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Assessment and Implications of Maximizing the Capacities in Social and Physical Infrastructure in Middle-Income Asian countries

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Abstract

Infrastructure capacities are essential elements and one of the sustainable lines to drive economic growth. Infrastructure development, both physical and social, is vital to sector-wise economic development. However, there is limited evidence of how infrastructure development in certain sectors benefits the economy as a whole. This study explains the relationships between infrastructure and economic growth in selected middle-income Asian countries, highlighting the essential criteria to benefit from both physical and social infrastructure, as well as sectoral (agriculture, industry, and services) economic output. The research uses the data from 1990 to 2020 for empirical estimations. The study used Levin, Lin, & Chu test, ADF- Fischer chi- Square, and PP- Fischer Chi-Square to test unit root and to observe the stationary nature of the panel. Padroni and Kao cointegration is applied to check the cointegration among different panes. A Fully Modified OLS was employed for checking the association between physical and social infrastructure and economic growth. Results show that physical and social infrastructure negatively impact sectoral output in Asia's middle-income countries. Apart from infrastructure the per capita GDP growth, tax to GDP ratio, and population growth shows a simultaneous relation between infrastructure and sectoral economic growth.

Keywords: Physical Infrastructure, Social Infrastructure, Sectoral Output, Middle-income Countries

JEL Classification Codes: E01, H76, H54

1. Introduction

Infrastructure is one of the main factors that contribute to the growth of every country, as every competitive economy desires sustainable development. It aligns with the goal of rapid industrialization, capital development, and a high standard of living. Therefore, public investment in infrastructure is an essential part of the economic development process (Pedroni, 2001). Infrastructure plays a significant role in economic growth through reduced cost, increased productivity, better economic conditions with extra employment opportunities, an investment-friendly environment, and global competitiveness (Sahoo et al., 2010).

Infrastructure provides the base for the country's structure and all other economic activities. Literature divides the infrastructure services into two major components, i.e., physical and social infrastructure. Physical infrastructure includes transport (Nguyen et al., 2021) (roadways, airways, railways, and water supply), electricity, telecommunication, and irrigation, whereas social infrastructure includes education and health facilities (Nguyen et al., 2021).

Physical infrastructure also contributes significantly to the agricultural sector and improves social infrastructure services (Ghosh & De, 2004). Social infrastructure, on the other hand, plays a more important role in the formation of human capital through health, education, and housing facilities that promote labor productivity and a higher standard of living (Ghosh & De, 2004).

2. Literature Review

Many studies were conducted to examine the effects of infrastructure on economic growth but they were

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primarily concerned with time-series data or cross-country analysis (Rawlings et al., 2004). The main concern of this research is to estimate the relationship between infrastructure and economic growth in Middle-income Asian countries. Many studies confirmed the positive impact of infrastructure on economic development, employment growth, and quality of life (Esfahani & Ramírez, 2003). The endogeneity and direction of causation between infrastructure and growth is a major concern in this regard, as infrastructure is critical to the increase in productivity and output (Holtz-Eakin & Lovely, 1996). Economic growth, on the other hand, has an impact on infrastructural determinants. Some studies, found no evidence of such biases, while others concluded, based on state-level panel data, that long-run fixed effects could not indicate a positive relationship between infrastructure and economic growth (Holtz-Eakin & Schwartz, 1995).

Using panel data from 1975 to 2007, Sahoo et al. (2010) estimated the relationship between social and physical infrastructure and economic growth in China. Using the Generalized Method of Moments (GMM), they found that infrastructure stock, labor force, governmental and private investment all had a significant impact on economic growth. Furthermore, the findings revealed that economic policy in developed countries improved physical infrastructure, human capital formation, and economic growth. Fatai (2016) explained that private and public capital, per capita health, education, and infrastructure positively impact economic growth. Infrastructure development to support economic policies resulted in increased infrastructure and human capital development for long-term growth. Srinivasu and Rao (2013) explained the positive long-run association between economic growth and telecommunication infrastructure using time-series data.

Tripathy et al. (2016) analyzed the relationship between economic growth and infrastructure investment in the case of India. This research used time-series from 1971 to 2012, ARDL and Error correction, and Granger causality for estimation. Thus, the result explained that the long-run relationship between inflation and GDP is negative. Inflation decreases the GDP. So the results showed India maintained low inflation and advanced the economic growth.

3. Data Sources

The current study looks into the economic benefits of physical and social infrastructure in Asian countries with a middle income. The study highlights the fundamental frameworks for benefiting from these essential requirements, which include both social and physical infrastructure. Furthermore, the study uses data from 1990 to 2020 to make empirical estimates for Asia's middle-income emerging countries. World Development Indicators (WDI) is used for data collection for all the relevant variables.

4. Methodology

This study endeavors to uses the following theoretical and empirical methodology.

4.1. Theoretical Methodology

4.1.1. Fully Modified Ordinary Least Square

The fully modified least square technique (Kao & Chiang, 2001; Pedroni, 1999, 2004) is the most widely used cointegration technique (Pedroni, 2001). FMOLS approximates the cointegration vector for nonstationary panels. In cointegrated panel regression, FMOLS is useful. For the entire nonstationary coefficient, FMOLS estimates have a mixed normal bound division. Endogeneity and serial correlation effects in regressors are caused by the persistence of a cointegrating link, according to FMOLS. FMOLS investigates behavior in a model with the rank I(0) regressor model I(1) and I(0) regressor, a model with unit roots, and a model with stationary regressor. If variables are not cointegrated, then we reject the FMOLS model. FMOLS model can be used only for co-integral panel data.

4.1.2. Panel Unit Root

The unit root is a problem of time-series data in general. The preliminary tests for unit root and cointegration in the panel are IPS (Im et al., 2003) and LLC test (Levin et al., 2002). These are explained in this section.

i. The Levin and Lin (LL) Test

Levin et al. (2002) presented the unit root test as an extension of Dicky Fuller (DF) test.

$$\Delta Y_{i,t} = \alpha_i + \rho Y_{i,t-1} + \sum\nolimits_{k=1}^{n} \varnothing_k \Delta Y_{i,t-k} + \delta_{i,t} + \varnothing_t + u_{i,t}$$

The unit root alternative hypothesis, which argues that no unit root exists, is stated as the null hypothesis.

ii. The Im, Pesarn, and Shin Test

The IPS test (Im et al., 2003) gives a different estimation for each section. The model is as follow

$$\Delta Y_{i,t} = \alpha_i + Y_{i,t-1} + \sum\nolimits_{k=1}^{n} \varnothing_k \Delta Y_{i,t-k} + \delta_{i,t} + \varnothing_t + u_{i,t}$$

To estimate the t-statics, the test assumes that t should be the same for all the cross-sections required for a balanced panel.

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N}\left(t_{pi}\right)$$

They also described that under specific assumptions $tp_i \rightarrow tp_{iT}$ the variance is finite Mean is $(E[t_i + 1 \mid p_i = 1])$ and Variance is $(\text{var}[t_i + 1\ p_i = 1])$. Based on these values, the IPS statics constructed for testing of a unit root in the panel is given as

$$t_{ips} = \frac{\sqrt{N}\left(E - 1/N\sum_{i=1}^{N} E\left[t_{it} \mid p_i = 0\right]\right)}{\sqrt{\text{var}\left[t_{it} \mid p_t = 0\right]}}$$

4.1.3. Panel Cointegration

The econometric technique elaborates the relationship between factors; that is why the researchers applied the panel cointegration technique developed by Pedroni (1999, 2001, 2004) and Kao (1999) (who stated the null hypothesis that no cointegration exists in heterogeneous and homogenous panels).

i. The Kao Test

Under the null hypothesis of no cointegration, Kao (1999) describes two tests. So, a model such $Y_{it} = \alpha_i + [\![\beta X]\!]_{it} + e_{it}$, $y_{(it)} = [\![y]\!]_{it} + u_{it}$, $x_{it} = x_{(it-1)} + \varepsilon_{it}$ can be used. Furthermore, the OLS estimator is as follows:

$$\hat{\rho} = \frac{\sum_{i=1}^{N}\sum_{t=2}^{T}\hat{e}_{it}\hat{e}_{it-1}}{\sum_{i1}^{N}\sum_{t=2}^{T}\hat{e}_{it-2}^{2}}$$

Kao shows the following *t*-Statistics is:

$$\text{ADF} = \frac{t_{\text{ADF}} + \sqrt{\sigma N \hat{\sigma}_v / 2\hat{\sigma}_{0v}}}{\sqrt{\hat{e}_{0v}^{2}}}$$

ii. The Pedroni Test

Pedroni (1999, 2001, 2004) cointegration in panel data models allows for deterministic patterns with diverse coefficient slopes for individual specific and fixed effects. Pedroni (1999) presented a number of panel cointegration tests (Pedroni, 2004).

Padroni presents the regression model.

$$Y_{i,t} = \alpha_i + \delta_t + \sum_{m=1}^{M} B_{mi} X_{mi,t} + u_{i,t}$$

The test statistics of this test is.

a) Panel V Statistics

$$T^2 N^{\frac{3}{2}} Z_{\hat{v}\text{NT}} = \frac{T2N3/2}{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{u}_{2t}^{2}}$$

b) Panel Statistics

$$T^2 N^{\frac{3}{2}} Z_{\hat{v}\text{NT}} = \frac{T\sqrt{N}\left[\sum_{i=1}^{N}\sum_{t=1}^{T}\left(\hat{u}_{2t-1}^{2}\,\Delta\hat{u}_{2t}^{2} - \wedge\hat{2}\right)\right]}{\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{L}_{11i}^{-2}\hat{u}_{2t}^{2}}$$

4.1.4. Panel Cointegration Fully Modified Ordinary Least Square

"Panel cointegrated regression models, regression coefficient and the associated statistical tests are different from those of the time series cointegration regression models (Kao & Chiang, 2001; Pedroni, 2001, 2004; Phillips & Moon, 1999). Pedroni (2004) proposed a Fully Modified estimator (Hansen & Phillips, 1990). Moreover, Kao and Chiang (2001) stated a precondition for panel cointegration, that is variables must be stationary in the same order. If variables are cointegrated, then apply the FMOLS model.

4.2. Empirical Econometric Model

The empirical analysis divided the infrastructure into two categories: social Infrastructure and physical Infrastructure (see Appendix).

4.2.1. Empirical Model 1: Contemplation of Physical and Social Infrastructure in the Agriculture Sector

$$\begin{aligned}\text{AGRI}_{it} = {} & \alpha_0 + \alpha_1(\text{PHYI})_{it} + \alpha_2(\text{SOCI})_{it} \\ & + \alpha_3(\text{GDPG})_{it} + \alpha_4(\text{TREV})_{it} \\ & + \alpha_5(\text{INFL})_{it} + \alpha_6(\text{LFPR})_{it} + \mu_t\end{aligned} \quad (1)$$

4.2.2. Empirical Model 2: Contemplation of Physical and Social Infrastructure in the Industrial Sector

$$\begin{aligned}\text{INDU}_{it} = {} & \beta_0 + \beta_1(\text{PHYI})_{it} + \beta_2(\text{SOCI})_{it} \\ & + \beta_3(\text{MONS})_{it} + \beta_4(\text{GDP})_{it} \\ & + \beta_5(\text{TREV})_{it} + \beta_6(\text{LFPR})_{it} + v_t\end{aligned} \quad (2)$$

4.2.3. Empirical Model 3: Contemplation of Physical and Social Infrastructure in the Service Sector

$$\begin{aligned}SERV_{it} = \gamma_0 + \gamma_1(PHYI)_{it} + \gamma_2(SOCI)_{it} \\ + \gamma_3(GDPG)_{it} + \gamma_4(TREV)_{it} \\ + \gamma_5(TRAD)_{it} + \gamma_6(INFL)_{it} \\ + \gamma_7(LFPR)_{it} + \gamma_8(HEXP)_{it} + w_t\end{aligned} \tag{3}$$

In the equations mentioned above, SERV is Service value-added, PHYI is Physical infrastructure index, SOCI is social infrastructure index, GDPG is Gross Domestic Product, TAXGDP is Tax to GDP ratio, TRAD is Trade, INFL is Inflation, LFPR is Labour force participation, POPG is Population Growth, and HEXP is Health expenditures.

4.3. Variable Description

i. **Broad Money Annual Growth**- Broad money is the sum of currency outside banks, including the time, savings, and foreign currency deposits of resident sectors other than the central government.
ii. **Current Health Expenditure**- Level of current health expenditure expressed as a percentage of GDP.
iii. **Population Growth Annual**- is the exponential rate of growth of midyear population from year $t-1$ to t, expressed as a percentage.
iv. **Tax Revenue of GDP**- Tax revenue refers to compulsory transfers to the central government for public purposes.
v. **Trade to GDP Ratio**- Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.
vi. **Inflation**- is measured by the consumer price index which reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services.
vii. **Labour Force Participation**- is the proportion of the population age, 15 and older that is economically active.

4.3.1. Construction of Infrastructure Development Indices

Researchers have formulated the physical infrastructure development index (PHYI) and social infrastructure development index (SOCI). The key benefit of creating an index is that it incorporates critical indicators and represents the various indicators as a whole. The researcher achieves this by assigning accurate weights to all indicators. Due to the distribution of fixed weights to all indications that may fluctuate over time, the conventional method of generating an index lake is left behind. In the production of infrastructure indexes, Principal Component Analysis (PCA) incorporates this challenge. At first, normalization follows the process as:

$$\text{Normalized Indicator} = \frac{\text{Actual Value} - \text{Minimum Value}}{\text{Maximum Value} - \text{Minimum Value}}$$

For index formulation, it is necessary to use a unit-free measure of the variable.

i. **Physical Infrastructure Development Index**
To describe physical Infrastructure in Middle-income Asian countries, researchers have formulated the physical infrastructure index (PHYI) by using four indicators; electricity consumption, rail (KM) availability, fixed telephone connections, and Air transport.

ii. **Social Infrastructure Development Index**
To describe social Infrastructure in Middle-income Asian countries, researchers have formulated the social infrastructure index (SOCI) by using two variables one is education, and the second is the health facility. The researcher used gross enrollment rate and immunization rate as the proxy for education and health, respectively (Ghosh & De, 2004).

5. Empirical Results and Discussion

5.1. Descriptive Statistics

In this section, the researcher has explained the descriptive statistics of the variables (Table 1).

5.2. Correlation Analysis

The correlation coefficient is a statistical measure of the strength of the relationship between the relative movements of two variables. The values range between −1.0 and 1.0. A correlation matrix is simply a table that displays the correlation coefficients for different variables. That is, it displays the possible association between two variables (Table 2).

5.3. Panel Unit Root

The researcher verifies data stationarity using a panel unit root test based on the techniques devised in the data and methodology section (Table 3).

Table 1: Descriptive Statistics

	Mean	Median	Std. Dev.
INDS	4.6119	5.2347	9.3456
PHYI	−0.0602	−0.0784	1.2290
SOCI	0.2134	0.1502	1.2633
GFCF	7.5699	7.0521	16.2091
GDPG	4.8520	5.2936	6.5914
TREV	14.2523	14.4133	4.2092
MONS	44.8011	16.4383	147.5686
TRAD	90.6354	81.0493	41.4729
LFPR	58.5510	59.8210	10.2180
HEXP	4.9362	4.2171	2.3066
POPG	1.5207	1.3035	1.2884
INTR	7.1677	5.8006	10.0788
INFL	43.4506	6.3396	260.2124
AGRI	3.0631	3.4157	6.9749
SERV	5.5279	5.6765	6.4444

Source: Author's Estimations using Eviews-9.5.

5.4. Cointegration Analysis

As shown in the panel unit root table above, all variables are integrated of order one I(1). Phillips and Hansen (1990) and Pedroni (1999, 2004) investigated panel cointegration using seven cointegration statistics; the first four, Panel *V*-statistics, pp-statistics, rho, and panel ADF statistics, are within-dimension based statistics, while the remaining are between-dimension based statistics (Table 4).

5.5. Estimation of Fully Modified Ordinary Least Square

Fully modified least squares (FMOLS) regression was initially considered in work by (Phillips & Hansen, 1990) to present the estimates of cointegrating regressions This method uses a modified least-squares approach to account for serial correlation effects and endogeneity in the independent variables discovered by a cointegrating relationship. Researchers examine the impact of infrastructure on the rate of agricultural growth in our first model. Models 2 and 3 of the research examined the relationships between infrastructure and industrial sector value-added and service sector value-added, respectively.

Table 2: Correlation Analysis

	PHYI	SOCI	GFCF	GDPG	TREV	MONS	TRAD	LFPR	HEXP	POPG	INTR	INFL	AGRI	SERV
INDS	−0.13	−0.10	0.33	0.63	−0.07	−0.47	−0.01	0.04	0.00	0.04	−0.05	−0.22	0.25	0.23
PHYI		0.62	−0.14	−0.07	0.02	0.02	0.27	−0.30	0.38	−0.01	−0.08	0.00	0.00	0.00
SOCI			−0.16	−0.05	0.10	−0.09	0.22	−0.23	0.32	−0.02	−0.10	−0.06	0.03	−0.01
GFCF				0.40	0.01	−0.09	−0.01	0.02	0.01	−0.03	0.09	−0.03	0.05	0.27
GDPG					−0.02	−0.48	0.03	−0.01	0.08	0.06	−0.12	−0.28	0.39	0.41
TREV						0.20	0.58	0.36	0.12	0.05	0.09	0.10	−0.08	0.05
MONS							0.03	0.03	0.01	−0.22	0.11	0.67	−0.30	−0.19
TRAD								0.26	0.06	0.16	−0.04	0.03	−0.05	0.08
LFPR									−0.56	−0.39	0.05	0.02	−0.09	0.04
HEXP										0.25	0.13	0.02	0.09	0.02
POPG											−0.14	−0.23	0.07	−0.07
INTR												0.08	−0.07	−0.20
INFL													−0.16	−0.12
AGRI														0.11

Source: Author's Estimations using Eviews-9.5.

Model one explained the impact of the physical and social infrastructure development index on agriculture growth proxied by the agriculture value-added. Table 6 presents the empirical estimation of infrastructure on agriculture value-added. All the explanatory variables have the expected signs and are statistically significant. Several recent studies have examined the role of infrastructure capital for sectoral productivity growth (Auerbach, 1990; Baffes & Shah, 1993; Hulten, 1992).

Model 1 shows the positive impact of the physical infrastructure index on agriculture value-added. The slope coefficient has a high level of significance; it reveals that a one-unit increase in the physical Infrastructure index results in a 0.06-unit increase in agriculture value-added and vice versa. This outcome is consistent with the findings of (Ghosh & De, 2004; Jan et al., 2012). In addition, the researcher used the GDP to tax ratio to highlight the financial compatibility of the regions and as a tool for financing social and physical infrastructure investment. The impact of tax revenue to GDP ratio is negative and significant; this implies that the higher the tax to GDP ratio, the lower the rate of increase in income of individuals belong to the agriculture sector.

Model 2 shows a highly significant slope coefficient for the positive influence of the physical infrastructure index on industrial value-added. The physical infrastructure index coefficient illustrates how a 1 unit change in physical infrastructure relates to a change in industrial value-added of 0.3596 units. The positive physical infrastructure coefficient is also important in the formation of private capital and contributes to economic production (Reinikka & Svensson, 1999). In Asia, the trend of returns is positive; this result is consistent with (Sahoo et al., 2010). With a significant probability value of 0.0003, social infrastructure has a positive and significant effect on industrial value-added.

On the other side, with a nominal probability value of 0.1519, the money supply, as measured by broad money yearly growth, has a negative impact on industrial value-added. The rate of GDP growth has a positive impact on industrial value-added. The key factor that promotes

Table 3: Panel Unit Root Table

Variables	Unit Root Process	Decision
PHYI	Unit Root at level	
ΔPHYI	No Unit Root at 1st difference	*I*(I)
SOCI	Unit Root at level	
ΔSOCI	No Unit Root at 1st difference	*I*(I)
MONS	Unit Root at level	
ΔMONS	No Unit Root at 1st difference	*I*(I)
HEXP	Unit Root at level	
ΔHEXP	No Unit Root at 1st difference	*I*(I)
GDPG	Unit Root at level	
ΔGDPG	No Unit Root at 1st difference	*I*(I)
TREV	Unit Root at level	
ΔTREV	No Unit Root at 1st difference	*I*(I)
INFL	No Unit Root at level	
ΔINFL	No Unit Root at 1st difference	*I*(0)
LFPR	Unit Root at level	
ΔLFPR	Unit Root at 1st difference	*I*(I)
POPG	Unit Root at level	
ΔPOPG	No Unit Root at 1st difference	*I*(I)

Source: Author's Estimations using Eviews-9.5.

Table 4a: Panel Co-Integration Result (Model 1)

Method	Alternative Hypothesis: Individual AR Coef (Within Dimension)			
			Weighted	
	***t*-Stat**	**Prob.**	***t*-Stat**	**Prob.**
Panel *V*-stat	−1.605796	0.9458	−2.339868	0.9904
Panel rho-stat	−0.164582	0.4346	0.687107	0.7540
Panel PP-stat	−9.709190	0.0000	−7.362665	0.0000
Panel ADF-stat	−4.693172	0.0000	−4.849959	0.0000
	Alternative Hypothesis: Individual AR Coef (Between Dimension)			
Group rho-stat	−0.062734	0.4750	–	–
Group pp-stat	−12.95301	0.0000	–	–
Group ADF-stat	−5.825480	0.0000	–	–

Source: Author's Estimations using Eviews-9.5.

Table 4b: Panel Co-Integration Result (Model 2)

Method	Alternative Hypothesis: Individual AR Coef (Within Dimension)			
			Weighted	
	t-Stat	Prob.	*t*-Stat	Prob.
Panel *V*-stat	1.909570	0.0281	−1.961554	0.9751
Panel rho-stat	−1.438096	0.0752	−0.980351	0.1635
Panel PP-stat	−11.99274	0.0000	−10.31652	0.0000
Panel ADF-stat	−6.778236	0.0000	−6.156965	0.0000
	Alternative Hypothesis: Individual AR Coef (Between Dimension)			
Group rho-stat	−0.062734	0.4750	−	−
Group pp-stat	−12.95301	0.0000	−	−
Group ADF-stat	−5.825480	0.0000	−	−

Source: Author's Estimations using Eviews-9.5.

Table 4c: Panel Co-Integration Result (Model 3)

Method	Alternative Hypothesis: Individual AR Coef (Within Dimension)			
			Weighted	
	t-Stat	Prob.	*t*-Stat	Prob.
Panel *V*-stat	−0.626148	0.7344	−2.362564	0.9909
Panel rho-stat	−2.444538	0.0073	−0.950855	0.1708
Panel PP-stat	−28.29815	0.0000	−12.44775	0.0000
Panel ADF-stat	−12.11225	0.0000	−8.447554	0.0000
	Alternative Hypothesis: Individual AR Coef (Between Dimension)			
Group rho-stat	0.536103	0.7041	−	−
Group pp-stat	−23.68619	0.0000	−	−
Group ADF-stat	−8.416417	0.0000	−	−

Source: Author's Estimations using Eviews-9.5.

sectoral development is the general economic environment. The economic expansion provides the basis for sectoral economic output. The simultaneous relation is also examined in literature by Herranz-Loncán (2007) and Pedroni 2004).

Model 3 looked at the impact of social and physical infrastructure on the growth value-added of the service sector. Physical infrastructure is a key factor that contributes to the service sector's economic growth. The physical infrastructure index did not have a significant positive impact to boost the service sector. Infrastructural development contributes to increased economic activity in the service sector. Growth has the indication and is also highly significant when it comes to the impact of social infrastructure. This demonstrates that social infrastructure has a positive impact on service sector growth, and (Ghosh & De, 2004) also identify social infrastructure's significant benefits to economic growth (Sahoo et al., 2010). The impact of social infrastructure on service growth is important. Because the ratio of investment in social infrastructure is higher than that in physical infrastructure in many countries, the rate of public investment in physical infrastructure is insignificant for service sector growth due to inefficient management, ineffective implementation of public policies, and corruption. Expenditures in health bring positive change in the service sector value addition; if individuals

Table 5: Estimation of Fully Modified Ordinary Least Square

Variables	Model - 1	Model - 2	Model - 3
	Agriculture Sector VA	Industrial Sector VA	Service Sector VA
PHYI	0.067275*** (3.958082) [0.0001]	0.3596*** (0.0088) [0.0000]	0.022509 1.215420 0.2249
SOCI	0.513801*** (32.27359) 0.0000	0.0522*** 0.0077 0.0000	0.064166*** 3.577179 0.0004
MONS		−0.030619 −1.4662 0.1519	
HEXP			0.229323*** 10.32028 0.0000
GDPG	0.459572*** 14.54114 0.0000	0.5074*** 0.0443 0.0000	0.509236*** 16.20168 0.0000
TREV	−0.030251 −1.550752 0.1218	0.5470* 2.4316 0.0155	0.147672*** 8.051678 0.0000
TRAD			0.008740 0.420387 0.6744
INFL	0.027055 1.156244 0.2483		−0.048406* −1.722061 0.0858
LFPR	0.069767*** 5.190772 0.0000	0.6818* 1.8447 0.0658	0.081878 5.161559 0.0000
POPG			−0.354149*** −31.13618 0.0000

Source: Author’s Estimations using Eviews-9.5.

invest in their health, it enhances individual productivity. This ultimately contributes to sectoral economic output. So, there is utmost need to improve health, education, and social protection sectoral governance, strengthen the management structures, allocate more financial resources, and effectively utilize these resources with proper policy implementation procedure.

The impact of the tax rate on the value-added of the service sector was determined to be significant. An increase in the tax rate boosts the service sector’s economic activity, and the coefficient has a significant slope coefficient. In response to a 0.1476 unit increase in tax revenue collection, service sector growth increases by 1unit. The GDP to tax ratio was used by a researcher to demonstrate the cross sections’ financial compatibility as a method for financing social and physical infrastructure investment. The impact of tax revenue to GDP ratio is positive and significant; this means that the higher the tax to GDP ratio, the higher the increase in individual welfare.

Moreover, financing infrastructure projects by taxes has a positive effect on sectoral output in the long run (Esfahani & Ramírez, 2003). Thus, the impact of population growth on service sector growth is positive and highly significant. Moreover, the estimated coefficient of population growth shows a significant impact of population growth on service growth, since researchers examine that in developing countries, population growth leads to economic growth through the channels of technological advancement, communication facilities, innovation, and economies of scale (Owusu-Manu et al., 2019; Simon, 1980).

6. Conclusion and Policy Recommendations

The main objective of this study was to estimate the relationship between infrastructure and sectoral output in Asian countries and examine the impact of physical infrastructure development and social infrastructure development on sectoral output. For this purpose, we have employed panel FMOLS to the data of middle-income Asian countries from 1990 to 2020. Apart from infrastructure indicators and per capita GDP growth analyses, the impact of public investment on infrastructure facilities is also examined in this study. Furthermore, both physical and social infrastructure have a positive and significant impact on each economic sector, as evidenced by the tax to GDP ratio and population; additionally, both physical and social infrastructure have a positive and substantial impact on each economic sector. Physical infrastructure investment, on the other hand, is less efficient in the case of service sector growth rates; as a result, the impact of public investment on social infrastructure growth is minimal and insignificant, resulting in a small proportion of economic growth explained by social infrastructure growth as compared to physical infrastructure. However, the performance of health and education indicators is alarming, so there is a dire need to bring structural reforms in the social infrastructure sector to enforce social development policies properly and effectively utilize resources. Furthermore, the extensive emphasis on the increase in productive social infrastructure investment will enhance the productivity of labor and innovation.

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Appendix