Quest Journals
Journal of Research in Humanities and Social Science
Volume 5 ~ Issue 9 (2017) pp: 28-32
ISSN(Online) : 2321-9467
www.questjournals.org

Research Paper

The Effects of Infrastructure Development on Economic Growth in the Northern States of Malaysia

Nor Aznin Abu Bakar[1*], Siti Hadijah Che Mat[2]
[1,2]School of Economics, Finance and Banking, Universiti Utara Malaysia
Corresponding Author: Nor Aznin Abu Bakar[*]

Received 07 Oct., 2017; **A**ccepted 14 Oct., 2017 © The author(s) 2014. **P**ublished with open access at **www.questjournals.org**

ABSTRACT: *This study analyse the effects of infrastructure development on economic growth in the northern states of Malaysian namely Kedah, Perlis, Pulau Pinang and Perak. An infrastructure development index is developed by merging four main indicators with several sub indicators and using the principal component analysis (PCA). The infrastructure development index is then used together with other variables such as labour force and capital investment to estimate its effect on the economic growth. Using the Hausman's specification test, the random effect model is chosen to estimate the impact of infrastructure on economic growth. Findings indicate that infrastructure development has a positive and significant impact on economic growth of the four states. Likewise, results obtained indicate that total labour force and total capital investment also positively and significantly affect the economic growth. Therefore, it is important for the policy makers to review and implement necessary policies that can improve infrastructure facilities as well as human capital development to promote economic growth in the region.*
Keywords: *Economic Growth, Infrastructure Development, Endogenous Growth Theory, Random effect model*

I. INTRODUCTION

Infrastructure means the basic structure that support and lubricates the economic activity to flow. The term indicates the road network, electricity, water and sanitation, telecommunication sector, including the cellular phones and internet service (ADB, 2017). Infrastructure plays an important role in the process of economic development and it has long been acknowledged by researchers and policy makers. Infrastructure development, both economic and social has been one of the main determinants of economic growth and lack of infrastructure remains to be one of the main obstacles that deterred economic growth in many developing countries. The role of infrastructure in promoting economic growth has been well documented in the literature. Amongst others are Aschauer, 1989; Calderon and Serven, 2003; Estache, 2006; Sahoo, Dash and Nataraj, 2010. Aschauer (1989) in his seminal work quantified the impact of infrastructure on income and growth. Later there was a wide range of empirical results proving the essential role of infrastructure on economic growth. Many studies have been carried out to see the relationship between infrastructure development and economic growth. The impact of infrastructure on economic growth is analyzed both from the theoretical and empirical viewpoints. The importance of infrastructure to economic growth is commonly analyzed using both the households and firms by looking at the availability and quality of infrastructure, causing in different decisions to invest. Specifically, the infrastructure services are used as final consumption items by households and as an intermediate consumption item for firms. The availability of infrastructure services significantly influence the development of regions and countries. The impact of infrastructure development on a country's economic development will lead to an important issue for the strategic and development policy management.

II. THEORETICAL FRAMEWORK

Endogenous growth theory emerged in 1980's as a response to the exogenous growth models. The exogenous growth theories collapse because not explaining the reasons of low economic growth in developing countries despite heavy investment. Whereas, the endogenous theory asserts most efficient and effective way to spur economic growth. Unlike the exogenous growth theory, endogenous growth theory focuses on endogenous factors to accelerate growth. The theory assumes technological change as endogenous factor, and more crucial factor for economic growth. In addition, the endogenous growth theory considers increasing return to scale with respect to the endogenous factor as technological change, human and physical capital. Moreover, the theory stresses on investment on research and development, human and physical capital to accelerate economic growth (Todaro and Smith, 2012).

The current study is based on the endogenous growth model. According to the theory, liberalizing the economy, investment in research and development, human and physical capital, technological advancement and their spillover effects encourage economic growth in an economy (Romer, 1986). The model assumes human capital, physical capital and technological change as a main contributing factor for economic growth. Hence, this study employs the endogenous growth model as employed by Manwa and Wijiweera (2016), to examine the impact of infrastructure development index, human capital and total capital investment on economic growth of four Malaysian states:

$$y = f(A\, IDI^{\gamma_1} TLF^{\gamma_2} TCI^{\gamma_3}) \qquad (1)$$

In equation (1), y denotes the economic growth, A indicates the technological change, IDI is an infrastructure development index, TLF is total labor force and TCI is a total capital investment.

III. DATA AND METHODOLOGY

This study uses an annual time series data for the period of 2007 to 2015, of the four northern states of Malaysia namely Kedah, Perlis, Pulau Pinang and Perak. All variables are expressed in logs. The data sets are obtained from the Economic Planning Unit (EPU), the Statistics Department of Malaysia and Energy Commission of Malaysia,

3.1 Infrastructure Index

The Infrastructure Development Index (IDI) is developed using various indicators of infrastructure and the principal component analysis (PCA) method is employed. Indicators are selected based on data availability for the four northern states of Malaysia and also these variables are essential components of infrastructure in an economy. The four infrastructure indicators are transportation, ICT, electricity and water & sanitation. These four categories are further divided into several sub indicators i.e. Total Pave Roads (TPR), Total Grave Roads (TGR), No of Cellular phones, Broad Band subscribers, Domestic Water consumption & Sanitation Services

3.2 Construction of Infrastructure Development Index

This study uses principal component analysis method (PCA) as a statistical tool to construct Infrastructure development Index. PCA method allocates the weights to each indicator used in index and merges various dimensions of a single phenomenon into a single numeric value without losing any information (Jolliffe, 2009). This method analyses the multiple correlation principle and explains the variance of the dependent variable. The factors are chosen by PCA method with eigenvalues greater than one and are considered as significant. The following formula is used by PCA to construct Infrastructure Development Index:

$$IDI = \sum_{i=1}^{n} W_i Z_i \qquad (2)$$

Where IDI is the weighted infrastructure development index (ID); W_i shows percentage contribution of each variable as weight and Z_i indicates the value of each indicator. PCA calculated the factor loadings for each indicator individually. The indicators are standardized first then eigenvalues are computed. It is recognized as the variance of factor of element and can evaluate the significance of any component. If the indicators are homogenous then their mean equals to zero and variance equals to one for each. And if we have N homogenous variables then the summation of their variance equals to one. PCA transforms the data in such a way that the aggregate variance components N distributed randomly among the components. The first eigenvalue is greater than the second and so on. The value that is extracted is referred as extracted value or commonalities (Haq M, MRM, & GMN, 2016)

IV. EMPIRICAL RESULTS

In examining the impact of infrastructure development on economic growth in the four northern states of Malaysia, the following econometric model is employed

$$LEG_{it} = \beta_i + \beta_1 LIDI_{it} + \beta_2 LTLF_{it} + \beta_3 LTCI_{it} + \varepsilon_{it} \quad (3)$$

Where, i=1,2,3,…N=4; t=1,2,3….N=9.

In equation (3), β_i, β_1, β_2 and β_3 are the coefficients and i and t are i_{th} time period and t_{th} country. LEG_{it} is the log of economic growth measured by real GDP, $LIDI_{it}$ is the log of infrastructure development index (IDI), $LTLF_{it}$ is the log of total labor force , $LTCI_{it}$ is the log of the total capital investment and ε_{it} is the error term. The term β_i is a constant parameter that varies across each cross sections but remain constant over time. The error term is supposed to be varying freely across each cross section because every single constant controls for cross sectional differences.

Before regression analysis, all the variables are converted into natural logarithm and summary of the descriptive statistics is presented in Table 1. The descriptive statistics show that the mean (measure of central tendency) value of economic growth, infrastructure development index, total labour force and total capital investment is 10.05, 13.11, 6.15 and 7.12 respectively. While standard deviation or the spread of our data shows that economic growth, infrastructure development index, total labour force and total capital investment are away from mean by the values 1.10, 1.54, 0.98 and 2.15 respectively.

Table 1: Descriptive Statistics

Variable	Mean	Maximum	Minimum	Std Dev.
LEG	10.05	13.11	6.15	7.12
$LIDI$	11.57	14.38	6.92	9.54
$LTLF$	8.05	9.96	4.41	1.13
$LTCI$	1.10	1.54	0.98	2.15

Source: author computation

4.1 Estimation Results.

The traditional panel data model; fixed effect and random effect models are employed to analyse the impact of infrastructure, labour force and capital on economic growth in the four northern states of Malaysia. Because of small data size, the fixed and random effect models are the best option for analysis (Gujarati, 2003). The Hausman's specification test is used to determine the best between fixed effect and random effect model (Hausman, 1978). For instance, fixed effect model will be chosen if the P-value is found less than 0.5 ($p<0.5$), and if the P-value is greater than 0.5 then random effect model is the most appropriate model to be employed. In addition to fixed and random effect model, we use robust least square method to check the robustness of the outcomes (Azam, 2016).

Based on the Hausman's specification test, with P-value (0.64) and chi-squared test value (62.279), the random effect model is chosen to estimate the effect of infrastructure on economic growth. The high R-square value (0.9192) of random effect model explains the 91% variation in the dependent variables. (Table 2)

Results obtained show that all the variables, including IDI and TLF are statistically significant except the TCI. The outcomes show that one percentage change in infrastructure causes 6.69% change in economic growth of the four selected Malaysian states. Also, the coefficient of total labour force (TLF) shows that one percentage change in labour force increases the economic growth by 0.61% percentage.

Table 2. Panel Estimation Results

Dependent variable: Economic Growth				
Variables	Fixed Effect		Random Effects	
	Coefficient	T-ratio	Coefficient	T-ratio
LIDI	1.12[0.004]**	3.06	6.69[0.000]*	6.70
LTLF	2.24[0.000]*	4.06	0.61[0.000]*	7.57
LTCI	-0.01[0.692]	-0.39	0.04[0.107]	1.65
R^2	0.9785		0.9192	
$Adj.R^2$	0.9738		0.9220	
F-statistics	205.4373		131.0883	
Prob(F-statistics)	0.0000		0.0000	
Correlated Random Effects - Hausman Test				
Test cross-section random effects				
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.	
Cross-section random	62.2790	3	0.64	

Note: * and ** show the significance level at 1% and 5 % respectively.

In addition, the one period lag of all the independent variables is used to check the robustness of the empirical results. The outcomes in Table 3 show a much better results. It differs from the panel estimation only in the sense that the total capital investment (TCI) variable is significant, indicating a one percentage change in TCI enhances economic growth of the four Malaysian states by 0.08 %.

Table 3. Panel estimation results (With one Period Lagged)

Dependent variable: Economic Growth				
Variables	Fixed Effect		Random Effects	
	Coefficient	T-ratio	Coefficient	T-ratio
LIDI (-1)	1.32[0.007]*	2.96	6.40[0.000]*	5.68
LTLF (-1)	2.56[0.000]*	3.94	0.56[0.000]*	6.19
LTCI (-1)	0.04[0.903]	0.12	0.08[0.009]**	2.78
R^2	0.9772		0.9291	
$Adj. R^2$	0.9713		0.9209	
F-statistics	164.8092		113.6735	
Prob(F-statistics)	0.0000		0.0000	
Correlated Random Effects - Hausman Test				
Test cross-section random effects				
Test Summary	Chi-Sq. Statistic		Chi-Sq. d.f.	Prob.
Cross-section random	48.6805		3	0.73

Note: * and ** show the significance level at 1% and 5 % respectively.

The robust least square method (with and without one period lag) is also employed to examine the robustness of the empirical outcomes. As can be seen in Table 4 and 5, results obtained are in line with the findings of the random effect model. This shows that infrastructure, labour force and capital investment have significant positive impact on the economic growth of the four states.

Table 4: Robust Least Squares Estimates

Method: Robust Least Squares		
Method: M-estimation		
M settings: weight=Bisquare, tuning=4.685, scale=Huber		
Huber Type I Standard Errors & Covariance		
Variables	Co-efficient	Z-statistics
LIDI	8.04[0.000]*	6.23
LTLF	0.44[0.000]*	4.25
LTCI	0.08[0.008]*	2.35
R^2	0.7422	
$Adj. R^2$	0.7164	

Note: * and ** show the significance level at 1% and 5 % respectively.

Table 5: Robust Least Squares Estimates (with one period lagged)

Method: Robust Least Squares		
Method: M-estimation		
M settings: weight=Bisquare, tuning=4.685, scale=Huber		
Huber Type I Standard Errors & Covariance		
Variables	Co-efficient	Z-statistics
LIDI(-1)	7.89[0.000]*	5.27
LTLF(-1)	0.07[0.080]**	4.01
LTCI(-1)	0.48[0.000]*	1.74
R^2	0.7250	
$Adj. R^2$	0.6933	

Note: * and ** show the significance level at 1% and 5 % respectively.

V. CONCLUSION

The study analyses the effect of infrastructure development on economic growth of the four northern states in Malaysia. Results obtained show that infrastructure development has a significant and positive impact on the economic growth of the respective states. Likewise, two other variables which are total labour force and total capital investment also indicated the positive and significant impact on economic growth. As infrastructure development has a significant and positive influence on economic growth, the government should identify the relevant infrastructure and investments should be made. Investment in infrastructure development projects will help to create jobs and therefore boost aggregate demand by increasing the income of the people. Moreover, infrastructure development will also help to attract more foreign direct investment inflows into these four states. At the same time, investment in human capital i.e. education and health, should not be ignore as labour force also play a crucial role in influencing economic growth of a country.

Acknowledgements.

The author(s) gratefully acknowledges receipt of research grant from the Fundamental Research Grant Scheme, Ministry of Higher Education (S/O No. 13229).

REFERENCES

[1] Abidin, M. Z., & Rasiah, R. (2012). *The Global Financial Crisis. UNDP, Malaysia.*
[2] ADB. (2017). *Asian Development Outlook 2017. Transcending the middle-income challenge.*
[3] Agénor, P., and B. Moreno-Dodson. (2006). Public infrastructure and growth: New channels and policy implications.*World Bank Policy Research Working* Paper No. 4064, Washington, DC.
[4] Aschauer, D.A. (1989). Is public expenditure productive? *Journal of Monetary Economics* (23), 177-200.
[5] Azam, M. (2016). Does environmental degradation shackle economic growth ? A panel data investigation on 11 Asian countries. *Renewable and Sustainable Energy Reviews*, *65*, 175–182.
[6] Bank Negara Malaysia. (2016). *Annual Report 2015 ENG.indb - Bank Negara Malaysia*
[7] Calderon, C. and L. Serven (2003). The output cost of Latin America's infrastructure gap. In Easterly, W., Serven L., (ed.). *The limits of stabilization: infrastructure public deficits, and growth in Latin America*. Stanford University Press.
[8] Canning, D., & Pedroni, P. (2008). Infrastructure, long-run economic growth and causality tests for cointegrated panels. *The Manchester School*, *76*(5), 504-527.
[9] Donaubauer, J., Meyer, B. E., & Nunnenkamp, P. (2014). *A New Global Index of Infrastructure: Construction, Rankings and Applications*. *Kiel Institute for the World Economy*
[10] Egert, B., T. Kozluk, and D. Sutherland. (2009). Infrastructure and growth: Empirical evidence, *William Davidson Institute Working Paper* No. 957, University of Michigan, Ann Arbor.
[11] Engle, R.F and Granger, C. W. J (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrica*, Vol. 55, 251-276.
[12] Estache, A., (2006), *Infrastructure: A survey of recent and upcoming issu*es, Washington D.C.: The World Bank.
[13] Estache, A., and M. Fay. (2007). Current debates on infrastructure policy. *World Bank Policy Research Working Paper* No. 4410, Washington, DC.
[14] Flaaen, A., Ghani, E., & Mishra, S. (2013). *How to Avoid Middle-Income Traps ? Evidence from Malaysia*. *Policy Research Working Paper*.
[15] Gujarati, D. N. (2003). Basic Econometrics Fourth Edition McGraw Hill.
[16] Haq M, A. ul, MRM, J., & GMN, I. (2016). Measuring the Socio-Economic Empowerment of Rural Households in Pakistan. *Business and Economics Journal*, *7*(3).
[17] Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometricia*, *46*(6), 1251–1271.
[18] Hirschman, A. (1958). The *strategy of economic development*. London: Duckworth.
[19] Jolliffe, I. T. (2009). Principal component analysis. Retrieved from url: http://people. maths. ox. ac. uk/richardsonm/ ?, 2009 - sdss.jhu.edu.
[20] Lee, C. (2011). Malaysia: Policies and Issues in Economic development. In *Infrastructure and economic development* (pp. 423–436).
[21] Manwa, Farai, and Albert Wijeweera. "Trade liberalisation and economic growth link: The case of Southern African Custom Union countries." *Economic Analysis and Policy* 51 (2016): 12-21.
[22] Roberts, M., and U. Deichmann. (2009). International growth spillovers, geography and infrastructure. *World Bank Policy Research Working* Paper No. 5153, Washington, DC.
[23] Roland-Holst, D. (2006). Infrastructure as a catalyst for regional integration, growth, and economic convergence: Scenario analysis for Asia. *ERD Working Paper* No. 91, Economics and Research Department, Asian Development Bank, Manila.
[24] Sahoo, P., Dash, R. K. and Nataraj, G. (2008). Infrastructure Development and Economic Growth in China. *IDE Discussion Paper*, No 261.
[25] Solow, R. (1956). A contribution to the theory of economic growth, *Quarterly Journal of Economics*, 70: 65-94.
[26] Straub, S. C. Vellutini, and M. Walters, 2008,"Infrastructure and Economic Growth in East Asia,". *Policy Research Working Paper*, *4589*.
[27] Todaro, M. P., & Smith, S. C. (2012). Population growth and economic development: causes, consequences, and controversies. *Economic development (11th ed., pp. 285-290). Boston: Pearson Addision Wesley*.
[28] Yong, H. K. (2017). Infrastructure Financing in Malaysia. *Nomura Journal of Asian Capital Markets*, *1*(2), 26–30
[29] Yusof, Z. A., & Bhattasali, D. (2008). *Economic growth and development in Malaysia: policy making and leadership*. International Bank for Reconstruction and Development. The World Bank.
[30] Yusoff, M. B., Hasan, F. A., & Jalil, S. A. (2000). Globalisation , economic policy , and equity : The case of Malaysia. *OECD Development Center*, (33 1), 1–85.

Nor Aznin Abu Bakar*. "The Effects of Infrastructure Development on Economic Growth in the Northern States of Malaysia." Quest Journals Journal of Research in Humanities and Social Science , vol. 05, no. 09, 2017, pp. 28–32.