Infrastructure Development (Physical), Economic Growth andPolicy Choices: A Cross-Country Analysis

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Abstract

The following study inspects the influence of the physical infrastructure on economic growth of Asian countries. The countries in the studies are under-develop and have same geographical area. Countries from where data is selected for examination are Pakistan, China, India, Bangladesh, Iran and Sri Lanka. The data of last 50 years have been regressed from1970 to 2019 of Pakistan, China, India, Bangladesh, Iran and Sri Lanka. The findings explain that there is substantial relationship between infrastructure development and economic growth; infrastructure reflects physical. Energy consumption (oil) other variables proved positively significant relationship with economic growth. Policy has been recommended for economic growth and approach to value the variables according to needs and financial constraints and then prioritize the sectors in which government should invest.

Keywords: Economic growth, Infrastructure development, Physical infrastructure.

Introduction

There is a heated debate regarding the relationship between the economic growth verses infrastructure development and its policy implications. Multipurpose studies regarding these issueswere conducted since the late 90's. The role of infrastructure is very much important in economicgrowth over long run. There are two types of infrastructure defined by the researchers Physical Infrastructure. The studies on physical infrastructure relationship has been conducted by (Aschauer, 1989; Lau & Sin, 1997; Lynde & Richmond, 2019; McGuire, 1990; Ratner, 1983). They have attempted to capture the relationship between public infrastructure capitals and the total factor productivity of the US economy and established that there is a positive effect of public infrastructure capital growth on the economy of US and the effect was highly significant and positive. Likewise, numerous such studies have been conducted in China regarding this subject. China hadexecuted very high infrastructure(physical) investment policy for economic growth (Démurger, 2001; Nannan & Jianing, 2012; Sahoo, 2010; Wang, 2002) their studies show the highly significantrelationship transpires between infrastructure (physical) development and economic growth. The last two decades of the Pakistan economy has shown a little bit of boom. The last 5 years the economic policies were infrastructure intensive, due to that the GDP has raised (Batool, Awais, Rehman, Shafiq, & Dar, 2019; Ellahi, Awais, & Raza, 2018; Yaqub, Rehman, Awais, & Shafiq, 2018) and also a high raise in infrastructure development in the country with remittances boost in early 2000. The economy had seen investment in infrastructure development through connection of roads and mainly CPEC.

Research Problem

Infrastructure investment in Pakistan is more focused towards physical infrastructure i.e. roadsand highways and tangible infrastructure projects and is it as beneficial for the economic growth for the struggling country as it is portrayed. In thelight of this the research problem of studies will look into the factors which are more inclined towards investment in physical infrastructure. So, this has been further operationalized into following research objectives.

Research Questions

The previous studies demonstrated the a rather positive relation between the public investment in infrastructure and economic growth. In the light of this there are following research questions.

- Does physical- infrastructure play major part in the economic growth?
- Viability of infrastructure development in short run and long run?

Research Design

Direction, technique and research design depends upon the types of inquiry in qualitative, quantitative and mix-method approach (Creswell, 2014). This research is directed towards quantitative methods to look at the elements of infrastructure development, economic growth and policy choices by analyzing the indicators in physical and non-physical infrastructure. Researcher has selected descriptive research design for this research because data required for this research is external, secondary taken from World Bank statistics. As this research is based on quantitative research methods with descriptive design; data has been produced and results have been described in tabular form. Data and result have been produced in order to meet the objective of research.

Research Strategy

Creswell examined an inquiry into social and human issues demanding of testing and speculation or hypothesis made out of factors, estimated with numbers and broke down with measurable strategies. In the direction of this researcher used quantitative research strategy because it involves, he measures of tangible and countable features with the help of available statistical data.

Literature Review

The observed research on effect and the role infrastructure plays in economic growth started after the foundational work by (Aschauer, 1989) where Aschauer reasoned that public spending is reasonably productive, and the decrease in the U.S productivity was in direct relevance to decline in the public infrastructure and has assessed the relation between the infrastructure stock and growth in USA that mainly compromises of physical infrastructure that include roads and highways, gas and electricity and mass transport systems that can be elaborated as fundamental infrastructure stock. (Fedderke et al.,2006) scrutinized the relationship of infrastructure investment by the government and output growth, by analyzing the data set of 88 countries the variable he opted was stock of infrastructure. The time series selected was from 1960 to 2000. PMG (pooled mean group) was employed for the estimation of the data and estimates are statistically significant and an also stout to alternate infrastructure measures and dynamic specifications.

Straub and Terada-Hagiwara (2011) explained the overview of infrastructure development in context of developing Asian countries. This paper applies two discrete approaches that are growth regressions and accounting of growth to investigate the linkage between productivity of an economy and economic growth and infrastructure. Egert, Kozluk, and Sutherland (2009) found that infrastructure has enhanced the economic growth in OECD countries through economies of scale, network externalities and enhancement in market competition. They found a strong and positive impact of efficient investment in telecom and power sector in long run economic growth across the countries. Despite that the transportation sector effects are not included in these positive effects on economic growth.

The literature above gives a thorough image of studies that are conducted in different parts of the globe regarding infrastructure development and economic growth. From developed economies to the developing economies. The literature mainly comprises of Physical infrastructure development and its effect whether its long run or short run.

Research Gap

The research gap that has identified is that there isn't enough research present that has shown that either infrastructure investment/development can be used as a tool to maintain or increase the rate of economic development and also which side of infrastructure either physical or nonphysical infrastructure should be used in a long run for better economic growth.

Model, Data and Methodology

Theoretical Framework

Infrastructure can be divided into two physical and non-physical; there are studies that show the effects and impacts of different variables from physical having significant effect on economic growth. Physical infrastructure has a significant role in economic growth as defined by (Button, 1998). Physical infrastructure can be further examined bydifferent variables. (Economics, 2017; Pillai, 2008; Sahoo & Dash, 2012; Shoukat, 2017) these papers show the significance of physical infrastructure in economic growth in different economies including Pakistan's. Electricity production and consumption is a crucial part of an economy. Electricity consumption is regarded as key variable to see the effect of infrastructure development on economic growth; the electricity consumption has a significant impact both in short and long- run on economic growth (Abbas & Choudhury, 2013; Chaudhry & Safdar, 2012; Egert et al., 2009; Kusharjanto & Kim,2011; Muhammad & Wasif, 2012; Shahbaz & Feridun, 2012; Ullah, 2013). Oil consumption is also used as a proxy of physical infrastructure; it has significant positiveimpact on the economic growth in Asian economies. Construction Industry has a big share in Asianeconomies, constructions is highly significant impact on economic growth (Aqeel, 2001; B. Huang, Hwang, & Yang, 2007; Chaudhry & Safdar, 2012).

Hypothesis

Hypothesis 1

$H°$ = There is significant relationship between physical infrastructure and other variables definedin study.
H^1 = No significant relationship between physical infrastructure and other variables defined instudy.

Data and Data Sources

The data will be used is panel data of last 50 years and 6 countries Pakistan, India, China,Bangladesh, Iran and Sri Lanka. The data source is World Bank.

Econometric Model

The model has used four variables because of their significance level based on their R Square values by using simple regression ARDL approach is used for forecasting and to disentangle long run relationship from short run dynamics. The researcher has used ARDL approach because of time series data also ARDL method is used for stationery and non-stationery data. The data has auto regressive nature and value of all variables is determined by its past values and some adjustment factors. ARDL is also used to find out the long-term relationship between variables i.e. between physical,nonphysical, and economic growth. In addition, it is statistically much more significant approach forthe determination of co-integration relationship in small samples while allowing different optimal lag of variables.

The model for the estimation is ARLD Model. ARLD was used by (Y.Shin, M. Hashem, n.d.)(Richard J. Smith, n.d.) (Z. Khan, Rabbi, Ahmad, & Siqun, 2019).

$$\Delta Y_{GD(it)} = a_1 Eclectric_{it} + a_2 Energy_{it} + a_3 Industy_{it} + \mu_{it} \quad \textbf{(Eq. 1)}$$

It's a Log-Linear model as the values of GDP Per Capita changed to log values to change it topercentage values.

Electricity Consumption Kwh Per Capitaas Electric, Energy Consumption (Oil Kgs) , Per Capita as Energy and Industry (construction) Value Added % GDP as Industry. Whereas (i) is cross section and (t) is time from 1970-2019.

λ_1, λ_2, and λ_3 are coefficient and μ_{it} is the error term.

$$\Delta Y_{GD(it)} = \lambda_1 Eclectric_{it} + \lambda_2 Energy_{it} + \lambda_3 Industy_{it} + \mu_{it} \quad \textbf{(Eq. 2)}$$

Results and Interpretation

Table 1.1: Unit Root Test

Results of Panel Unit Root Tests		
	Levin-Lin-Chu (2002) (LLC)	
Variables	I(0)	I(1)
Electricity Consumption	-1.36109 (0.0867)	-0.10686 (0.000)
Energy Consumption (oil)	-0.39282 (0.3584)	-0.10686 (0.4574)
Industry (Construction)	0.93371 (0.8248)	-0.10686 (0.000)

The results of Table 1.0 illuminate that the variables are integrated at $I(1)$. The results support us to use ARDL Bound Test approach for cointegration.

Table 1.2: Long Run Analysis:

Long Run Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Electricity Consumption (kwh)	0.001454	0.000468	3.10485	0.0022
Energy Consumption (Oil Kg)	-0.00132	0.000549	-2.404559	0.0172
Industry(Construction)	0.087863	0.022017	3.990662	0.0001

Table 1.2 shows the results for the long run. The variables are significant, 1 % change in electricity consumption changes GDP by 0.0014 %, as the developing economies are mostly reliant on industrial and services sector for the growth these sectors highly dependent of electricity consumption the positive relation that means higher the consumption higher the GDP (Siddiqui, 2004). 1% increase in Energy Consumption (Oil) decreases GDP by 0.00132 % as oil is being imported for the domestic usage also for industrial usage that has impact on balance of payments that in broad terms effects the GDP inversely. Same results have been shown by (Khan et al., 2019; Chaudhry et al., 2012). 1% increase in Industry (construction) impacts the GDP 0.08%, construction industry is an integral part of economic growth and also it is related to other sectors of economy too as construction provide much employment and also it mobilize the private sector as well that also play important part in economic growth (Durdyev & Ismail, 2012; Farooqui, Ahmed, & Lodi, 2008).

Table 1.3: Short Run Analysis

Short Run Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Λ	-0.097585	0.037756	-2.584657	0.0105
D(GDP(-1))	-0.044608	0.114935	-0.388116	0.6984
D(ELECTRIC(-1))	-0.004981	0.004832	-1.030835	0.304
D(ENERGYOIL(-1))	-0.002775	0.002965	-0.935938	0.3506
D(INDUSTRY(-1))	-0.06275	0.063979	-0.980789	0.328
C	0.321247	0.160305	2.003968	0.0466

Mean dependent var	0.111017	S.D. dependent var	1.064845
S.E. of regression	1.257494	Akaike info criterion	-1.431262
Sum squared resid	281.47	Schwarz criterion	0.074943
Log likelihood	336.6893	Hannan-Quinn criter.	-0.828477

Table 1.3 reports the short run findings, major portion of variables show insignificant relationshipwith the GDP, industry (construction), electricity consumption and energy consumption (oil). λ denotes the speed of adjustment towards the equilibrium or the convergence towards the long-run equilibrium, at every year 9.7% adjustment takes place. Most of the variablesshows the negative impact on economic growth, in long-run these variables showed the positive impact on the economic growth. That means sudden boom in the education, health and physical infrastructure don't show any positive impact on economic growth. But in long-term these investments bear the fruit of economic growth. That means government shouldn't stop investmentin education, health, construction industry and energy infrastructure sector.

Conclusion and Policy Recommendations

Conclusion

Infrastructure development plays a crucial role in economic growth, whether its physical infrastructure or non-physical. The results show the significance of physical infrastructure. The physical variables have positive and significant effect on economic growth in long run except Energy Consumption (oil). Other variable does show the significance and the movement towards the long run equilibrium.

Electricity consumption has shown positive response towards the economic growth, as in previous years there was significant government spending in the electricity projects that shows the importance of energy sector spending in Pakistan.While Energy Consumption (oil) has negative impact on the economy as larger portionof the oil is imported from the international market and government buy it on deferred payments which leads to increase in foreign debts and the current account deficit. So rather than using imported oil we should move towards the local energy sources. In accordance to the study if we see the results, there are similarities and the results shows the significance of the selected variables on the economic growth. China is leading the way in world of production and capturing the international markets through the infrastructure investment in the developing countries. Results has also shown the significant investment in infrastructure in India. The investment in infrastructure and the in-education infrastructure has grown greatly. The estimations and results show the positive impact ofinfrastructure in the Indian economy ultimately leading to economic growth. As of Bangladesh, The study shows the positive impact of the variables on the economic growth but with higher investment in the long run.

Policy Recommendations

Governments should invest in the sectors that are craving more funds like energy production and roads infrastructure. Physical infrastructure is regarded as a defining variable for economic growth, it's a necessity for domestic and commercial sector of the economy. Long term investment in electricity infrastructure and construction industry which will also benefit the economy. Lastly the unavailability of technological advancement to process the crude oil for future consumptions has negative effect on the economic growth which can be changed by technological advancements so that we can process the crude oil domestically. Collective Policy Recommendations for Developing Economies (India, Pakistan, China, Iran, Bangladesh, & Srilanka). Economy of developing economies (India, Pakistan, China, Iran, Bangladesh, & Srilanka) is heavily oil reliant with no real foreign exchange and not having the technological advancement to process the crude oil for future consumption purpose. and cause inflation in the country. The governments of above-mentioned developing economies need to makea concerted effort to diversify its energy reliance on solar, hydro, and clean coal.

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