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The Determinants of Total Factor Productivity Growth in Pakistan: An Exploration

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ABSTRACT

With variables identified based on the literature on total factor productivity (TFP) growth, this paper explores the determinants of TFP in Pakistan. The results show that openness, inflation, capital intensity, institutions, innovation, and credit-to-Gross Domestic Product (GDP) ratio positively correlate with TFP growth. On the other hand, IMF programs, education, and infrastructure are negatively related to TFP. The results indicate that to enhance TFP growth, which the literature shows is very important for sustained GDP growth, Pakistan needs to adopt market-friendly and deregulatory policies and improve the quality of institutions to improve the governance quality. Such policies could increase investment, aid in innovation, make the economy more outward-oriented, and enhance the role of the private sector in leading economic growth.

Keywords: Total factor productivity growth, determinants, GDP

"It is not by augmenting the capital of the country, but by rendering a greater part of the capital active and productive than would otherwise be so, the most judicious operations of banking can increase the industry of the Country". Adam Smith, An Inquiry into the Nature and Cause of the Wealth of Nations (p. 131).

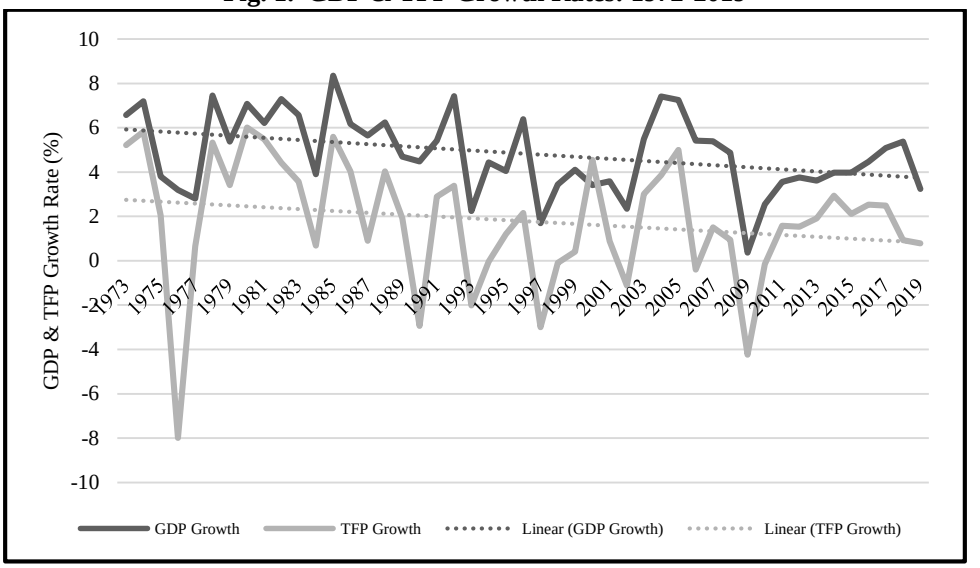
1. MOTIVATION

Total factor productivity (TFP), also known as multifactor productivity, is that part of the GDP that cannot be attributed to factor inputs, including labour, capital, human capital, and materials. TFP essentially tells us how productively economies use factor inputs. Some economies produce more output with the same inputs, while others produce less. Therefore, an increase in TFP growth is essential for long-run sustained growth. Economic theory and evidence also point in the same direction.

One can also judge the importance of TFP from Warren Buffet's quote that it is the "secret sauce" in the U.S. economic success story over the last 150 years (Lambert, 2016). Empirical evidence shows that the economies with higher TFP growth have grown at a higher rate for a sustained period (for example, China). On the other hand, the countries that grew on the back of factor accumulation could not sustain higher growth for an extended period (for example, the Soviet Union). Citi GPS (2018) shows that in 60 percent of the cases, the economies with TFP growth of more than 3 percent grew at 8 percent or more. However, in 66 percent of cases, TFP growth of 2-3 percent was associated with GDP growth between 3 and 7 percent.

In Pakistan, although there have been periods when both TFP and GDP growth increased, on average, as shown by the trend lines in Figure 1, both TFP and GDP growth are declining. The figure shows that TFP and GDP growth move together, i.e., when TFP growth increases, GDP growth also increases and vice versa. According to Siddique (2020), in Pakistan, whenever there have been episodes of liberalisation and market-friendly policies, the TFP growth has increased, leading, consequently, to improved economic performance. For example, in the 2000s, TFP and GDP growth took place due to better macroeconomic fundamentals, structural reforms, institutions, governance, and private sector dynamism. Certain structural reforms were undertaken, i.e., financial sector restructuring, privatisation, liberalisation, deregulation of the economy, and bank reforms leading towards a market-led economy. A privatisation process was also pursued; the focus was on banking, telecommunication, oil and gas, and the energy sector.

Fig. 1. GDP & TFP Growth Rates: 1972-2019



Source: Siddique (2020).

In light of the above discussion, it is worthwhile to explore the determinants of TFP growth in Pakistan. It is important to examine what factors contribute to TFP growth in Pakistan and the factors negatively related to TFP growth. A few papers have attempted to determine the determinants of TFP growth in Pakistan, such as Khan (2006) and Pasha, et al. (2002). This paper is different because it draws on the literature that has identified the determinants of TFP growth based on an extensive literature review. Specifically, we follow two papers: Kim and Loayza (2019) and Isaakson (2007), to identify the determinants of TFP growth.

The rest of the paper is organised as follows. After the introductory section, Section 2 discusses the TFP growth literature in general, while Section 3 briefly discusses the relevant literature on Pakistan. Section 4 describes the variables used in the analysis, and caveats are discussed in Section 5. The analysis framework is outlined in Section 6, while results are discussed in Section 7. The discussion is concluded in Section 8.

2. LITERATURE REVIEW

Drawing on the literature reviewed by Kim and Loayza (2019) and Isaakson (2007), the paper discusses some relevant literature that explains the patterns and determinants of TFP across the world.

Based on an extensive review of the growth literature, Kim and Loayza (2019) narrow down five main determinants of TFP worldwide: institutions, infrastructure, innovation, education, and market efficiency. Using factor and principal component analysis, they construct indices of these five indicators. They find that in the OECD and developed countries, market efficiency, whereas in developing countries, education is the most crucial determinant of variance decomposition in TFP growth in the 2010s.

Similarly, Isaksson (2007) carries out a comprehensive literature review of the determinants of TFP growth. The review shows that education, health, infrastructure,

imports, institutions, openness, competition, financial development, geographical predicaments, and capital intensity appear to be the most important determinants suggested in the literature. Isaksson argues that policies that encourage investment will also positively impact TFP growth.

Education

An educated population helps an economy to acquire and use relevant knowledge. Education, which increases an economy's human capital, affects TFP because it enhances its capacity to carry out technological innovation (Romer, 1990). From the perspective of a developing economy, education helps to adopt foreign technology.

According to Kim and Loayza (2019), education, as the knowledge and skills of the population, is crucial for generating new technologies and disseminating, adapting, and implementing these technologies throughout the economy. Moreover, an educated workforce is more productive and helps expand and disseminate technological frontiers (p. 7). Studies, such as Benhabib and Spiegel (1994), Griffith, Redding, and Reenen (2004), Bronzini and Piselli (2009), and Erosa, Koreshkova, and Restuccia (2010), to name a few, suggest education indicators are associated with output growth through both TFP improvements and the direct contribution of human capital.

Innovation

Many studies show the impact of innovation on TFP growth. For example, using indicators such as investment in research and development (R&D), the number of patents, and the number of scientific and technological journal publications, Nadiri (1993), Chen and Dahlman (2004), and Guellec and van Pottelsberghe de la Potterie (2004) show that the creation or adoption of new technology is positively associated with TFP growth.

Abdih and Joutz (2005) find a positive long-run relationship between TFP and patents. Guellec and van Pottelsberghe de la Potterie (2001) investigate the association between R&D and TFP growth at the macro level for 16 OECD countries, using data from 1980 to 1998. The results show that R&D is important for TFP growth.

Ulku (2004) shows that innovation proxied by patent applications – is essential for GDP per capita and TFP. He argues, however, that only large Organisation for Economic Co-operation and Development (OECD) countries can increase their level of innovation through R&D investment. Smaller OECD countries learn from the large group to promote their innovation.

Trade

Various studies argue that trade enhances productivity growth. For example, according to Mayer (2001), since trade is a carrier of knowledge and imports introduce advanced foreign technology into domestic production, it positively affects TFP. Other examples include Coe and Helpman (1995), Coe, et al. (1997), Connolly (1997), and Keller (1998).

Hall and Jones (1999) find a strong impact of trade on productivity. Using nine measures of trade openness, Edwards (1992) shows that outward-oriented economies, that is, more open economies, tend to grow faster than countries with trade distortions. Similarly, Bosworth, Collins, and Chen (1995) analysed data on 88 countries from 1960

to the 1990s. They find a positive effect of outward orientation on TFP growth. Miller and Upadhyay (2002) also find that trade positively relates to TFP growth. Their study covers 83 countries from 1960 to 1989. Melitz (2003) shows that exposure to trade induces more productive firms to enter the export market and the least productive firms to exit, leading to an increase in aggregate industry productivity growth.

Infrastructure

In the literature on economic growth, public infrastructure is a source of timely and cost-effective market access. Therefore, public infrastructure supports all possible economic activities. In terms of quantity, quality, and diversity, an appropriate infrastructure network can complement private capital and labour, increasing their returns and impact on economic growth. Therefore, spending on public infrastructure becomes a source of TFP growth (Kim and Loayza, 2019).

A robust infrastructure enhances the productive capacity of an economy by increasing resources and expanding the productivity of private capital. However, it is pertinent to mention that even though the increase in public capital formation leads to an increase in overall capital formation, it may negatively affect an economy through crowding-out effects.

One of the most cited studies on the infrastructure-productivity nexus is Aschauer (1989). According to his findings, public investment in the U.S. has substantial returns. However, a caveat in this regard is that returns to such investments are significantly higher in places where infrastructure is inadequate. Similarly, Munnell (1992) argues that public infrastructure investment positively affects private investment, output, and employment growth.

Structure/Institutions

Institutions, including regulatory, justice, policy, and political systems, are fundamental to promoting social and economic stability, providing a safe living and working environment, defending property rights, and safeguarding civil rights. The literature on institutions (North, 1990; Acemoglu, Johnson, and Robinson 2004) shows that public institutions are deep, as opposed to proximate determinants of economic development.

Deep determinants are the ones that affect long-term economic growth. In other words, behind some common determinants, there are deep forces at work that aid economic growth and development (Isaakson, 2007). There are mainly three institutional issues that are stressed in the literature: the enforcement of property rights (encourages investment), constraints on the actions of elitist, political and other groups with power (reduce risks of expropriation of incomes and others' investments), and equal opportunity for broad segments of society (enhanced investment in human capital and participation in productive activities) (Isaakson, 2007).

There is ample evidence that good governance (reflected in political stability, the rule of law, the protection of property rights, bureaucratic quality, transparency and accountability, and the absence of corruption) positively affects productivity and economic growth.

It is argued in the literature that technology is endogenous to those institutions which facilitate the adoption of superior production techniques. It can be further argued that better institutions create more incentives for savings and investment, leading to higher TFP (Isaakson, 2007).

An economy's structure also plays a crucial role in its productive capacity. In a study, Chanda and Dalgaard (2003) argue that an economy's structure plays a crucial role in aggregate TFP. In turn, institutions are essential in shaping an economy's structure. Their main argument is that the correlation between institutions and TFP arises because institutions determine the economy's structure.

Djankov, et al. (2002) and Loayza and Serven (2010) show that the quality of the regulatory framework matters significantly for the ease of resource reallocation, including firm dynamics and structural transformation. Ulubasoglu and Doucouliagos (2004) show that economic and political institutions positively impact TFP and labour force growth.

Market Efficiency

Efficient markets – labour, capital, etc. – allow efficient allocation of resources across firms and sectors, which leads to an increase in TFP. Market efficiency induces unproductive firms to exit the market, facilitates productive firms to grow, and allows new firms to enter the market. Various studies have found that the extent of market efficiency can be a cause of variation in productivity across firms, sectors, and countries (Kim and Loayza, 2019, p.8).

Financial Development

In economies with a well-developed financial system, investment opportunities materialise quickly. Moreover, well-developed financial systems allow optimal allocation of resources. However, this may not necessarily be the case in economies with less-developed financial systems. Intuitively, this affects productivity growth in developing countries (Isaakson, 2007).

Fisman and Love (2004) study the relationship between industrial growth and financial development, both for developed and developing economies. They find support for financial development and economic growth. Similarly, Aghion, Howitt, and Mayer-Foulkes (2005) find that financial development affects convergence mainly through TFP growth rather than capital accumulation.

3. STUDIES ON PAKISTAN

In the context of Pakistan, Khan (2006) has explored the macro determinants of TFP in Pakistan. Using data from 1960 to 2003, he finds that macroeconomic stability (proxied with inflation), foreign direct investment, and financial sector development play an important role in increasing TFP. However, he finds no role in education expenditures in the determination of TFP in Pakistan.

Pasha, et al. (2002) have also analysed the determinants of TFP in Pakistan for the overall economy and each sector (manufacturing, services, and agriculture). According to their results, human capital, measured as average years of schooling, is the most important variable in explaining the TFP in Pakistan. However, a problem with this result is that human capital is already used in estimating the TFP index, which could lead to spurious results, also pointed out by Amjad and Awais (2016).

4. VARIABLE DESCRIPTION

The variables included in the study are selected based on the literature review on the determinants of TFP growth and keeping in view Pakistan's conditions.

The following variables are identified that may have a strong association with TFP growth:

(i) Total Factor Productivity

TFP is generated using the growth accounting framework. The data on TFP is taken from Siddique (2020) (see Box 1).

Box 1: TFP Estimation - Methodology

Total factor productivity (TFP) can be estimated using the neoclassical production function:

$Y = F(A, K, L)$ … … … … … (1)

In equation 1, Y is real output, K is capital stock, L is the employed labour force, and A is the residual term, which is TFP.

We can write equation 1in the growth form as:

$$g^Y = \alpha g^L + (1 - \alpha)^k + g^{TFP} \text{ … … … … … (2).}$$

g^Y denotes the growth rate of output, g^L denotes the growth rate of labour, g^{TFP} denotes the growth rate of TFP, α is the share of labour in output, and (1-α) is the share of capital in output. According to equation 2, the output growth rate is a weighted average of growth in the employed labour force, capital stock, and technological progress, given by the growth of TFP, and the weights are factors shares of labour and capital.

Assuming that output and inputs can be observed, the TFP can be calculated using the following equation:

$$g^{TFP} = g^Y - \alpha g^L - (1 - \alpha)^K \text{ … … … … … (3).}$$

The TFP can be estimated using either regression techniques or the growth accounting framework. For our analysis, the growth accounting framework is used, assuming that the output in the economy can be approximated by constant returns to scale Cobb-Douglas production function.

Following, Romer (1990), we also add a human capital variable in the model. Our model, thus, becomes:

$$Y = AK^{\alpha} (LH)^{(1-\alpha)} \text{ … … … … … (4).}$$

In the above equation, all the variables are the same as in Equation 1, except for LH, which is the human capital-augmented employed labour force. This variable captures increases in labour productivity as a result of educational attainment and is calculated by using the mean years of schooling. We assume that an additional year of education raises the level of productivity by 7 percent, following López-Cálix et al. (2012).

Writing equation 4 in the growth form, it becomes:

$$\Delta \ln (Y) = \alpha [\Delta \ln (K)] + (1 - \alpha)[\Delta \ln(LH)] + \Delta\ln(A) \text{ … … … … … (5).}$$

Using equation 5, TFP growth is estimated as:

$$\Delta\ln(A) = \Delta \ln (Y) - \alpha [\Delta \ln (K)] - (1 - \alpha)[\Delta \ln(LH)] + \text{ … … … … … (6).}$$

Different studies assume different factor shares. For our analysis, following the Asian Productivity Organisation (APO) data, the share of capital is assumed to be 0.52 and that of labour 0.48.

Source: Siddique (2020).

(ii) Openness

To capture the impact of openness on TFP growth, we use the sum of total exports and total imports as an indicator of openness. The data are taken from various issues of the Pakistan Economic Survey.

(iii) Capital Intensity

According to Isaakson (2007), capital intensity is one of the main determinants of TFP growth. He argues that policies that encourage investment also positively impact TFP growth (p.1). Capital intensity is measured as capital per unit of labour in the present paper. The data on capital is taken from Siddique (2020), while the data on the employed labour force is sourced from various issues of the Pakistan Economic Survey.

(iv) Inflation

The consumer price index (CPI) is included in the analysis to control macroeconomic stability. Khan (2006) has also used inflation to measure macroeconomic stability or lack thereof. High inflation could be an indication of macroeconomic stability and vice versa. Moreover, moderate inflation, for example, in the range of 7-9 per cent, is generally a sign of a healthy economy. The data is taken from various issues of the Pakistan Economic Survey.

(v) IMF

It is essential to see how IMF programs have affected the TFP growth in Pakistan's case. Since 1958, Pakistan has entered into 22 programs – 19 since 1972 (not all bailouts) – with the IMF. The IMF programs are supposed to bring about structural improvements in the economy and, therefore, should positively affect the output and TFP growth. However, despite all these programs, Pakistan's structural problems remain. Thus, to see the impact of IMF programs on TFP growth in Pakistan, we add a dummy that takes the value of 1 in the years when an IMF program was in operation and 0 (zero) otherwise.

(vi) Education

To construct the education index, Kim & Loayza (2019) have taken the share of the population aged 25 and above with completed secondary and tertiary education and a standardised international test score. However, for Pakistan, neither the data on the share of the population aged 25 and above with completed secondary and tertiary education nor a standardised test score is available. Therefore, we construct the education index using the following variables: education expenditure as a percentage of GDP, primary school enrollment rates, secondary school enrollment rates, and tertiary school enrollment rates. The data are taken from various sources, including World Development Indicators (WDI).

(vii) Infrastructure

Following Kim and Loayza (2019), we construct the infrastructure index using the following variables: road network (length in kilometres), electricity (generation capacity megawatt-hours), and the number of fixed telephone lines subscriptions (per 100 people).

The data on these variables are taken from various issues of the Pakistan Economic Survey and World Development Indicators.

(viii) Innovation

The innovation index is constructed using the following indicators: R&D expenditure as a percentage of GDP, number of patents by residents and non-residents, and the number of publications in scientific journals. The data on these variables are taken from various sources, including the World Development Indicators and Pakistan economic survey.

(ix) Institutions

In Kim and Loayza (2012), to capture the impact of institutions, an index of institutions using the following indicators is constructed: voice and accountability (citizens' participation in selecting their government and freedom of expression); control of corruption (the extent to which public power is exercised for personal gain); government effectiveness (the quality of public services and policy formulation and implementation); political stability (the absence of politically motivated conflict); regulatory quality (the ability of government to formulate and implement regulations that promote private sector development); and the rule of law (the extent to which citizens have confidence in and abide by laws). They have obtained the data from the World Bank Worldwide Governance Indicators. In the case of Pakistan, however, data from 1971 onwards is not available. The data for Pakistan is only available from 1990 onwards.

(x) Financial Depth

We also use the credit-to-GDP ratio as a proxy for financial depth. A higher credit-to-GDP ratio indicates more financial depth. It implies that there is more credit available to the private sector for investment. Therefore, a higher credit-to-GDP ratio is supposed to lead to higher TFP growth. The data is sourced from various issues of the Pakistan Economic Survey.

5. CAVEATS

In an applied setting it is a daunting task to analyse the determinants of output and TFP growth, especially for a single country using time-series data, because of the non-availability of the required data. For Pakistan, the data for several variables are not available. For example, data to construct a market efficiency index is not available. Therefore, we are forced to omit a measure of market efficiency from our analysis.

Keeping in view these caveats, we proceed further.

6. THE FRAMEWORK OF ANALYSIS AND EMPIRICAL INVESTIGATION

The basic framework employed in this paper is as follows:

$$TFP_t = \alpha + \beta X_t + \mu_t \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

In Equation 1, TFPt is total factor productivity, Xt is a vector of the determinants of TFP, and μt is the error term. Based on the variables identified in sections 2, 3, and 4 above, Equation 1 can be written as:

$$TFP_t = \alpha + \beta_1(Openness)_t + \beta_2(Capital\ Intensity)_t + \beta_3(CPI)_t + \beta_4(IMF)_t + \beta_5(Education)_t + \beta_6(Infrastructure)_t + \beta_7(Innovation)_t + \beta_8(Institutions)_t + \beta_9(Financial\ Depth)_t + \mu_t \quad \ldots \quad \ldots \quad (2)$$

In Equation 2, β_is are parameters to be estimated.

Following Kim and Loayza (2019), the education, infrastructure, innovation, and institutions indexes are constructed using factor analysis. Factor analysis "captures as much of common variance in the indicators as possible in a single index" (p. 14). The period of the analysis is 1972–2019. It must be noted that some of the variables used to construct indexes had missing values. Therefore, the missing values are imputed using built-in polynomial interpolation/extrapolation techniques in MS Excel to get consistent time series for these variables.

In principal component analysis (PCA) the constructed variables are linear combinations of actual variables to ensure orthogonality (to avoid possible multicollinearity). The treatment of these constructed variables is slightly different from the actual macro variables. Many missing values are estimated using polynomial extrapolation/interpolation techniques. Therefore, we use OLS with robust standard errors to estimate Equation 3.

Furthermore, the analysis explores the possible determinants of TFP growth in Pakistan. Thus, this paper is exploratory. Secondly, the estimation methodology is chosen to see the effect of the growth of the independent variables on the growth of TFP. To this end, we have taken the log of the dependent and independent variables, the first difference of which shows growth.

7. RESULTS AND DISCUSSION

Results from the estimation of Equation 2 are presented in Table 1 below. Regression 1 in Table 1 shows the regression results with the institutions index included. Since we have the data on the institutions index only from 1990 to 2019, and for the rest of the variables, data are available from 1972, we also run a regression without the institutions index to exploit an extended time series. As can be seen from Table 1, the results of the two regressions are largely similar.

Openness has a positive association with TFP growth. Since we have taken the natural log of the dependent variable and all the independent variables, the coefficients can be interpreted as elasticities. Therefore, the coefficient of openness in Regression 1 means that a one percent increase in openness leads to a 0.0771 percent increase in TFP growth. In other words, more openness leads to positive growth in TFP. In Regression 2, the coefficient of openness is not only positive but also highly significant. The related literature also shows that outward orientation positively impacts TFP growth. The channel through which higher openness contributes to TFP growth is that trade openness exposes the economy to competition which enhances productivity. Furthermore, the import of capital goods also aids in productivity growth.

Capital intensity, i.e., capital per unit of employed labour, is positive and significant. This implies that since higher capital results from higher investment, higher capital intensity leads to higher TFP growth. Moreover, higher capital intensity means that each unit of labour has higher capital to work with, which ultimately leads to TFP growth.

The coefficient of CPI is positive and significant in both regressions. It implies that growth in CPI, i.e., inflation has a positive association with TFP growth. The positive association could be because in Pakistan, on average, the inflation has remained at 9 percent, which is neither too high nor too low. Moderate inflation, therefore, positively affects TFP growth. Also, in Pakistan, the positive association between TFP growth and inflation is perhaps because of idle capacity, i.e., unused resources. In this case, inflation means an increase in productivity growth.

Table 1

Estimation Results: Determinants of TFP in Pakistan

Dependent Variable: Log of Total Factor Productivity				
	Regression 1		Regression 2	
Independent Variables	Coefficient (Robust Std. Error)	t-stat	Coefficient (Robust Std. Error)	t-stat
Openness	0.0771 (0.06676)	1.16	0.2684*** (0.0344)	7.81
Capital Intensity	0.3671*** (0.0900)	4.08	0.4521*** (0.0712)	6.35
CPI	0.2051*** (0.0481)	4.27	0.1254*** (0.0337)	3.72
IMF	–0.0161* (0.0104)	–1.55	–0.0254** (0.0119)	–2.12
Education	–0.0893 (0.0598)	–1.49	–0.1457*** (0.0638)	–2.28
Infrastructure	–0.2002*** (0.0291)	–6.87	–0.1654*** (0.0390)	–4.24
Innovation	0.0841*** (0.0135)	6.24	–0.0050 (0.0200)	–0.25
Institutions	0.1318* (0.0795)	1.66	--	--
Credit-GDP Ratio	0.0805** (0.0455)	1.77	0.1702*** (.0577)	2.95
Constant	3.0491*** (0.9129)	3.34	0.0101 (0.6765)	0.01
Observations	30		Observations	48
F (9,20)	193.10***		F (8,39)	336.94***
R^2	0.9867		R^2	0.9816
Adjusted-R^2	0.9808		Adjusted-R^2	0.9778

Note: *, **, *** Represent significance at 10 percent, 5 percent, and 1 percent, respectively. The figures in parentheses are robust standard errors.

An interesting and important result is the negative coefficient of the IMF dummy included in our analysis. The coefficient of the IMF dummy is negative and both the regressions, and it is significant at the 5 percent level in Regression 2. The result indicates that the programs that Pakistan has entered into since 1972 have not aided in growth. On the contrary, the programs have, on average, negatively affected Pakistan's economic performance. Since the IMF programs impose certain conditions on the economy, such as reducing the fiscal deficit and bringing more agents into the tax net, it compresses demand, at least in the short run. Thus, the IMF dummy also negatively affects TFP growth.

The coefficient of education is detrimental. The result is at odds with what the literature tells us. According to the literature, an increase in education expenditure and enrollment rates adds to the human capital, which aids in adopting new technologies, ultimately leading to higher TFP growth. In the case of Pakistan, however, the reason could be the quality of education. Since not much attention is paid to the quality of education, higher enrollment rates and education expenditure does not improve the quality, which does not help to increase TFP growth.

Similarly, the coefficient of infrastructure is negative, which again is contrary to the growth literature. However, in the case of Pakistan, the focus has been on big-ticket items, which has not aided in meaningful growth in TFP. Instead, it has negatively affected TFP growth because perhaps the resources have been siphoned off to less productive infrastructure projects. It is argued, for example, in PIDE (2021) and Haque (2020) that in Pakistan, the focus is still on infrastructure that is perhaps not needed. There is little attention paid to the infrastructure, such as road networks in rural areas connecting the produce to markets, which is more efficient.

Institutions are regarded as deeper determinants of growth. Better institutions, such as better regulatory quality, improved rule of law, and better government effectiveness, lead to better economic performance, including higher TFP growth. Our results are in line with the theoretical literature on the subject and the empirical evidence found in the literature.

Finally, financial depth, measured as the ratio of credit to the private sector to GDP, has a significant and positive coefficient in both the regression equations. The result is straightforward: access to credit increases, and productivity also increases. The access to credit makes it easier for the agents to undertake investment to fulfil the needs of their ventures, be it a working capital requirement or additional and/or new investment.

8. CONCLUSIONS

The caveats noted in Section 5 and the common problems in measuring TFP notwithstanding, this study has attempted to explore the determinants of TFP growth in Pakistan. Generally, the results are in line with the empirical literature on the determinants of TFP growth.

However, there are a couple of results that are at odds with the literature:

- Education is negatively related to TFP growth in Pakistan. This could be because of the quality of education and low education expenditures as a percentage of GDP.

- Infrastructure also has negatively impacted TFP growth. The reason could be that most of the infrastructure projects are undertaken in Pakistan because of political expediency instead for their utility, as noted in several PIDE publications, such as PIDE Growth Reform Agenda (2021) and Haque (2020).
- A significant result is the negative effect of the IMF programs on TFP growth since 1972. Since IMF programs impose strict conditionalities, these programs hurt the economy's progress.
- Better institutions – especially better regulatory and bureaucratic quality and higher government effectiveness – are a must for the economy's sustained growth.

In the light of the results and as noted in Siddique (2020), Pakistan's TFP and GDP growth rates have soared whenever deregulation and market-friendly policies have been adopted.

It follows that:

- Pakistan needs to adopt policies that remove constraints on market development and the regulatory burden on the private sector, as argued in the PIDE Growth Reform Agenda (2020). Growth happens in an environment where the private sector is free from regulatory burdens.
- The government needs to reduce its footprint on the economy (Haque and Rafiullah, 2020). The presence of government in almost all the markets limits the role of the private sector, which, in turn, hampers TFP and GDP growth.
- Such policies will lead to more openness, capital accumulation, better quality and valuable infrastructure, innovation, and better-quality institutions.
- Pakistan needs to do away with the current public investment paradigm, influenced by the dated Haq-HAG model (Haque, 2020). Under this paradigm, big-ticket infrastructure projects are undertaken that are inefficient and create dead capital.

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