

## Total factor Productivity and its Contribution to Economic Growth of Pakistan

Aimen Shah<sup>1</sup>, Nadeem Iqbal<sup>2</sup>, & Aisha Rehman<sup>3</sup>

<sup>1</sup> MPhil scholar, Department of Economics, University of Peshawar

<sup>2</sup> Assistant Professor, Department of Economics, University of Peshawar, Email: [nadeemiqbal@uop.edu.pk](mailto:nadeemiqbal@uop.edu.pk)

<sup>3</sup> Phd Scholar, Department of Economics, University of Peshawar, Email: [aisharehman1995@gmail.com](mailto:aisharehman1995@gmail.com)

### ARTICLE INFO

#### Keywords:

Total factor Productivity, Economic Growth, labour Force, GDP.

#### Corresponding Author:

Nadeem Iqbal

Email: [nadeemiqbal@uop.edu.pk](mailto:nadeemiqbal@uop.edu.pk)



### ABSTRACT

*This research discusses the importance of total factor productivity i.e. employed labor force, stock of capital and energy consumption that plays an important role in accelerating output growth for Pakistan's economy. The results shows, that Pakistan productivity performance is not improving and now it is high time for Pakistan to shift its focus on investments in (R&D) activities. Results do not support that GDP growth in Pakistan has been motivated by increased use of labor and capital only. And the major factor contributing to low TFP growth has been the low and decreasing levels of saving and investments in the economy. Thus it is important to shift from traditional ways of production and move towards the modern techniques of accelerating output for the economy.*

## Introduction

The concept of productivity of labor was described by the Nobel laureate Paul Krugman: “output is not everything, but it is everything in the long term. The output per worker is most important to increase the living standard of people in any nation. At this time production occurs by using the combination of different factor of production such as land, labor, and capital. Growth of any country is determined by the GDP that is affected by the industrial growth (Hossain & Majumder, 2015).

The concept of productivity is based on a wide range and need more understanding to see the present management. There are many definitions of productivity but the basic definition is the ratio of output to input. Over time, Pakistan's economy has been growing at an annual rate of five percent with variations since independence. In Pakistan point of view, the productivity of labor trend is both skimpy and intensely perturbing. The growth rate has been 5 percent on average with up to 18% of investment to GDP that showing the capital to output ratio is low in Pakistan than many other developing countries. Some key factors are playing a role to

determine how a country can produce the output. The factors of production are the size of the labor force and capital stock. Other than that some more variables are government regulations and education to determine the growth rate of the economy (Khan, 2006).

In 1980s Pakistan's labor productivity was growing at the rate of 4.2 percent annually and after that, from 2000 to 2015 this decreased to 1.3 percent. Since 2007 the ratio of growth is just 1% while on the other hand the out share border India is moving on the other direction and growing labor productivity by 5 percent during this time.

In the 1990s world was moving very fast and due to rapid globalization, the rapid changes occurred in information and communication technology (ICT). After the world of this rapid change was making benefits and increasing their economic growth, Pakistan was still struggling with how to make the best use of existing resources.

Pakistan being rich in any natural resources is one of the countries that grows very fast if its resources are utilized properly and is treated in top 10 growing economies. During this era when Pakistan has accessed to the internet like after 1990, Pakistan failed to give much importance to labor that it deserves.

The basic thing is the efficiency of every performing sector of the economy because due to this nation will move towards economic development. According to the 2015-16 economic survey, the contribution of the manufacturing sector of Pakistan is almost 64 percent in total GDP. The other sector is agriculture sector because due to this sector manufacturer sector is working and is the main source of employment in our country. In the textile sector, many other sub-sectors are working under this sector such as textile composite, textile weaving and textile spinning (Wasti & Imtiaz, 2017).

Economic growth is very important for the economy that is why Pakistan needs to put more attention on it. At the initial stage the best and solid relationship among productivity, efficiency and Total Factor Productivity progresses and that the most extreme Total Factor Productivity improves also. Their commitment to development is acknowledged for the period of times of high productivity growth. Secondly, the elements of this association differ, particularly among manufacturing and agriculture. On account of the industry, the reason is principally productivity growth determined through greater levels of investment that is carried by its new technical equipment enclosed as the most recent information and innovation (Asghar et al., 2024; Ishfaq et al., 2024).

This might be present a significant explanation that changes remained less effective in industry contrasted with agricultural business. Flow of money to Pakistan's monetary development remains inadequately small notwithstanding a significant push to progress instruction furthermore, abilities pointers, inferring that these have still not come to the least limit at which they could be a critical element in driving monetary growth. At last, there might be actual increases if there be located a move in accentuation to research concentrated on the crop growing area just as a basic audit of why prevailing exploration establishments in crop growing have neglected to convey substantial outcomes (Amjad & Awais, 2016; Asghar et al., 2024a).

For instance, while Solow (1956) shows that innovative enhancement is significant, the endogenous development models underscore that human capital and information capital prompting enhancements in innovation creation, selection, and assimilation are significant elements of profitability development.

Prior, thinking about uncovering the way that the fabricating part of an economy not just affects the development of the economy yet additionally drives the nation towards greatness regarding profitability and productivity. In Pakistan, the assembling area adds to practically 64.71 percent of the complete GDP ("Economic Survey of Pakistan," 2015-2016). Both, inside as well as outside components largely affect the assembling area. Besides, the material industry, after agribusiness, is a transcendent assembling division and a fundamental wellspring of work in our nation. It is the real existence blood of our economy since this part coordinates the venture patterns, contributes around 0.11% in the monetary improvement and in particular, is one of the significant wellsprings of pay and openings for work. A contemporary perception identifying with the material business has demonstrated a development pace of 0.50 percent throughout the last, not many years. The material business covers three sub-areas, including material composite, material weaving, and material turning. Each material producing segment is essentially significant for financial advancement ( Naz, Khan, & Syed, 2017; Asghar et al., 2023).

All out factor efficiency development was most elevated during 2001-10 when the Total Factor Productivity development rate was 1.9 percent. The commitment of Total Factor Productivity to yield development be situated 73%, while the staying 27% was the commitment of sources of info while. TFP development was least during 1991-2000 when TFP development stayed 1.3 percent and commitment of efficiency to yield development remained 69%, while, the staying 31 percent was the information source commitment. In this way, the hole among yield and info development was crossed over by the absolute factor profitability. Yield development of 2.6 percent was most extreme during 2001-2010 while it stayed at least (2%) percent during 1991-2000. Information development of 1.2 percent was greatest during 1981-90 while it stayed at least 0.6 percent during 2001-10.

This shows the huge relative decrease being used of contributions to examination with a considerable increase in generation during the examination time frame. This enormous yield gain explains that Total Factor Productivity has become a central point contributing to yield development.

While looking through all markets the monetary development is brought about by development in physical as well as human capital and how much extent is brought about by components, for example, innovation and institutional changes. The financial experts have the view that supported institutional and innovative development is a significant supporter of continued high development with uncommon centers around issues of agrarian advancement and profitability development. Profitability development is the part of the development underway that isn't the consequence of the utilization of the ordinary sources of information.

In this way, the efficiency development is brought about by the elements, for example, upgrades in human capital, interest in innovative work, institutional as well as infrastructural advancement. Enhancements in the asset use productivity and innovation increment efficiency. With the present populace of the nation is (184 million) having the development pace of 2 percent it is normal that Pakistan will be positioned fifth among the most crowded nations through 2050. To encourage such a huge populace, rural efficiency must expand, because of the higher cost of creation; the usage of regular assets can't be expanded past a specific limit.

Elis called attention to that profitability development in horticulture builds salary for the country networks, which advances their spending on the non-ranch segment. All out factor efficiency (TFP) can assume a key job in the lightening of provincial destitution in creating

nations. In the 21st century, confronting the issue of nourishment security Pakistan needs to show exceptional execution through profitability development to contend the world under WTO situation. The profitability development due to innovative change can be clarified by the upward movement of the generation outskirts so the same amount of sources of info produce more measure of yield. Permitting market sign to transmit to makers and expulsion of market flaws is the chief point of the auxiliary change program. The new structure in Pakistan for monetary development focuses and distinguishes the need to raise profitability development by the improvement of energetic markets, improving administration superiority as well as stimulating youth (Sibt-e-Ali et al., 2021; Sibt-e-Ali et al., 2018).

Interestingly, Pakistani Punjab indicated yield development pace of 1.3 percent and TFP development pace of 1.5 percent. It was reasoned that low TFP development in Pakistan stayed because of the issue of soil debasement. The examination likewise distinguished various factors adding to Total Factor Productivity development. These components included interest in agrarian inquire about, streets, instruction, and sponsorships on participations. The author analyzed the job of various factors affecting agrarian TFP in Pakistan on a long haul premise. They finished up that human capital enhancement represented 1.6 to 1.8% yearly upsurges in TFP. They found that quicker development in TFP as of late was to a great extent because of the upgraded commitment of non-factor inputs. They reasoned that there existed a significant degree for expanding all-out factor profitability by means of putting more in training, particularly at the essential and auxiliary level.

A study assessed TFP record since 1960 to 1996 for Pakistan agriculture based business utilizing Number juggling.. This study was carried out through different indexes. During this whole period normal yearly pace of development of absolute factor, profitability was 2.3 percent and output growth during this period was 58 percent. During this period the concept of total factor productivity played a significant role in productivity of agriculture based business. Moreover this study also stresses on the importance of technological advancements and R&D activities (Shujat, 2004)

A nation's long struggling monetary improvement relies on its profitable capacities and the kinds of items it creates and sends out. The East Asian nations (EACs), understanding the significance of a reasonable long struggling vision of mechanics and to get up to speed with the current world, structured their modern strategies. In this manner, these nations bit by bit climbed the modern stepping stool and created capacities for the generation of increasingly mind-boggling and modern items. This, in our view, altogether contributed towards their sensational monetary presentation. The ongoing writing on the Product Space and Economic Complexity experimentally supports this rationale of monetary advancement through mechanical enhancement. This flood of writing additionally appears that the capacity of a nation to broaden its fares relies on the sorts of businesses that the nation spends significant time in. It is demonstrated that Pakistan has neglected to understand the significance of a long drag vision which includes modern and mechanical make up for lost time with created nations.

Ceteris Paribas (all other things being constant), if the items sent out by a nation are delivered by numerous different nations, at that point the ECI (employment cost index) of that nation would be lower. Proportions of Diversity are commonly used to address one another while computing the ECI of nations, since not every single different economy can be considered to have complex profitable structures. ECI is likewise a significant determinant of monetary development. A portion of the econometric models displayed in the show that ECI is unequivocally related to higher per capita pay development in nations. Moreover, it is found

to be a vastly improved indicator of per capita salary development than the customary proportions of foundations, aggressiveness and human capital. The exchange above stresses the significance of an assorted modern structure would complex the scenario for the future development of an economy. In the following segment, we examine the "financial multifaceted nature" markers for Pakistan and their recorded development by drawing correlations with some different nations (Ishtiaq & Chaudhry, 2015)

Pakistan's efficiency execution in the course of the last 35 year (1980–2015) distinguishes elements that help clarify the declining pattern in work efficiency and all-out total factor profitability (TFP), the two of that could have filled in as significant drivers of profitability development as occurred in East Asia as well as all the more as of late in India. A key outcome is that the most extreme Total Factor Productivity gains and their commitment to monetary development are acknowledged during times of high-yield development.

The absence of supported development and small and decreasing levels of the venture have all the earmarks of being the greatest important reasons for the low commitment of TFP to profitability development, which has now arrived at levels that ought to be of significant anxiety to representatives opposite to the possibilities of Pakistan's development. Utilizing the endogenous development model, we look at the commitment of physical capital, human capital and Total Factor Productivity to work efficiency. The outcomes recommend that, over these 35 years, the commitment of physical capital as well as instruction stays unobtrusive as well as there has been a deteriorating pattern in TFP development.

The economy of Pakistan is not exploited the great mechanical advancements of the period. We likewise question the perspective communicated by ongoing examinations that Pakistan's development has been driven principally by inputs factors, to be specific work and capital, and not by Total Factor Productivity development. The paper contends despite what might be expected that it is the absence of interest in and development of the supply of capital epitomizing the latest information and innovation that has hindered Total Factor Productivity development post-1990. At long last, there is a critical requirement for further research to comprehend the elements of development in administrations and to bring Total Factor Productivity up in this part as India has done post-1990.

Work efficiency, or yield development per specialist, can be credited to three central points (disregarding arable land, which didn't develop in this period): (i) increments in physical wealth (apparatus as well as related contributions), (ii) increments in social capital (estimated through normal long stretches of tutoring) as well as (iii) what market analysts term 'all out factor efficiency' (TFP), which estimates the commitment of mechanical growth as well as increasingly proficient utilization of current properties. The recession in Pakistan's budget during the 1990s centered consideration on the elements answerable for as well as the conduct as well as job of Total Factor Productivity development in this procedure. It likewise denoted a move of accentuation to the general economy as well as its significant segments as opposed to the prior accentuation on assembling. This study spread the dated 1972 to 1997, isolated through the Five-Year Plan eras, yet focus taking place the log jam in Total Factor Productivity development during the 1990s.

They locate a reasonable relationship among Total Factor Productivity as well as the development of the budget, expressing that the "economy develops quickly when Total Factor Productivity takes increased quickly." For the general time frame, they discovery that Total Factor Productivity development was answerable for more than 40% of the development of the economy. Their sectors examination of Total Factor Productivity from

1992 to 1997 uncovers wide varieties in the presentation of Total Factor Productivity inside various areas. While Pasha et al. give the primary examination that features the significance of the administration's part in hindering generally speaking Total Factor Productivity development just as prompting generally financial development, they don't offer any persuading answers to clarify the terrible showing of the administrations part. Examining patterns in TFP development and its association with monetary development, he finds a much more grounded affiliation than Pasha et al. (2002), expressing that "Gross domestic product development and TFP development pursue indistinguishable conduct all through the time of perception". He doesn't, in any case, seek after this discovering further.

For the economy in general, TFP developed through 1.1% a year with seventy-five percent of this development credited to work as well as capital stock. These sectorial gauges placed Pakistan on standard with, or above your head the normal for, other creating nations, yet lingering a long way behind the East Asian economies. Chaudhry in this way infers Pakistan saw input-driven instead of profitability was driven development (Rashid & Namra, 2016; Rehman & Islam, 2023). Monetary wasteful aspects are frequently observed in different countries of the world. It is seen that monetary development regularly slacks the stunning mechanical progress and South Asian district is no special case. Islam, Salim, and Bloch (2016) look at the effect of intra-local activities on different parts of effectiveness alongside the development of efficiency in South Asia. They saw that the South Asian district has experienced absolute factor efficiency shrinkage and financial pounding of a few degrees through innovative wasteful aspects and are delayed in receiving such mechanical advancements. Amjad and Awais (2016) audit Pakistan's profitability execution over the time of 1980 to 2015. Creators analyzed the commitment of physical capital, human capital, and TFP to work profitability and saw that the commitments of physical capital and training stayed humble and there has been a declining pattern in TFP development. They distinguished the declining pattern in labor profitability and all-out factor profitability (TFP) for which the absence of continued development, what's more, declining levels of the innovative venture were seen as the key causes. They presumed that Pakistan's economy has not taken a full bit of leeway of the ideal innovative advancements. This is fairly like the forecasts of Moore's Law, which has held for over four decades.

It was noticed that organizations purchased PCs on the assurance that the "PC age" would change business. During the 1970s, data innovation (IT) related specialized gear represented about 25% of all data innovation related to business ventures. Be that as it may, various looks into in the 1980s and 1990s neglected to get any proof for development in such a mechanical efficiency commitment (Rehman & Islam, 2023; Berndt and Morrison, 1995). During the 1980s and the mid-1990s, the "efficiency Catch 22" was generally discussed. The efficiency Catch 22 is the bizarre perception made that as the greater venture is made in IT, laborers' efficiency rather than developing decays.

In spite of striking advances in the PC field, what's more, expanding the limit of the IT area, the development pace of profitability declined in the US economy. Work profitability development rate in the 1960s was around 3% and tumbled to roughly 1% at the start of the new thousand years. These confusing profitability designs are moreover alluded to or named "Solow Computer Paradox" because of Solow's (1987) proclamation "You can see the PC age all over the place however in the profitability measurements" (Rasheed & Ahmad, 2017 and Ali & Akhtar, 2024).

In this study, the main issue is to identify the share of different inputs and what are the returns of those inputs. Pakistan is a labor intensive country, so it is more important to find

out the impact of the three inputs (Labor, Capital and Energy Consumption) on GDP growth. Pakistan has an agricultural based economy, so it is important to measure the share of labor input and implement the policies according to that. Moreover the share of capital and energy consumption is specified but the share of labor is still facing many deficiencies that need to be properly examined. By decrease in share of labor it is meant that due to decrease in the payrolls the efficiency of labor and the quantity of labor is highly at risk. So the objective of study is to analyze the importance of multiple factor inputs and their role in economic growth and to determine the impact of growth rates of employed labor force, capital stock and energy consumption (electricity) on GDP growth.

## **Data Sources**

There are two major variables capital and labor, and the data of labor force in working hours is not available that is why in this study for the employed labor force data is taken from the survey of labor force in Pakistan. The other challenging variable is measuring the stock of capital and the increase of rate in the real term because a huge part of the investment is not recorded in national income accounts. For the sake of stock of capital, we used a perpetual inventory method where we applied a yearly depreciation rate of 5 percent to existing stock of capital and adding incremental investment.

The dependent variable is the Gross Domestic Product (GDP) and data is taken from the World Development Indicator (WDI). The other independent variable is energy consumption and data is taken from the economic survey of Pakistan. The current study covers the time period for analysis between 1990 to 2018.

## **Theoretical Framework**

Productivity performance of Pakistan is calculated by the growth model that pioneered by the Solow (1956). The main input factors of the model are physical capital and labor for the sake of economic growth and the residual.

The basic model is considering here neoclassical production function,

$$Y = F(A, K, L) \tag{1}$$

In the above production function, Y is real output (GDP), K is capital stock, L is employed labor force and A is a residual term like total factor productivity (TFP). The above production function is in standard form, but in this study, we use a modified version with commercial energy consumption just for the sake of to see the impact of energy consumption on GDP growth.

$$Y = F(A, K, L, E) \tag{2}$$

All other variables are the same as above except E that is shows to energy consumption. Suppose, the Cobb Douglas production function shows the specific economy output level due to change in input.

$$Y(L, K, E) = AL^\alpha K^\beta E^\gamma \dots \dots \dots \tag{3}$$

The technological parameters Alpha, Beta, and Gama measure the contribution of the Labor, Capital, and Energy respectively to a production process. Through this Cobb Douglas production function we can find the marginal product of these variables such as first we are calculating for labor.

First, we will take derivative w.r.t to labor (L),

$$\partial Y / \partial L = \alpha A L^{\alpha-1} K^{\beta} E^{\gamma} \dots \dots \dots (3')$$

$$\partial Y / \partial L = \alpha A L^{\alpha} K^{\beta} E^{\gamma} / L \dots \dots \dots (3'')$$

$$\partial Y / \partial L = \alpha Y / L \dots \dots \dots (3''')$$

The above equation shows the Y/L is equal to the average product of labor and the ratio of marginal product to average product is equal to  $\alpha$ .

This means the percentage change in one variable divided by percentage in another variable. There is a total of three possibilities is  $\alpha > 1$  then it means the percentage change in labor generate a larger impact on the percentage change in output. If this is  $\alpha < 1$  then the percentage in input have less impact on percentage in output and diminishing return to scale term would be inelastic. If  $\alpha = 1$  then on to one relationship between the inputs to output.

Simply, in this case (When  $\alpha < 1$ ) we are saying due to the increase in the number of unit of labor output decreases like the negative relationship between labor and output.

The current Cobb Douglas production function is not-linear and we should convert into a linear form such as by taking the natural log of both sides, we obtain

$$\ln(Y) = \ln(A) + \alpha \ln(L) + \beta \ln(K) + \gamma \ln(E) \dots \dots \dots (4)$$

Now, for the sake of simplicity technology taken as constant over time but we are differentiating equation 4 with respect to time and taking technology as flexible over time.

$$\frac{1}{Y} \frac{dy}{dt} = \frac{1}{A} \frac{dA}{dt} + \alpha \frac{1}{L} \frac{dL}{dt} + \beta \frac{1}{K} \frac{dK}{dt} + \frac{\gamma}{E} \frac{dE}{dt} \dots \dots \dots (5)$$

The left-hand side of equation 5 is the growth rate of Y, we can show as a new variable such as  $g_y$  and for simplicity, the other variables are  $g_A$   $g_L$   $g_K$  and  $g_E$ .

We can write equation (5) as,

$$g_Y = g_A(TFP) + \alpha g_L + \beta g_K + \gamma g_E \dots \dots \dots (6)$$

Simply, the left-hand side is the growth rate of output,  $g_A$  is total factor productivity,  $g_L$  is the growth rate of labor,  $g_K$  is the growth rate of capital and  $g_E$  is the growth rate of energy consumption.  $\alpha, \beta$ , and  $\gamma$  are the share of labor, capital, and energy consumption in output. For the estimation process, we use here Ordinary Least Square (OLS) method.

### **Construction of Variables**

Gross Domestic Product (GDP) is the total market value of all the final goods and services that are produced inside a country in a selected period of time. Here in this study real GDP is taken in percentage form.

Employed labor force is measured in many ways. Normally labor input measured as several working hours, but in Pakistan time series data in term of working hours is not available. Moreover, the emerging importance of human capital is affecting the worker quality and this quality normally measured by the number of year of schooling. The data of employed labor force is taken from Pakistan Economic Survey.



The capital stock is a major input variable to find out the GDP growth rate and for this perpetual inventory method, that shows the capital stock is the accumulation of the past capital stock values or investment such as,

$$K_t = I_t + (1 - \phi)K_{t-1}$$

Initial capital is showing as  $K(0)$  and for the sake of the construction of capital stock series using Nehru and Dhareshwar (1993),

$$K_t = (1 - \phi)^t K(0) + \sum_{i=0}^{t-1} I_{t-i} (1 - \phi)^i$$

In the above equation  $\phi$  is the rate of geometric decay and as we said  $K(0)$  is the starting capital stock value that is in period zero. We estimated the initial capital in different ways and the values of the 1<sup>st</sup> period are estimated by the linear regression of the log of investment against time. By the following equation the fitted line of the initial investment used for the sake of calculation of initial capital stock.

$$K_{t-1} = \frac{I_t}{(g + \phi)}$$

In the above equation,  $g$  is the growth rate of output (GDP) and  $\phi$  is the depreciation rate of capital and in previous studies; the depreciation rate used is 4 percent.

TFP is extracted from the growth accounting equation. Total factor productivity reflects the per unit output with the set of mutual inputs and with the change of TFP the change in productivity that not accounted by the variation in mutual inputs. Total factor productivity showing the joint effect of numerous aspects such as research and development (R&D), new skills, economies of scale and administrative and managerial skills. Total factor productivity is also called multi-factor productivity; normally this is measured by the ratio of GDP (aggregate output) to aggregate inputs. Total factor productivity is calculating by dividing total output by weighted average of inputs and total factor productivity measure of economic efficiency and cross country per capita income. Growth rate of total factor productivity is calculated by subtracting growth rates of inputs from growth rate of total output like GDP.

High growth in output is not only increased by the use of capital and labor but is a result of technical progress. In the production process the technical progress is called total factor productivity (TFP). For the sake of measure TFP this study uses the standard growth accounting framework that was introduced by Solow in 1957. Solow formulated the productivity measures in the production function to focus on neutral shifts in technical changes.

$$g_Y = g_A(TFP) + \alpha g_L + \beta g_K + \gamma g_E \quad (6)$$

In above equation  $g$  is treated as growth rate and all the variables are observed except  $g^A$  and we can compute it by rearranging the production function as follows,

$$g_A = g_Y - \alpha g_L - \beta g_K - \gamma g_E \quad (7)$$

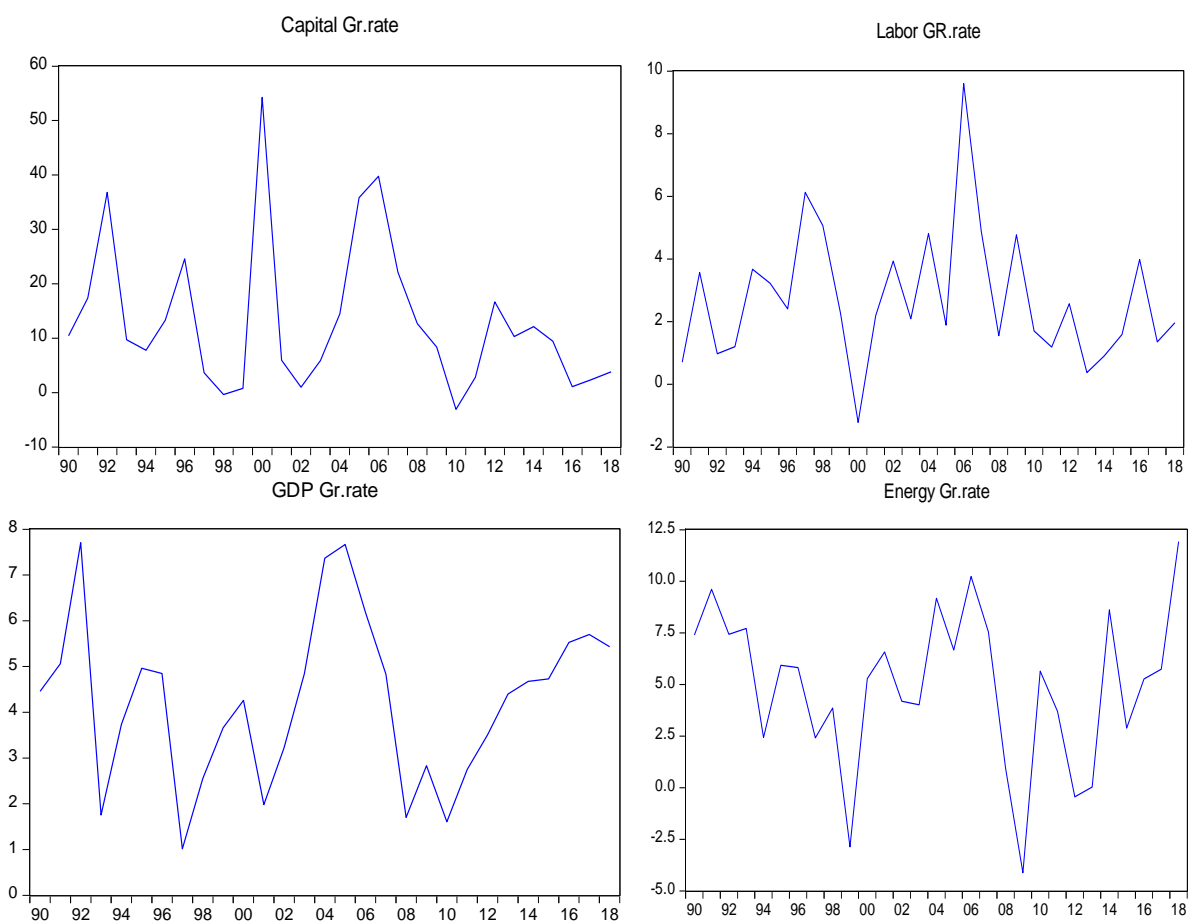
$$TFP = A = \frac{\text{Total Production}}{\text{Weighted Average of Inputs}} = \frac{Y}{L^\alpha * K^\beta}$$

$$\frac{\Delta Y}{Y} = \alpha * \frac{\Delta L}{L} + \beta * \frac{\Delta K}{K} + \frac{\Delta A}{A}$$

$$\frac{\Delta A}{A} = \frac{\Delta Y}{Y} - \alpha * \frac{\Delta L}{L} - \beta * \frac{\Delta K}{K}$$

Energy consumption is an important supplement to the capital and labor in the production process directly or indirectly. Energy consumption plays a significant role in economic growth, that is, the increase of energy consumption will promote the growth in real GDP while energy conservation policy will have an adverse effect on economic growth.

### Results and Discussions



The above graphs are presenting the data trend over time such as growth rates of GDP, employed labor force, capital stock and energy consumption. On vertical axis time is measured while horizontal line shows the yearly measurement.

All the four variables are fluctuating over time like the capital growth rate at highest in 2000s and then in 2005-06. After 2007 a huge decline in capital growth rate was observed and again in 2012 it was increased.

On the other hand, labor growth rate was going opposite to capital growth rate like in 2000s when capital growth increasing at same time labor growth rate was declining. In 2008 labor growth rate was increasing when the capital growth rate was declining.

GDP growth rate fluctuated over time and GDP growth from 2002 to 2008 was on peak and after 2008 the growth rate was declining till 2010 and then increasing.

Energy consumption is taken as an electricity consumption that is fluctuating over time.

It is important to discuss here that the evolutionary highlights are important phase of TFP: Whereas literature of standard growth is assumed to estimate technological progress, absolute deteriorations are not easy to interpret in this way. Consequently, a more common interpretation of TFP is required. In particular, the accurate interpretation measured the degree of proficiency for TFP and institutions and market work together for allocation of productive factor in the economy. Remarkably, under this wider interpretation, efficiency can deteriorate in absolute terms for a long period of time, as we detect for the case of Pakistan. This study analyzes the contribution of TFP to economic growth of Pakistan for different period's i-e 1990-2000, 2001-2010, 2011–2018, showing contribution of TFP to economic growth of Pakistan.

**Table 1**

<b>Years</b>	<b>% TFPG (Average)</b>	<b>% <math>\Delta</math> in TFP (average)</b>	<b>% Contribution of TFP in GDPG</b>
1990-2000	1.118	0.689	8.197
2001-2010	1.115	-0.087	8.779
2011-2018	1.146	0.774	8.674

The traditional neoclassical model indicates that steady-state growth and therefore the possibility of improving living standards over time are due to TFP growth. Indeed, suppose that the important parameter (*a*) of the model of Solow–Swan is stable over the time period. The table below shows the results of growth accounting approach by alternative method, where results showed that average TFPG is increasing gradually. Since the beginning, the average (per worker) labor productivity growth shows improvement, but during the period of 2001-2010, it is shown that somewhere in between this period the average% age TFPG is negative.

**Table 2**

<b>Years</b>	<b>% TFPG (Average)</b>	<b>% <math>\Delta</math> in TFP (average)</b>	<b>% Contribution of TFP in GDPG</b>
1990-2000	1.238	0.877	4.139
2001-2010	1.286	-0.0675	4.193
2011-2018	1.384	0.649	4.188

The below table showing the descriptive results of four variables such as GDP growth rate, Labor growth rate, Capital growth rate, and growth rate of energy consumption (Electricity). There are 29 observations that are presenting minimum and maximum values as well as mean values.

During this time the minimum GDP growth rate was 1.014% and maximum rate is 6.706 %. While the average value of the GDP growth rate is 4.54 % and the standard deviation of GDP growth was being very low as only 3.78 % from the mean value.

The maximum value of the labor growth rate was 5.6% while the average value of labor growth rate is 2.73% and the standard deviation is 2.12% lower than the mean value.

The maximum value of capital growth rate is 4.2% while the average value is 3% and standard deviation of capital growth rate is lower than its mean value i-e 1.6%.

The maximum growth rate of energy consumption (electricity) is 5.9% while the average value is 4.3% and the standard deviation for growth rate of energy consumption is lower than its mean value i-e 1.7%.

So in this case, the highest standard deviation is of GDP (3.7).

**Table 3: Descriptive analysis**

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
GDP Gr.rate	29	1.014	6.706	4.54034	3.788540
Labor GR.rate	29	-1.2176	5.6020	2.738098	2.1252677
Capital Gr.rate	29	-3.0888	4.2633	3.106326	1.6355500
Energy Gr.rate	29	-4.1267	5.9303	4.355454	1.7745501

Source: Author Estimation

**Table 4: Findings of Stationary using Augmented Dickey Fuller (ADF) test**

Variables	Prob.
GDP Growth Rate	0.0001
Capital Growth Rate	0.0034
Labor Growth rate	0.0043
Energy Growth rate	0.000

The above table showing the stationary results of data like all variables is stationary at level I (o). Gross Domestic Product (GDP) is stationary at 1 percent because the absolute value of the T-state is higher than 4.33. While capital growth rate variable is stationary at 5% level of significance and the other two independent variables are stationary at level 1% and their absolute values are higher.

**Table 5: Impact of Total factor input factors on Gross Domestic Product**

Variables	Coefficient	T-Statistics	Prob.
Capital Growth Rate	0.41	2.02	0.03
Labor Growth Rate	0.58	7.2	0.05
Energy Growth Rate	5.56	2,44	0.02

The above table showing the impact of capital stock, employed labor force and energy consumption on gross domestic product (GDP).

In this model GDP is taken as dependent variable and we can say if there is one percent increase in capital then GDP will grow with 0.41 percent. T-statistics is 2.02 and probability value is less than 0.05. So capital growth rate has significant impact on GDP growth rate.

When there is one percent increase in Labor growth rate then GDP grows by 0.58 percent so thus the relation is significant because p value is equal to 0.05.

If there is one percent increase in energy consumption (Electricity) then GDP will grow by 5.56 percent on positive side. The variable is significant because the probability value is less than 0.05.

In this model Durbin Watson value is 1.91 that is high enough so no need for removal of autocorrelation.

## **Conclusion**

Pakistan is essentially an agrarian economy, employing more than 42.3% of the economically vast population and producing more than 19.5% of GDP (Pakistan Economic Survey). However, economic growth is weak, and the standard of living of people of Pakistan is decreasing day by day. The results indicate that long-term economic growth is basically dependent upon many factors without which the economy cannot improve. The study tries to highlight the role and contribution of TFP in generating output and also to observe its relationships with GDP through multiple factors like employed labor force, capital stock and energy consumption (electricity). However the growth of dependent variable GDP is the high. Furthermore, contribution of all independent variables in generating output is satisfactory. They all show a significant relation with GDP. It is concluded that Pakistan economy cannot change its economic scenario in a blink of an eye. All input factors needs to be taken into consideration and improvised again and again to get solid results. The uses of these inputs if measured properly can possibly change the overall production scenario of Pakistan's economy by giving new birth and new opportunities to industries and firms.

The contribution of human capital to Pakistan's economic growth remains disappointingly low despite a major force to improve education and skills, showing that these have still not reached the minimum limit at which they could be a significant factor in driving economic growth. Moreover the agricultural sector that is supposed to be a driving sector for increasing growth of the economy have failed to deliver satisfying results. The basic reason to this failure is the lack of facilities and know how as to how to improve from the substantial ways of production and moving towards the modern ways of producing and generating output. Lack of suitable investments and quality education has been the major reason for this setback.

It is important to note that capital stock is the foundation of human's advanced way to social development. The process of production is accelerated by using different and unique equipment that helps in increasing output of the economy and in turn also improve the living standard of people. But Pakistan is losing its focus on savings, investments and those policies that helps in improving the overall performance of economy. In this regard the human capital fails to transform the natural resources into capital goods and welcomes the market risks and failed policies.

Our results do not support fully the view put forward by López- Cáliz et al. (2012) that output growth in Pakistan has been motivated by increased use of labor and capital and not multiple factors productivity growth (TFP), but that a major factor contributing to low TFP growth has been the low and decreasing levels of saving and investments in the economy. While there is appreciable scope for economic reforms that leads to higher output and Total factor productivity growth.

It seems as if Pakistan's economy is stuck in a state of multiple equilibrium and in order to get out of this extra ordinary adjustment needs to be made. Public sector overall growth is essential for any long-term sustainable growth in Pakistan. Private sector must not replace the public sector. Furthermore, any outcome growth will be impacted by how the conversion

happens and whether for instance it is attached to devaluation, balance of payments problem etc. therefore it is important that the transition and conversion of economy is less painful.

Political fusion must become strong, as they are ones to push and force reforms. Any reform that is passed must be attached to legislative reforms by provincial governments. There must also be a clear and known political concretion on how to transform and bring reforms. All of this needs to be strategically thought out by the parliament. It is the responsibility of government to implement correct measures of policies that are to be implemented for improving the productivity performance of Pakistan economy

## References

1. Ali, L., & Akhtar, N. (2024). The effectiveness of export, FDI, human capital, and R&D on total factor productivity growth: The case of Pakistan. *Journal of the Knowledge Economy*, 15(1), 3085-3099.
2. Amjad, R., & Awais, N. (2016). Pakistan's Productivity Performance and TFP Trends, 1980-2015: Cause for Real Concern. *The Lahore Journal of Economics*, 112(2), 33-63.
3. Asghar, M. M., Safdar, R., Zubair, M., & Hanif, M. (2024a). Exploring the Influence of Financial Development, Institutional Quality and Trade Openness on Inclusive Growth in SAARC Countries. *Pakistan Journal of Humanities and Social Sciences*, 12(2), 1450-1461.
4. Asghar, M. M., Sultana, R., Ullah, S., & Arshad, M. (2023). Analyzing the External Debt and Exports-Led Growth Hypothesis in Selected Asian Countries. *Zakariya Journal of Social Science*, 2(2), 43-55.
5. Asghar, M. M., Tanzeel, M., Ullah, S., & Hussain, S. (2024). Analyzing the Economic Impact of Construction Sector in Pakistan. *Zakariya Journal of Social Science*, 3(1), 21-34.
6. Hossain, M. & Majumder, A. (2015). On measurement of efficiency of Cobb-Douglas production function with additive and multiplicative errors. *International academic press Statistics*, 3(1), 96-104.
7. Ishfaq, M., Rasool, A., Asghar, M. M., Karim, S., & Ahmad, R. (2024). Impact of Natural, Physical and Human Capital Formation on Economic Growth in Pakistan: An ARDL Analysis. *Journal of Asian Development Studies*, 13(3), 222-233.
8. Khan, S. U. (2006). Macro Determinants of Total Factor Productivity in Pakistan. State Bank of Pakistan.
9. Naz, F., Khan, H., & Syed, M. (2017). Productivity and Efficiency Analysis of Pakistani Textile Industry using Malmquist Productivity Index Approach. *Journal of Management and Research (JMR)*, 144(1), 64-89.
10. Rashid, A., & Namra, A. (2016). Pakistan's productivity performance and TFP trends 1980-2015: Cause for real concern. *MPRA*, 102(1), 22-98.
11. Rehman, F. U., & Islam, M. M. (2023). Does energy infrastructure spur total factor productivity (TFP) in middle-income economies? An application of a novel energy infrastructure index. *Applied Energy*, 336, 120836.
12. Shujat, A (2004). Total Factor Productivity Growth in Pakistan's Agriculture. *The Pakistan Development Review*, 43(4), 493-513
13. Sibte-Ali, M. S., Khan, U. U., & Parveen, S. (2021). The relationship between financial development and foreign direct investment and its impact on economic growth of Pakistan. *iRASD Journal of Economics*, 3(1), 27-37.

14. Sibt-e-Ali, M., Chaudhary, I. S., & Farooq, F. (2018). Impact of Human and Social Capital on Economic Development in Pakistan: Empirical Evidence from Primary Data Analysis. *Journal of Accounting and Finance in Emerging Economies*, 4(1), 39-46.
15. Wasti, E., & Imtiaz. (2017). Growth & investment economic survey of Pakistan. *Pakistan: Government of Pakistan, Ministry of Finance*.