" which shows that about 40% of changes in GG are explained by the changes in GPPE. Moreover, "the F-statistic value (3.9077) is also significant at 5% level of significance for the model" which shows the overall significance of the model and that the independent variable in the model (GPPE) significantly affects the dependent variable in the model (GG).

6.4 CAUSALITY ANALYSIS

"The Granger causality test" is commonly used for causality analysis. Its hypothesis states that "a variable does not Granger Cause another variable and this hypothesis is used for bidirectional causality".

"Granger causality is a useful tool for characterizing the dependence among time series in reduced-form VARs." VAR Granger Causality Test is used for the VAR-based regression models for time series data.

The results of "VAR Granger Causality Tests" are presented in the Table-12.

Table 12
VAR Granger Causality Tests (India)

VAR Granger Causality/Block Exogeneity Wald Tests
Sample 1991 2020
Included observations 28

Dependent variable GG			
Excluded	Chi-sq	df	Prob.
GPPE	6.061607	2	0.0483
All	6.061607	2	0.0483
Dependent variable GPPE			
Excluded	Chi-sq	df	Prob.
GG	6.775496	2	0.0338
All	6.775496	2	0.0338

The first null hypothesis to be rejected is that "GPPE does not Granger Cause GG". As per the results, the corresponding null hypothesis is rejected because it is significant in terms of Chi-square (6.0616) and p-value (0.0483). Consequently, the alternate hypothesis is accepted which proves that GPPE Granger Causes GG.

The second null hypothesis to be rejected is that "GG does not Granger Cause GPPE". As per the results, the corresponding null hypothesis is rejected because it is significant in terms of Chi-square (6.7754) and p-value (0.0338). Consequently, the alternate hypothesis is accepted which proves that GG Granger Causes GPPE.

The overall results show that bidirectional causality exists as causality runs from GG to GPPE and from GPPE to GG.

6.5 RESULTS OF HYPOTHESIS TESTING (INDIA)

The results of Hypothesis Testing are presented in the Table-13.

Table 13
Results of Hypothesis Testing (India)

No.	Statements	Result
$H2_0$	Statistically significant causal association does not exist between "Labor Productivity Growth" and "Economic Growth" in India.	**Supported**
$H2_A$	Statistically significant causal association does exist between "Labor Productivity Growth" and "Economic Growth" in India.	

The hypothesis was developed to test the causal association between "Labor Productivity Growth" and "Economic Growth" in India. This Hypothesis testing was based on testing, regression relation between "Labor Productivity Growth" and "Economic Growth" in India. For this purpose, the "Vector Autoregressive (VAR)" based time series regression analysis was conducted.

The VAR regression analysis results highlighted the "significant and positive causal relationship" between "Labor Productivity Growth" and "Economic Growth" in India.

The overall analysis proved the existence of a causal association between "Labor Productivity Growth" and "Economic Growth" in India. The satisfactory results proved that this hypothesis is fully supported in this study.

6.6 DISCUSSION ON THE RESULTS – ECONOMY OF INDIA

The results presented earlier are discussed thoroughly in this section.

The overall "descriptive statistics" are varied as descriptive statistics highlight the normal data distribution for the variable GPPE and the abnormal data distribution for the variable GG.

The "Pearson Correlation Analysis" was also applied to confirm the relationship between both variables in the model. The results proved the existence of a strong and positive Correlation between both variables of the model.

"Stationarity Check" was applied with "Unit Root Test". Unit root testing has been carried out using "The Augmented Dickey-Fuller (ADF)" test for both GG and GPPE with a constant for regression and an automatic lag length selection utilizing "SIC (Schwarz Information Criterion)" along with maximum lag length. The presence of a "unit root" in the data for both variables is confirmed as both GG and GPPE have a unit root "at first difference".

"Optimal Lag Order Selection" for the regression technique was conducted using "Lag length criteria or Lag Order Selection Criteria". The "Lag Order Selection Criteria" was employed after the application of an initial VAR on the variables "at level" with the default settings. Most of the available criteria ("FPE, AIC, HQ") produced the lowest values for the model at the same lag order (2). Whereas, one available criterion ("SC") produced the lowest values for the model at different lag order (0). Consequently, based on all the criteria, the lag order 2 was decided as the "optimal lag" for the model and used for the further regression analysis procedure.

"Co-integration Check" was applied with the "Engle-Granger Cointegration Test" for the confirmation of the potential presence of cointegration in time series data and also the potential long-run relationship between variables. The results for Engle-Granger tau-statistic and Engle-Granger z-statistic indicated the absence of Cointegration between the variables GG and GPPE in the model. The results for Engle-Granger Test

Equation also indicated the absence of Cointegration between the variables GG and GPPE in the model.

The "Vector Autoregressive (VAR)" regression analysis was selected for this model for testing the causal association between GG and GPPE. The "VAR regression analysis" results proved the existence of a "significant and negative causal relationship" between "Labor Productivity Growth" and "Economic Growth" in India.

"Causality Analysis" was also carried out to test the causality between both variables of the model using the "Granger causality test" It is evident from the results that GPPE Granger Causes GG, and GG Granger Causes GPPE. Thus, bidirectional "Granger causality" exists as causality runs from GG to GPPE and GPPE to GG.

All the results of the statistical analyses discussed above demonstrated that the expected relationships of variables based on the theoretical and econometric modeling of the current study were fully supported.

6.7 COMPARISON OF PAKISTAN AND INDIA

The results of Regression analyses have been presented and discussed in detail earlier for the economy of Pakistan (*Chapter 5*) and the economy of India (*Chapter 6*). A comparison of findings from Correlation Analyses; Regression Analyses; and Causality Analyses are given next.

6.7.1 Comparison of Correlation Analyses – Pakistan and India

"Correlation analyses results suggest that a strong and positive association between both variables GG and GPPE in the case of both Pakistan and India exists." Results indicated that the Correlation coefficient (0.772) for Pakistan and the Correlation coefficient (0. 699) for India are strong and positive. Therefore, a strong and positive association between both variables GG and GPPE in the case of both Pakistan and India exists. These results are similar and close to each other in the case of both Pakistan and India.

6.7.2 Comparison of Regression Analyses-Pakistan and India

"Regression analyses results suggest that a statistically significant association between both variables GG and GPPE in the case of both Pakistan and India exists."

In the case of Pakistan, the "Ordinary Least Squares (OLS)" regression analysis was selected for testing the causal association between GG and GPPE. The OLS regression analysis results proved the existence of a "significant and positive causal relationship" between "Labor Productivity Growth" and "Economic Growth" in Pakistan.

In the case of India, the "Vector Autoregressive (VAR)" regression analysis was selected for testing the causal association between GG and GPPE. The "VAR regression analysis" results proved the existence of a "significant and negative causal relationship" between "Labor Productivity Growth" and "Economic Growth" in India.

These results are in the same direction although they are different from each other due to the use of different regression analysis techniques in the case of Pakistan and India.

6.7.3 Comparison of Causality Analyses – Pakistan and India

"Granger causality test results suggest that Granger causality does not exist in any direction for Pakistan and Granger causality exists in both directions for India."

In the case of Pakistan, results indicated that GPPE does not Granger Cause GG; and GG does not Granger Cause GPPE, therefore Granger causality does not exist in any direction either from GG to GPPE or from GPPE to GG for Pakistan.

In the case of India, results indicated that GPPE Granger Causes GG; and GG Granger Causes GPPE, therefore bidirectional Granger causality exists as causality runs from GG to GPPE and from GPPE to GG for India.

These results are opposite to each other in the case of Pakistan and India.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

The seventh chapter is based on the overall outcome of the entire study that is presented in terms of conclusions and recommendations.

7.1 CONCLUSIONS

This study aimed to highlight the significance of "Labor Productivity Growth" in promoting "Economic Growth" in Pakistan. The research model and hypotheses were developed and research design and methodology were planned to carry out a thorough research process for the study.

The first research objective was "to identify the key determinants of 'Labor Productivity' and 'Economic Growth' relevant to Pakistani and Indian economies". To achieve this objective the research question to be answered was "what are the key determinants of 'Labor Productivity' and 'Economic Growth' relevant to Pakistani and Indian economies"? The answer was in the form of a literature review based on determinants of labor productivity and economic growth. "The key determinants of labor productivity and economic growth were identified which were *Human Capital*; *Education and Training*; *Innovation*; *Financial Development*; *Trade Openness*". In this way, the research question was answered and the research objective was achieved successfully.

The second research objective was "to understand the role of 'Labor Productivity Growth' in improving 'Economic Growth' in Pakistan". To achieve this objective the research question to be answered was "does any level of causal association exist between 'Labor Productivity Growth' and 'Economic Growth' in Pakistan"? The answer was in the form of hypothesis testing for the statement "statistically significant causal association does exist between 'Labor Productivity Growth' and 'Economic Growth' in Pakistan". The hypothesis testing was done by empirical analysis and the "Ordinary Least Squares (OLS)" regression analysis was conducted.

The "Ordinary Least Squares (OLS)" regression analysis was selected for this model for testing the causal association between GG and GPPE. The OLS regression analysis results proved the existence of a "significant and

positive causal relationship" between "Labor Productivity Growth" and "Economic Growth" in Pakistan. The causal association between "Labor Productivity Growth" and "Economic Growth" was found to exist according to satisfactory results. Thus, this primary hypothesis was supported in the study. In this way, the research question was answered and the research objective was achieved successfully.

The third research objective was "to compare the role of Labor Productivity growth in improving Economic Growth in Pakistan with India". To achieve this objective the research question to be answered was "does any level of similarity exist between causal association of Labor Productivity with Economic Growth of Pakistan and India"? The answer was in the form of a comparison of findings from "Correlation Analyses; Regression Analyses; and Causality Analyses" from statistical analyses results for the economy of Pakistan and the economy of India.

Before that, the process of statistical analyses for hypothesis testing was carried out for the economy of India which was different from the process carried out for the economy of Pakistan earlier. The hypothesis testing was done by empirical analysis as the "Vector Autoregressive (VAR)" regression analysis was conducted.

The "Vector Autoregressive (VAR)" regression analysis was selected for this model for testing the causal association between GG and GPPE. The "VAR regression analysis" results proved the existence of a "significant and negative causal relationship" between "Labor Productivity Growth" and "Economic Growth" in India.

The causal association between "Labor Productivity Growth" and "Economic Growth" was found to exist according to satisfactory results. Thus, this primary hypothesis was supported in the study.

The fourth research objective was "to develop strategies for 'Labor Productivity Growth' leading to improved 'Economic Growth' in Pakistan". To achieve this objective the research question to be answered was "How to improve 'Labor Productivity Growth' that may lead to better 'Economic Growth' in Pakistan"? The answer was in the form of policy recommendations for the development of strategies. These recommendations have been stated and described well in the recommendations section. These policy recommendations shall lead to the development of strategies in an actionable way and form if adopted by the concerned economic and financial decision-makers in the country. In this way, the research question was answered and the research objective was achieved successfully.

7.2 RECOMMENDATIONS

The recommendations of this study are in the form of policy recommendations for the development of strategies. These recommendations are stated and described in this section.

The improvement in productivity growth demands well-targeted policies. A well-targeted reform agenda shall boost productivity growth, especially in developing countries like Pakistan. It is essential to understand the Evolution of regional productivity and the Sources of regional productivity growth as the Policy options are supposed to be based on the status of productivity in the region.

7.2.1 Evolution of regional productivity

According to the World Bank Publication on Global Productivity (World Bank, 2021), "the evolution of regional productivity in the South Asian region involved certain factors as compared to other regions". These include "(a) Robust productivity growth; (b) Low productivity levels; (c) Within-region disparity of productivity levels; (d) Slowing contribution from capital deepening". In the case of Pakistan, "the annual productivity growth during 2013-18 elevated to an average of 3.5 percent as compared to an average of 2.5 percent during the pre-global financial crisis". In fact, "productivity growth was aided by new infrastructure projects and higher Foreign Direct Investment (FDI) inflows in the private sector during the post-global financial crisis period".

7.2.2 Sources of Regional Productivity Growth

According to the World Bank Publication on Global Productivity (World Bank, 2021), "the sources of regional productivity growth in the South Asian region depend upon varied elements as compared to other regions". These include "(a) Most Productivity gains from within-sector reallocation; (b) Limited global integration; (c) Lack of supporting infrastructure; (d) Firm characteristics; (e) Weak human capital; (f) Gender gaps; and (g) Productivity outlook".

7.2.3 Policy options

According to the World Bank Publication on Global Productivity (World Bank, 2021), the well-directed Policy options for productivity growth in the South Asian region (Pakistan and India inclusive) are the following

1. **Improving factors of production**
   a. Support physical capital accumulation, especially infrastructure investment
   b. Strengthen investment in human capital
   c. Reduce gender gaps

2. **Enhancing firm productivity**
   a. Increase the region's integration into the global economy
   b. Improve corporate management practices
   c. Address informality

3. **Promoting efficient sectoral reallocation of resources**
   a. Optimize between- and within-sector allocation of resources
   b. Encourage intersectoral linkages

4. **Creating a growth-friendly environment**
   a. Unlock access to finance
   b. Improve business environments
   c. Ensure macroeconomic and political stability"

These policy recommendations shall lead to the development of strategies in an actionable way and form if adopted by the concerned economic and financial decision-makers in the country.

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APPENDIX

Table 1
Original and Transformed Data Sets (GG and GPPE) – Pakistan

Period	GG *	GPPE *	GPPE
1991-2020	*Original*	*Original*	*Transformed* **
1991	5.062	10411.775	0.021
1992	7.706	10934.519	0.050
1993	1.758	10948.860	0.001
1994	3.737	10971.193	0.002
1995	4.963	11438.735	0.043
1996	4.847	11496.718	0.005
1997	1.014	11109.340	-0.034
1998	2.550	11033.507	-0.007
1999	3.660	11008.586	-0.002
2000	4.260	11018.722	0.001
2001	3.554	11108.933	0.008
2002	2.508	11066.419	-0.004
2003	5.777	11252.731	0.017
2004	7.547	11630.721	0.034
2005	6.519	12110.730	0.041
2006	5.899	12548.788	0.036
2007	4.833	12749.809	0.016
2008	1.701	12595.979	-0.012
2009	2.832	12480.426	-0.009
2010	1.607	12244.798	-0.019
2011	2.748	12260.311	0.001
2012	3.507	12381.662	0.010
2013	4.396	12664.699	0.023
2014	4.675	12799.574	0.011
2015	4.731	13058.873	0.020
2016	5.527	13528.033	0.036
2017	5.554	14012.641	0.036
2018	5.836	14556.441	0.039
2019	0.989	14324.023	-0.016
2020	0.526	14803.313	0.033

Note: *Source of data The Worldbank.Org website

**Labor Productivity was converted into Labor Productivity growth by transforming GDP per person employed from non-percentage annual data into growth rate annual data (annual %) to attain its Growth rate form

Table 2
Original and Transformed Data sets (GG and GPPE) – India

Period	GG *	GPPE *	GPPE
1991-2020	*Original*	*Original*	*Transformed* **
1991	1.057	5251.190	0.046
1992	5.482	5422.296	0.033
1993	4.751	5548.006	0.023
1994	6.659	5781.293	0.042
1995	7.574	6084.283	0.052
1996	7.550	6403.417	0.052
1997	4.050	6510.255	0.017
1998	6.184	6766.437	0.039
1999	8.846	7210.591	0.066
2000	3.841	7312.986	0.014
2001	4.824	7477.902	0.023
2002	3.804	7567.410	0.012
2003	7.860	7972.183	0.053
2004	7.923	8395.116	0.053
2005	7.923	8844.208	0.053
2006	8.061	9497.756	0.074
2007	7.661	10166.948	0.070
2008	3.087	10413.409	0.024
2009	7.862	11199.949	0.076
2010	8.498	12105.813	0.081
2011	5.241	12714.421	0.050
2012	5.456	13398.755	0.054
2013	6.386	14154.036	0.056
2014	7.410	15104.822	0.067
2015	7.996	16216.932	0.074
2016	8.256	17452.642	0.076
2017	6.795	18541.710	0.062
2018	6.533	19673.843	0.061
2019	4.042	20062.985	0.020
2020	-7.252	20202.781	0.007

Note: *****Source of data The *Worldbank.Org* website

****** Labor Productivity was converted into Labor Productivity growth by transforming GDP per person employed from non-percentage annual data into growth rate annual data (annual %) to attain its Growth rate form