Journal of Positive School Psychology http://journalppw.com
2023, Vol. 7, No. 2, 1249-1266

Roads To Riches; Impact Of Roads On Economic Development Of Pakistan

Ahtasham Nasir[1] , Muhammad Zahir Faridi (Corresponding Author)[2] , Rana Zafar Hayat[3] , Khawaja Asif Mehmood[4] , Muhammad Aurmaghan[5]

[1]Lecturer (HED), Emerson University Multan PhD Scholar, School of Economics Bahauddin Zakariya University, Multan, Pakistan E-Mail: ahtashamkhan1990@gmail.com
[2]Professor School of Economics Bahauddin Zakariya University, Multan, Pakistan E-mail: zahirfaridi@bzu.edu.pk
[3]Lecturer (HED), Govt. College Civil Lines Multan, PhD Scholar, School of Economics Bahauddin Zakariya University, Multan, Pakistan E-Mail: its.ranazafarhayat@gmail.com
[4]Assistant Professor School of Economics Bahauddin Zakariya University, Multan, Pakistan Email: khawjaasif@bzu.edu.pk
[5]PhD Scholar, School of Economics Bahauddin Zakariya University, Multan, Pakistan E-Mail: aurmaghan.khan@gmail.com

ABSTRACT

Roads play imperative devoir in human progression since primeval times. Commencing earliest road about 2600 BC in Egypt to the modern-day district roads, highways, and motorways, the roadways have bolstered humans throughout the history chronicles to evolve socially, politically, and in economic activities. The primary objective of this study is to investigate relationship between roads and riches in Pakistan. The empirical findings of panels formed in the study have revealed that roads lead to prosperity as they have stronger positive bond with gross domestic product, agricultural output, industrial output, human development index, per capita income, urban area growth, employment in agricultural, industrial, and services sector. Roads lead to transformation of economy from traditional to the advance. For a growing economy, roads are like veins through which all economic activity flows, links firms to access the markets and labor to the firms.

Keywords: Roads, GDP, HDI, Per capita income, Urban Area, Sectoral Growth

1- Introduction

Humans have travelled a long haul headed for the destination of economic development, and they have travelled through roads. From the first road built in Egypt around 2600 years ago to the contemporary routes, all economic activities took place in presence of roadways. Our ancestors moved through rough pathways around 10000 years ago. Boulder cemented streets of 'Ur' city of Mesopotamian society (presently in south Iraq) recorded about 4000 BC, corduroy or log roads were appeared about 4000 BC in Glastonbury, England, timber roadways in Northern European region were built about 3807 BC (Flaherty et al., 2002), Archaeologists discovered oldest track way in Plum stead in 2009 and that was supposed to be about 6000 years old. Persian king Darius the Great initiated a far-reaching road system for the Achaemnid Persian Empire which was finest one of its time connecting western part of the empire Sardis (modern day turkey) to the eastern city of Susa which was located at lower Zargros mountains (modern day Iran, Iraq) in east of Tigris river of Mesoptamia (Jona, 2007), the roadway extended to Central Asian city Bactriana (modern day Afghanistan, Uzbekistan and

Tajikstan) and later till India (Boederman & John, 1997).

The Romans extensively built direct roadways connecting North Africa with Europe about 312 BC to support their invasions. The Romans built 29 roads covering 78000 kilometers from the Capital (Flaherty et al., 2002). Chinese Han Dynasty opened trade with Europe and Middle East through famous Silk Road about 130 BC which remained opened till the ottoman Empire stopped trading with China in 1453 (Kelly., 2005). Many roads were built in Arab region in 8th century the most well-built roads were in Baghdad which were surfaced with tar (Ajram., 1992). Highway Act of 1555 in England reassigned responsibility for keeping an eye on roads maintenance to local community after reducing role of government in repairs of roads. It resulted in low quality of roads so that a trust established in 1706 to build quality roads and amass tolls from vehicles on roads. The turnpike trusts had support of Britain parliament in collecting tolls and maintaining the roads. Later, in 19th and 20th centuries roadways were built at large which promoted tourism, trade and exchanged cultural norms. All major civilizations in history had considered transportation as main source of political and economic development (Campbell., 1963).

Organization for economic development and cooperation (OECD) delineates roads as a line of communication between two places (OECD glossary, 2007). A "Road" means the entire surface of any way or street open to public traffic (Vienna Convention on Road Traffic, 1968). Roads are essential networks in contemporary world on which the entire infrastructure and development depend upon. From corduroy, earthen, gravel and Murrum roads to Kankar, water bound macadam (WBM), bituminous and concrete roads these are human's endeavors. National highways, state highways, district roads, rural roads, streets, boulevard, avenues are arteries and veins of a country. Smooth flow of these arteries and veins put a country on good economic health. Roadways are not conventionally used to travel from one place to another but it guarantees the economic development in modern world. Transportation is an imperative element capital formation (Gauthier., 1970). Roads and railways had always contributed in economic development (Hunter., 1965). Isolated communities for long period of time suffer huge economic losses (Wilfred., 1959).

Economic development has been observed as key factor of all progress and prosperity of any nation. Economic progress is observed as key foundation of growth (Harvey., 1985), regional vitality (Molotch., 1976) and wealth accumulation (Smith & Harvey., 2008). In an ordinary fashion by economic progress wealth is generated through job creation which as a result increases national tax base (Blakly & Bradshaw., 2002). Along with growth economic development increases income (Knopman et al., 2015), wealth, reduces disparity among various income groups (Kuznets.,1955), increases standard of living, brings social requisites of democracy (Lipset., 1959), increases urban employment (Todaro, 1969), stabilizes financial markets (Arestis et al., 2001), improves environmental quality (Shafik., 1994), amplifies telecommunications and infrastructure (Roller & Waverman., 2001), women empowerment (Mehra., 1997), and international trade (Kavoussi., 1985).

The present study is focused to analyze the role of roads and transportation in development process of Pakistan. The center of attention of this study is to probe the significance of roads to riches in Pakistan. The current study is not immune to limitations. It has some restrains and impediments. The study has not taken into account environmental challenges in constructing roads. Future studies can enlighten the significance of roads and transportation with environment.

2- Review of Literature

Park (2005) analyzed impact of roads on economic development. The author explained that intellectuals and bureaucrats of South Korea realized the need of planned economic development in debatable position of different group of intellectuals supporting lassize faire, guided capitalism and social democracy. The research explained that economists in South Korea endorsed Nukse's 'Balanced Growth Theory' and asserted upon structural changes rather than focusing on growth. All intellectuals from different school of thought were of the view that development of South Korea after Korean War was linked with infrastructural reforms.

Polyzos and Tsiotas (2020) investigated the contribution of transport infrastructure to the economic and regional development. The study explained that transport infrastructure had a significant role in economic development at regional and local level. The results of the study revealed that transport infrastructure was a driving force for regional and local economic development. Investing in transport resulted as stimulus for economic growth. The study asserted that transport infrastructure was of main importance for development.

Affuso et al. (2003) compared the investment in roads and railways. The researchers explained optimality of public funds allocating for roads and railways. The inter-urban road projects were found more significant in the study than railway projects. The study concluded that development in road infrastructure had higher returns than railway projects.

Closs and Bolumole (2015) elucidated that supply chains were linked with transportation which results in economic development. The authors had found that roads play a vital role to support industrial sector of any region. Large supply needed freight networks to excess global markets and increase supply chains. The study concluded that logistics, supply chains and transportation strengthen industrial sector and economic development.

3- Theoretical Framework

The word transport in its etymological definition means carry across derived from two Latin words 'Trans' which means across and 'portare' which means carry (Adeniran,2016). The proto-west Germanic 'Raidu', middle English 'rode', from old English 'rade', proto-Indo- European 'reyd', west Frisian reed to the word 'Road' it has travelled through history to form his modern world shape. In its etymological meaning 'Road' by and large means pathway for travelling and transportation of goods.

The neoclassical theory of economic growth postulated that economic growth could only be achieved when firms efficiently employ labor, capital and natural resources (Solow, 1956). On the contrary to neoclassical the endogenous theorists believed factors contributing to growth like capital, technological progress, labor is of endogenous in nature in growth process, (Hirschman, 1958), (Myrdal, 1957), (Martin & Sunley., 1998), (Weber., 1909) than exogenous as neo classical theorists explained. The Neoclassical theory proposed the investment in infrastructure as key strategy for sustainable economic growth. The Endogenous theorists see it as necessary but not the sufficient condition (Dicken & Lloyd, 1990), investment yield positive externalities and increased return through economies of agglomeration (Haggett., 1975), (Sheppard., 2000). Some economic activities put more power impacts than other factors (Dicken & Lloyd, 1990).

Growth pole theory explained that economic development was 'Polarization' concept and linked with the expansion of geospatial cities, towns and other geographical units (Peoux., 1950). While the Growth axis theory 1960's by Werner Sombart stressed that economic development and economic growth could only be achieved through construction of roads and infrastructure. Connecting parts of city with a center through roads and rails would do miracles with economic growth. It would reduce cost of

transportation for economic agents and would form industrial zones which would cause tertiary transportation routes, high tech industry and would promote urbanization (Peng, 2012). Roads have forwarded induced effects on economic growth which directly improves the countries conditions in multi-dimensions (Aschauer., 1989), (Blum., 1982), (Biehl, 1986) and ripple effects by producing positive externalities (Emmanuel., 1995).

4- Data and Methodology

4.1- Data Source

The data is taken from 2000-2020, which was an oscillating epoch of infrastructure eminently for roads infrastructure in Pakistan. This was the time when Pakistan had au fait one military and three democratic governments rule. The desideratum of governments in this period ostensibly has been on advancement of infrastructure. Motorway projects were extended and many highways and district roads were constructed. The data on GDP and Per-capita at constant 2010, Agricultural and Industrial output at local currency unit, are taken from World Bank. The data on high roads, low roads, total roads in kilometers, and total number of vehicles on roads are taken from National Transport Research Center.

4.2 Model Specification

In present study various panels have been constituted to probe the impact of road infrastructure on various indicators of development.

Panel A. The Gross Products and Roads infrastructure

Panel A consists of Gross Domestic product, Gross Industrial output, Gross Agricultural output and gross output of commodity producing sector.

Gross Domestic Product (GDP)

$$\Delta(\mathrm{GDP})_t = \alpha_o + \alpha_1(\mathrm{GFC})_{t-1} + \alpha_2(\mathrm{N})_{t-1} + \alpha_3(\mathrm{Rh/Rt})_{t-1} + \alpha_4(\mathrm{Rl/Rt})_{t-1} + \alpha_5(\mathrm{Rt})_{t-1} + \alpha_6(\mathrm{V/Rt})_{t-1} + \sum_{k=1}^{n} \alpha_{1k}\,\Delta(\mathrm{GFC})_{t-k} + \sum_{k=0}^{n} \alpha_{2k}\,\Delta(\mathrm{N})_{t-k} + \sum_{k=0}^{n} \alpha_{3k}\,\Delta(\mathrm{Rh/Rt})_{t-k} + \sum_{k=0}^{n} \alpha_{4k}\,\Delta(\mathrm{Rl/Rt})_{t-k} + \sum_{k=0}^{n} \alpha_{5k}\,\Delta(\mathrm{Rt})_{t-k} + \sum_{k=0}^{n} \alpha_{6k}\,\Delta(\mathrm{V/Rt})_{t-k}$$

Gross Industrial Output (Yind)

$$\Delta(\mathrm{Yind})_t = \beta_o + \beta_1(\mathrm{GFCI})_{t-1} + \beta_2(\mathrm{Nind})_{t-1} + \beta_3(\mathrm{Rh/Rt})_{t-1} + \beta_4(\mathrm{Rl/Rt})_{t-1} + \beta_5(\mathrm{Rt})_{t-1} + \beta_6(\mathrm{V/Rt})_{t-1} + \sum_{k=1}^{n} \beta_{1k}\,\Delta(\mathrm{GFCI})_{t-k} + \sum_{k=0}^{n} \beta_{2k}\,\Delta(\mathrm{Nind})_{t-k} + \sum_{k=0}^{n} \beta_{3k}\,\Delta(\mathrm{Rh/Rt})_{t-k} + \sum_{k=0}^{n} \beta_{4k}\,\Delta(\mathrm{Rl/Rt})_{t-k} + \sum_{k=0}^{n} \beta_{5k}\,\Delta(\mathrm{Rt})_{t-k} + \sum_{k=0}^{n} \beta_{6k}\,\Delta(\mathrm{V/Rt})_{t-k}$$

Gross Agricultural Output (Yagr)

$$\Delta(\mathrm{Yagr})_t = \theta_o + \theta_1(\mathrm{GFCA})_{t-1} + \theta_2(\mathrm{Nagr})_{t-1} + \theta_3(\mathrm{Rh/Rt})_{t-1} + \theta_4(\mathrm{Rl/Rt})_{t-1} + \theta_5(\mathrm{Rt})_{t-1} + \theta_6(\mathrm{V/Rt})_{t-1} + \sum_{k=1}^{n} \theta_{1k}\,\Delta(\mathrm{GFCA})_{t-k} + \sum_{k=0}^{n} \theta_{2k}\,\Delta(\mathrm{Nagr})_{t-k} + \sum_{k=0}^{n} \theta_{3k}\,\Delta(\mathrm{Rh/Rt})_{t-k} + \sum_{k=0}^{n} \theta_{4k}\,\Delta(\mathrm{Rl/Rt})_{t-k} + \sum_{k=0}^{n} \theta_{5k}\,\Delta(\mathrm{Rt})_{t-k} + \sum_{k=0}^{n} \theta_{6k}\,\Delta(\mathrm{V/Rt})_{t-k}$$

Commodity Producing Sector Output (Ycps)

$$\Delta(Ycps)_t = \omega_o + \omega_1(GFC)_{t-1} + \omega_2(N)_{t-1} + \omega_3(Rh/Rt)_{t-1} + \omega_4(Rl/Rt)_{t-1} + \omega_5(Rt)_{t-1} + \omega_6(V/Rt)_{t-1} + \sum_{k=1}^{n} \omega_{1k}\,\Delta(GFC)_{t-k} + \sum_{k=0}^{n} \omega_{2k}\,\Delta(N)_{t-k} + \sum_{k=0}^{n} \omega_{3k}\,\Delta(Rh/Rt)_{t-k} + \sum_{k=0}^{n} \omega_{4k}\,\Delta(Rl/Rt)_{t-k} + \sum_{k=0}^{n} \omega_{5k}\,\Delta(Rt)_{t-k} + \sum_{k=0}^{n} \omega_{6k}\,\Delta(V/Rt)_{t-k}$$

Human Development Index and Roads infrastructure

$$\Delta(HDI)_t = \vartheta_o + \vartheta_1(Rh/Rt)_{t-1} + \vartheta_2(Rl/Rt)_{t-1} + \vartheta_3(Rt)_{t-1} + \vartheta_4(V/Rt)_{t-1} + \sum_{k=0}^{n} \vartheta_{1k}\,\Delta(Rh/Rt)_{t-k} + \sum_{k=0}^{n} \vartheta_{2k}\,\Delta(Rl/Rt)_{t-k} + \sum_{k=0}^{n} \vartheta_{3k}\,\Delta(Rt)_{t-k} + \sum_{k=0}^{n} \vartheta_{4k}\,\Delta(V/Rt)_{t-k} + \epsilon t$$

Per Capita Income and Roads infrastructure

$$\Delta(\mathrm{PCI})_t = \rho_o + \rho_1(\mathrm{Rh/Rt})_{t-1} + \rho_2(\mathrm{Rl/Rt})_{t-1} + \rho_3(\mathrm{Rt})_{t-1} + \rho_4(\mathrm{V/Rt})_{t-1} + \sum_{k=0}^{n} \rho_{1k}\,\Delta(\mathrm{Rh/Rt})_{t-k} + \sum_{k=0}^{n} \rho_{2k}\,\Delta(\mathrm{Rl/Rt})_{t-k} + \sum_{k=0}^{n} \rho_{3k}\,\Delta(\mathrm{Rt})_{t-k} + \sum_{k=0}^{n} \rho_{4k}\,\Delta(\mathrm{V/Rt})_{t-k} + \epsilon t$$

Urban Area Growth and Roads infrastructure

$$\Delta(\mathrm{UA})_t = \sigma_o + \sigma_1(\mathrm{Rh/Rt})_{t-1} + \sigma_2(\mathrm{Rl/Rt})_{t-1} + \sigma_3(\mathrm{Rt})_{t-1} + \sigma_4(\mathrm{V/Rt})_{t-1} + \sum_{k=0}^{n} \sigma_{1k}\,\Delta(\mathrm{Rh/Rt})_{t-k} + \sum_{k=0}^{n} \sigma_{2k}\,\Delta(\mathrm{Rl/Rt})_{t-k} + \sum_{k=0}^{n} \sigma_{3k}\,\Delta(\mathrm{Rt})_{t-k} + \sum_{k=0}^{n} \sigma_{4k}\,\Delta(\mathrm{V/Rt})_{t-k} + \epsilon t$$

4.1 Description of Variables

Y_{GDP}	Gross domestic product at constant 2010
Y_{ind}	Output in industrial sector
Y_{agr}	Output in agricultural sector
Y_{cps}	Output in commodity producing sector
HDI	Human development index

PCI	Per capita income
UA	Urban Area
R_H/R_T	Ratio of high road to total road
R_L/R_T	Ratio of low roads to total roads
R_T	Total road
Vch/R_T	Ratio of vehicle to total roads.
GFC	Gross Fixed capital formation
GFCA	Gross fixed capital formation in agriculture
GFCI	Gross fixed capital formation in industry
N	Total Labor force
N_{AGR}	Labor force in agriculture
N_{IND}	Labor force in industry

5- Results and Discussions

This section of study explicates estimates of different panels formed in study to check the impact of road infrastructure on (Panel A) gross products, (Panel B) human development index, (Panel C) per capita income, (Panel D) urban area, and (Panel E) employment. A unit root test paved the way for autoregressive distributed lag model (ARDL) to analyze the dynamic relationship among the variables.

5.1.1: Unit Root Test

Variables	Augmented Dicky Fuller		Phillips- Perron			
	Levels	**1st Difference**	**Integrated Order**	**Levels**	**1st Difference**	**Integrated Order**
Y_{GDP}	-2.00* -4.017**	-1.91* -2.0144**	I(0)	-0.719* 1.734**	-3.415* -3.625**	I(1)
Y_{AGR}	-2.665* -1.234**	-4.134* -4.482**	I(1)	-1.050* -1.234**	-4.135* -5.332**	I(1)
Y_{IND}	-1.727* -1.709**	-3.870* -4.111**	I(1)	-1.931* -1.629**	-3.847* -4.111**	I(1)
Y_{CPS}	-1.513* -0.9833**	-3.425* 3.713**	I(1)	-1.475* -1.185**	-3.445* -3.694**	I(1)
N_{AGR}	-1.892* -1.908**	-2.939* -3.421**	I(1)	-1.482* -3.012*	-7.132* -5.787**	I(1)
N_{IND}	-3.831* -1.898**	-5.508* -5.017**	I(1)	-2.007* -1.687**	-5.457* -8.316**	I(1)
HDI	-2.116* -1.958**	-4.65* -5.577**	I(1)	-2.647* -1.834**	-4.65* -5.57**	I(1)
PCI	-1.797* -4.345**	-1.767* -1.827**	I(0)	-1.046* -1.705**	-1.944* -1.927**	I(1)
R_H	-3.55* -3.16**	-2.725* -3.005**	I(0)	-2.948* -2.44**	-2.725* 2.998**	I(0)
R_L/R_T	-4.750*	-4.407*	I(0)	-4.750*	-4.480*	I(0)

	-1.368**	-4.793**		-5.09**	-5.42**	
R_T	-3.414* -1.963**	-7.848* -7.192**	I(0)	-3.411* -6.732**	-8.325* -7.557**	I(0)
V/R_T	0.718* -1.333**	-3.989* -4.095**	I(1)	1.104* -1.432**	-3.970* -4.181**	I(1)
UP	-0.994* -3.938**	-1.054* -1.172**	I(0)	-8.705* -4.413**	-3.861* -2.296**	I(0)
GFC	-1.444* -6.168**	-4.335* -4.305**	I(0)	-1.200* -1.932**	-2.912* -1.374**	I(0)
GFCA	-6.108* -5.422**	-3.73* -4.44**	I(0)	-1.742* -0.972**	-2.712* -4.838**	I(0)
GFCI	-0.666* -2.000**	-3.600* -3.536**	I(1)	-0.666* -2.203*	-3.592* -3.520**	I(1)

Source: Calculated by author's

The table shows unit root test to check stochastic trend of data. Augmented dickey fuller test which deals with large and multifarious models and Phillip Perron (PP) test which is modification of ADF and removes errors of heteroscedasticity and autocorrelation are checked to test stationarity of data. Unit root test has paved ways for auto regressive distributive lagged model (ARDL) as some variables are found to be stationary at first difference and others on levels. The short run dynamics and long run bounds relationship and trends among the variable are analyzed through co integration and ARDL.

5.1.2 Gross Output and roads Estimates: Long Run Results

Dependent Variable				
Independent Variables	**Y_{GDP}** (Gross Domestic Product)	**Y_{IND}** (Industrial Output)	YAGR (Agricultural Output)	**Y_{CPS}** (Commodity Producing Sector)
GFC	0.1926	0.158163[1]	0.073057[2]	0.533223[1]
GFCI[1]	0.027*	0.037398*	0.060540*	0.213055*
GFCA[2]	7.010**	4.229195**	1.206747**	2.502746**
	0.0000***	0.0014***	0.2490***	0.0278***
N	0.8298	0.249478[3]	0.011608[4]	-0.011750[3]
N_{IND}[3]	0.066*	0.140674*	0.003800*	0.031742*
N_{AGR}[4]	12.48**	1.773447**	3.054782**	-0.370184**
	0.000***	0.1038***	0.0092***	0.7177***
RH/RT	4.689	20.20813	23.5373	18.74803
(High Road)	1.573*	2.862139*	1.862152*	4.657052*
	2.979298**	7.060498**	12.63984**	4.025730**
	0.0107***	0.0000***	0.0000***	0.0017***
RL/RT	4.498443	18.54045	23.84503	11.40726
(Low Road)	1.344964*	2.215805*	1.607030*	3.591876*
	3.344657**	8.367365**	14.83795**	3.175849**

	0.0053***	0.0000***	0.0000***	0.0080***
RT	0.007048	0.007841	0.012206	0.030963
(Total Road)	0.002222*	0.003165*	0.007608*	0.023305*
	3.172473**	2.477463**	1.604450**	1.328578**
	0.0073***	0.0307***	0.1326***	0.013087***
Vhc/RT	0.000245	0.001486	0.001459	0.004533
(Total Vehicles)	0.000260*	0.000564*	0.001354*	0.002236*
	0.942852**	2.632943**	1.077240**	2.026810**
	0.3629***	0.0233***	0.3010***	0.0655**
F-Statistics	66.13	25.9	7.27	14.42

Note: Source: Calculated by author's, [1] Gross fixed capital in industry, [2] Gross fixed capital in agriculture. [3] Labor force in industry, [4] Labor force in agriculture. *Standard errors, ** t-values, ***P-values.

The table exhibits the long run results of roads on gross domestic product, industrial output, agriculture output, and commodity producing sector. The long run results of high roads on GDP, industrial output, agriculture output and commodity producing sector are found to be significant with impact of 4.689, 20.208, 23.537, and 18.748 respectively. In a similar fashion the low roads are also found to be significant with all dependent variables in the panel by an impact of 4.498 on GDP, 18.540 on industrial output, 23.845 on agriculture output, and 11.407 on commodity producing sector. The total roads have an impact of 0.0705 on GDP, 0.00784 on industrial output, 0.0122 on agriculture output and 0.0309 on commodity producing sector. The values of F-statistic for GDP are 66.13; industrial output 25.90, agricultural output 7.27 and commodity producing sector 14.42 which show a strong bond between our dependent and independent variables.

5.1.3: Gross Output and roads Estimates Short Run Results

	Dependent Variables			
Independent Variables	$D(Y_{GDP})$ (Gross Domestic Product)	$D(Y_{IND})$ (Industrial Output)	$D(Y_{AGR})$ (Agricultural Output)	$D(Y_{CPS})$ (Commodity Producing Sector)
D(GFC) D(GFCI)[1] D(GFCA)[2]	0.170084 0.029673* 5.732004** 0.0001***	0.242882[1] 0.056116* 4.328231** 0.0008***	0.0340[2] (0.030)* (1.112)** (0.286)***	0.1146[1] (0.158)* (0.725)** (0.482)**
D(N) $D(N_{IND})$[3] $D(N_{AGR})$[4]	0.732623 0.107521* 6.813733** 0.0000***	0.037932 0.151778* 0.249917** 0.8066***	0.0054 (0.002)* (2.291)** (0.039)***	-0.4508 (0.400)* (-1.12)** (0.28)***
D(RH/RT) (High Road)	4.140016 1.864804* 2.220081** 0.0448***	22.10778 4.200028* 5.263721** 0.0002***	10.983 (4.36)* (2.514)** (0.025)***	23.43 (8.871)* (2.64)** (0.021)***

D(RL/RT) (Low Road)	3.971632 1.641824* 2.419036** 0.0310***	19.50747 3.568241* 5.466971** 0.0001***	11.127 (4.31)* (2.580)** (0.022)***	16.258 (6.943)* (2.341)** (0.037)***
D(RT) (Total Road)	0.006223 0.001816* 3.425795** 0.0045***	0.007973 0.003385* 2.355420** 0.0381***	0.00569 (0.0032)* (1.729)** (0.107)***	0.0261 (0.023)* (1.112)** (0.287)***
D(V/RT) (Total Vehicles)	0.000216 0.000251* 0.861324** 0.4047***	0.001510 0.000610* 2.474451** 0.0309***	0.000681 (0.0007)* (0.925)** (0.371)***	0.00453 (0.001)* (3.22)** (0.007)***
CointEq(-1)	-0.882890	-1.016753	-0.46664	-0.8636

Note: Source: Calculated by author's [1] Gross fixed capital in industry, [2] Gross fixed capital in agriculture. [3] labor force in industry, [4] Labor force in agriculture. * Standard errors, ** t-values, ***P-values.

The table shows short run results of high, low and total roads along with vehicle on roads as controlled variable on gross domestic product, gross industrial output, gross agricultural output and gross commodity producing sector output. The short run results of high roads on GDP are 4.414, industrial output is 22.11, agricultural output is 10.98 and commodity producing sector is 23.43. The high roads are found to be significant for gross domestic product, industrial output, agricultural output and commodity producing sector in short run. Similarly, low roads results explain the impact on GDP is 3.972, industrial output 19.50, agricultural output 11.13 and commodity producing sector is 16.26. The short run results are found to be significant for low roads on GDP, industrial output, agricultural output and commodity producing sector. The total roads impact on GDP is found to be 0.006223, industrial output 0.007973, agricultural output 0.00569 and 0.0261 for commodity producing sector. The total roads are found to be significant for GDP and industrial output in short run while insignificant for agricultural output and commodity producing sector. The controlled variable vehicle on roads showed insignificant relationship with GDP by leaving impact of 0.000216, significant impact on industrial output by 0.00151, agricultural output by 0.000681 and commodity producing sector by 0.0045 in short run. The co-integration for model of GDP is -0.8829, industrial output -1.016753, agricultural output -0.46664 and commodity producing sector by -0.8636. The values of co-integration show that there is strong bond of roads with GDP, industrial output, agricultural output, and commodity producing sector.

5.1.4: Human Development and Roads Estimates: Long Run Results

Level Equation (no constant no trend)				
F-Bounds Test. Null Hypothesis: No levels relationship exists between HDI and Roads				
Test Statistic	Value	Significance	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.664	10%	1.9	3.01
k	4	5%	2.26	3.48
		2.5%	2.62	3.9

		1%	3.07	4.44

Note: Source: Calculated by author's

The Table shows the overall significance of the model. The value of F-statistic value 8.664 is greater than critical values at significance level 10%, 5%, 2.5% and 1%. It rejects the null hypothesis which states that no levels relationship exists and supports the argument that roads contribute in uplifting people's living standards and contribute in increasing human development index.

5.1.6: Human Development Index: Long Run Results

Dependent Variable: HDI				
Independent Variables	Coefficients	Standard Errors	T-values	P-Value
RH/RT (High Road)	5.376337	0.953540	5.638295	0.0005
RL/RT (Low Road)	4.269574	0.658770	6.481133	0.0002
RT (Total Road)	0.007067	0.003331	2.121339	0.0667
Vhc/RT (Total Vehicles)	0.000591	0.000316	1.871746	0.0981

Note: Source: Calculated by author's

The table shows long run results which states that roads have a significant relationship with human development index and high roads contribute by 5.376 low roads by 4.269. There is a long run bond between human development index, paved and unpaved roads. The roads contribute in human development in a sense that these provide access to schools, colleges, universities, hospitals, industrial zones and other institutions mandatory in life. All aforementioned variables contribute in uplifting individual's standard of living and contribute in increasing human development.

5.1.7: Human Development Index: Short Run Results

Dependent Variable: D(HDI)				
Independent Variables	Coefficients	Standard Errors	T-values	P-Value
D(RH/RT) (High Road)	4.873840	1.757936	2.772478	0.0158
D(RL/RT) (Low Road)	3.751302	1.297301	2.891622	0.0126
D(RT) (Total Road)	0.001869	0.003694	0.505967	0.6214
D(Vhc/RT) (Total Vehicles)	0.001479	0.001139	1.298181	0.2168

CointEq(-1)	-1.3171	0.178979	-4.407173	0.0007

Note: Source: Calculated by author's

The table shows short run results of roads impact on human development. The short run results revealed that paved or high roads are significant and contribute toward human development by 4.873. Similarly, the unpaved or low roads are found to be significant and contribute in human development by 3.751. The short run results for total roads and vehicle on roads are found to be insignificant for human development index. The value of co-integration equation -1.3171 explains that there is strong long run bond between roads and human development.

5.1.8: Per Capita Income and Roads Estimates: Long Run Results

F-Bounds Test:	Null Hypothesis: No levels relationship exists between PCI and Roads			
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	6.322244	Asymptotic: n=1000		
k	4	10%	1.9	3.01
		5%	2.26	3.48
		2.5%	2.62	3.9
		1%	3.07	4.44

Note: Source: Calculated by author's

The table shows that there is long run bond between per capita income and roads. The F statistic value shows overall significance of the model. The value of F statistic is greater than critical values and lies in critical region which rejects the null hypothesis that no bond exist between per capita income and roads. The values on different levels of significance 10%, 5%, 2.5%, 1% are lower than the value of F-statistic which shows the significance of the variables in long run.

5.1.9: Per Capita Income Long Run

Dependent Variable: Per Capita Income				
Independent Variables	Coefficients	Standard Errors	T-values	P-Value
(RH/RT) (High Road)	5.376337	0.953540	5.638295	0.0005
(RL/RT) (Low Road)	4.269574	0.658770	6.481133	0.0002
(RT) (Total Road)	0.007067	0.003331	2.121339	0.0667
(Vhc/RT) (Total Vehicles)	0.000591	0.000316	1.871746	0.0981

Note: Source: Calculated by author's

The paved and unpaved roads do have an impact on per capita income. As the results show that roads contributed a greater part in gross domestic product, industrial output, agricultural output and commodity producing sector in our first panel. This panel shows that there is a significant

relationship between per capita income and roads. The high roads have impact of 5.376 on per capita income and found to be significant. While the low roads have an impact of 4.2696 on per capita income, and found to be significant in long run.

5.1.10: Per Capita Income Short Run Results

Dependent Variable: D(PCI)				
Independent Variables	Coefficients	Standard Errors	T-values	P-Value
D(RH/RT) (High Road)	7.080962	3.134710	2.258889	0.0538
D(RL/RT) (Low Road)	5.623288	2.324093	2.419562	0.0419
D(RT) (Total Road)	0.009308	0.003544	2.626256	0.0304
D(Vhc/RT) (Total Vehicles)	0.001837	0.000563	3.262866	0.0115
CointEq(-1)	-0.788790			

Note: Source: Calculated by author's

The table shows short run results, the high roads ratio to total roads has an impact of 7.09 on per capita income and found to be slightly insignificant in short run while the low roads have a significant impact of 5.623 on per capita income. The total roads and vehicle on roads are found to be significant with impact of 0.0093 and 0.001837 on per capita income respectively. The co-integration equation value shows that there is a long run connection in our model.

5.1.11: Urban Area and Roads Estimates:

F-Bounds Test:	Null Hypothesis: No levels relationship Between Urban area and roads			
Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	44.19480	10%	1.9	3.01
k	4	5%	2.26	3.48
		2.5%	2.62	3.9
		1%	3.07	4.44

Note: Source: Calculated by author's

The table shows a strong long run bond between urban area growth and roads. The value of F-statistic is 44.195 which is greater than tabulated values at 10%, 5%, 2.5% and 1% and lies in critical region so we reject our null hypothesis that no level relationship exists between the variables.

5.1.12: Urban Area Long Run Results

Dependent Variable:				
Independent Variables	**Coefficients**	**Standard Errors**	**T-values**	**P-Value**
(RH/RT)	15.20838	1.253682	12.13097	0.0000

(High Road)				
(RL/RT) (Low Road)	15.06211	1.186215	12.69762	0.0000
(RT) (Total Road)	**0.015900**	0.004256	3.736072	0.0047
(Vhc/RT) (Total Vehicles)	0.001196	0.000514	2.327365	0.0449

Note: Source: Calculated by author's

The long run results show that high roads are significant on urban area growth which is core variable of economic development in contemporary world. The impact of high road on urban growth is observed to be 15.2084 and it is highly significant in long run. The unpaved or low roads are found to be highly significant too by leaving impact of 15.062 on urban area growth. The total roads impact on urban area is 0.0159 and impact of vehicles to the ratio of total roads is 0.001196 on urban area. The estimates support the argument that roads promote urbanization which as a result contribute in national treasury by increasing output and living standards.

5.1.13: Urban Area Short Run Results

Dependent Variable: Urban Area				
Independent Variables	Coefficients	Standard Errors	T-values	P-Value
D(RH/RT) (High Road)	0.106248	0.025857	4.109028	0.0026
D(RL/RT) (Low Road)	0.105226	0.025282	4.162057	0.0024
D(RT) (Total Road)	0.000111	2.15E-05	5.155777	0.0006
D(Vhc/RT) (Total Vehicles)	8.36E-06	4.69E-06	1.781754	0.1085
CointEq(-1)	-0.6986	0.000391	-17.86574	0.0000

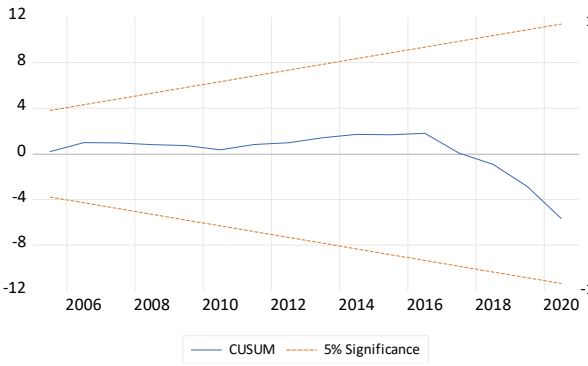
Note: Source: Calculated by author's

The table shows short run results of roads the impact of high roads on urbanization is 0.1062, low roads on urban area growth is 0.10523, total roads on urban area growth is 0.000111 and all are found to be significant in short run. The vehicle to total roads ratio variable is found to be insignificant in short run. The co-integration equation value is negative which paved the ways for long run bond between roads and urban area growth.

5.2.1: Stability Diagnostic test

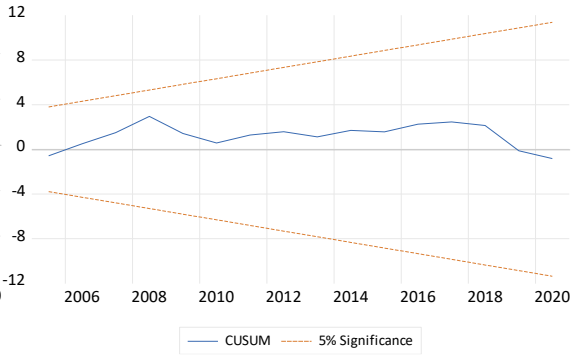
The consistency of ARDL is being checked through stability diagnostic test,and the figure shows residual.

Figure 1



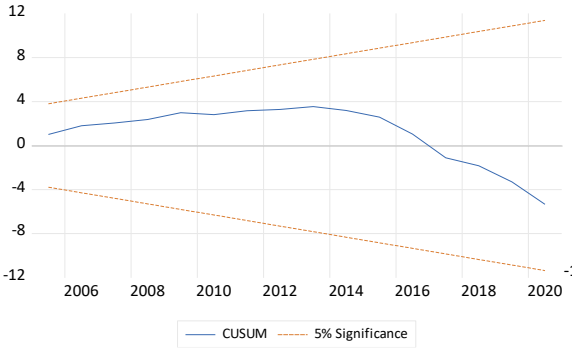
Gross Domestic Product and Roads

Figure 2



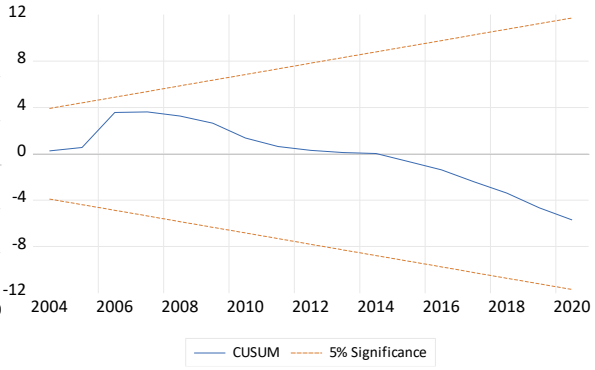
Industrial Output growth and Roads

Figure 3



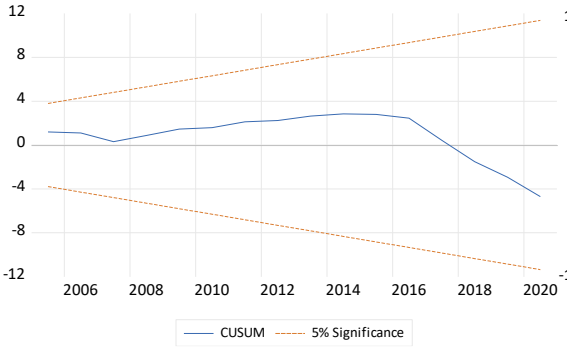
Agricultural Output and Roads

Figure 4



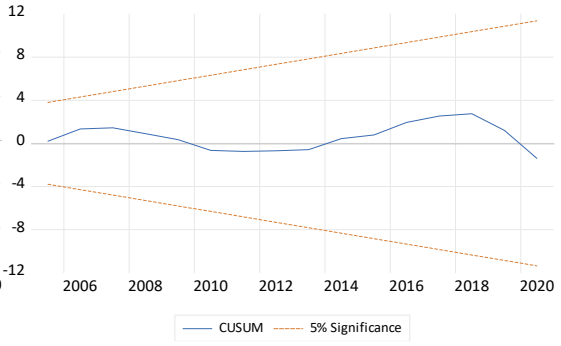
Commodity Producing Sector and Roads

Figure 5



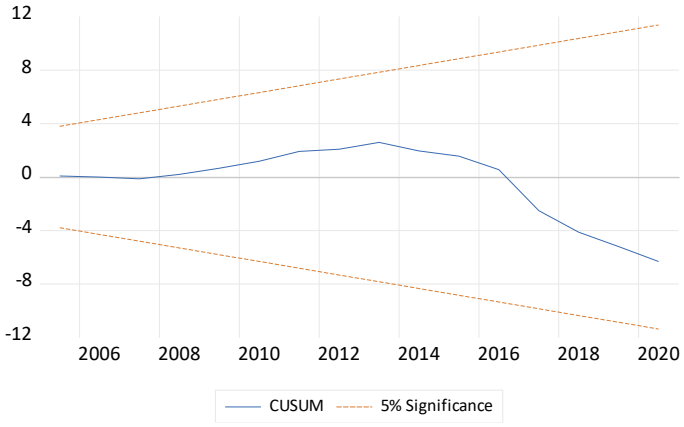
Human Development Index and Roads

Figure 6



Per capita income and Roads

Figure 7



Urban Area Growth and Roads

The reliability of ARDL is being checked by cumulative sum of recursive residuals (CUMSUM). The abrupt and structural breaks in residuals are observed and the model of roads with gross domestic product, industrial output, agricultural output, commodity producing sector, human development index, per capita income and urban growth are found to be stable as shown in figure 1-7 above.

6- Conclusion

Throughout the history roads had been preeminent factor for economic development. Roads are capillaries leading to arteries and veins, which flows economic development throughout the country like veins flow blood in all parts of body. Old lang syne to contemporary world roads have comforted humans in all aspects. Our ancestors moved through rough pathways around 10000 years ago and resided all around the earth. The present study is an endeavor to investigate the impact of roads infrastructure on core variable of economic development. The empirical results of various panel constituted in the study show a significant relationship between roads infrastructure and economic development variables nitty gritty.

The roads have showed a positive and significant relationship with gross domestic product, gross agricultural output, gross industrial output, and gross commodity producing sector output in panel A of the study. Expansion of roads infrastructure in long run would increase GDP, Industrial output, Agricultural output and commodity producing sector output. A strong long run relationship exists between roads infrastructure and output. Human development index and per capita income are other axial indicators of economic development and the impact of roads infrastructure is found to be significant in our estimates. The roads are root cause of urbanization and the impact of roads on urban area growth is observed significantly in short run as well as in our long run estimates. Roads help students reach educational institutions, patients to hospitals and labor to workplace, and have multifaceted impacts. Road infrastructure inaugurates opportunities and present study has investigated that roads lead to riches. Total number of vehicles to the roads is taken as controlled variable to reduce the impact of extraneous variables in the present study and has positive significant impact with economic development variables in long run.

The results of the present study show that roads play an imperative and decisive part in economic growth and roads leads to riches. The riches which would bring prosperity in any nation by increasing opportunities of employment, improving human development with more roads leading to educational institutions, hospitals, parks and tourism along with increased per capita income and per capita output.

7- Policy Recommendations

States have always been working on bringing improvements in infrastructure especially roads. The policy makers over the time have realized that investment in roads infrastructure can really bring sustainable economic growth. The results of present study are endorsement to the doctrine which believes a strong positive relationship between roads infrastructure and economic growth. Roads have to be expanded as these are core factor of persistent economic growth and development. By expanding roads does not mean construction of highways only but expansion of output, employment, urbanization, human development, and all economic activities. Investment in road infrastructure can really lift the nation up from low growth to the path of high growth. There is dire need that policy maker purpose more investment in roads infrastructure for sustainable economic growth.

References

1. Affuso, L., masson, J., & Newbery, D. (2003). Comparing investments in new transport infrastructure: roads versus railways? Fiscal Studies, 24(3), 275–315.
2. Arestis, P., Demetriades, P. O., & Luintel, K. B. (2001). Financial development and economic growth: The role of stock markets. Journal of Money, Credit and Banking, 33(1), 16–41.
3. Boederman, John (1997). The Cambridge ancient history. Cambridge University Press. p. 178.
4. Button, K., & Yuan, J. (2013). Airfreight transport and economic development: An examination of causality. Urban Studies, 50(2), 329–340.
5. Campbell, T. C. (1963). Transportation and regional economic development. Transportation Journal, 3(1), 7–13.
6. Closs, D. J., & Bolumole, Y. A. (2015). Transportation's role in economic development and regional supply chain hubs. Transportation Journal, 54(1), 33–54.
7. Cole, L. M. (1968). Transport investment strategies and economic development. Land Economics, 44(3), 307–317.
8. Ding, C. (2013). Transport development, regional concentration and economic growth. Urban Studies, 50(2), 312–328.
9. Gauthier, H. L. (1970). Geography, transportation, and regional development. Economic Geography, 46(4), 612–619.
10. Glossary of Statistical Terms, OECD. 2004-02-26.
11. Harbeson, R. W. (1969). Intermodal competition in transportation and economic development. Nebraska Journal of Economics and Business, 8(2), 32–47.
12. Harvey, D. (1985). The geopolitics of capitalism. Macmillan Education UK.
13. Hunter, H. (1965). Transport in Soviet and Chinese development. Economic Development and Cultural Change, 14(1), 71–84.
14. John Kelly (2005). The great mortality: An intimate history of the black death, the most devastating plague of all time Harper.
15. Kasem, A. (1992). The miracle of Islam science (2nd ed.). Knowledge House Publishers.
16. Knopman, D., Zmud, J., Ecola, L., Mao, Z., & Crane, K. (2015). Quality of life indicators and policy strategies to advance sustainability in the Pearl River Delta. RAND Corporation. Retrieved from: http://www.jstor.org/stable/10.7249/j.ctt19w7212
17. Kuznets, S. (1955). Economic growth and income inequality. The American Economic Review, 45(1), 1–28.
18. Lipset, S. M. (1959). Some social requisites of democracy: economic development and political legitimacy.

The American Political Science Review, 53(1), 69–105.
19. Mallon, r. D. (1960). Transport and economic development. Economic Digest, 3(2), 8–13.
20. Marshall, A. (1961). Principles of Economics, (1890). London: Macmillan. Originally published 1890.
21. Mehra, R. (1997). Women, empowerment, and economic development. The Annals of the American Academy of Political and Social Science, 554(1), 136-149.
22. Meyerson, M. (1963). Strategy planning for transportation and economic development. Ekistics, 16(92), 6–14.
23. Molotch, H. (1976). The city as a growth machine: Toward a political economy of place. American Journal of Sociology, 82, 309–332.
24. Flaherty, C. A., Boyle, A., & Zoorob, S. E. (2002). Highways: The location, design, construction & maintenance of road pavements. Elsevier Ltd.
25. Owen, W. (1959). Transportation and economic development. The American Economic Review, 49(2), 179–187.
26. Park, T.-G. (2005). Different roads, common destination: economic discourses in south korea during the 1950s. Modern Asian Studies, 39(3), 661–682.
27. Polyzos, S., & Tsiotas, D. (2020). The contribution of transport infrastructures to the economic and regional development: a review of the conceptual framework. Theoretical and empirical researches in urban management, 15(1), 5–23.
28. Röller, L.H., & Waverman, L. (2001). Telecommunications infrastructure and economic development: A simultaneous approach. The American Economic Review, 91(4), 909–923.
29. Rostam M. Kavoussi. (1985). International trade and economic development: the recent experience of developing countries. The Journal of Developing Areas, 19(3), 379–392.
30. Shafik, N. (1994). Economic development and environmental quality: An econometric analysis. Oxford Economic Papers, 46, 757–773.
31. Smith, N., and D. Harvey. (2008). Uneven development: nature, capital, and the production of space. athens: University of Georgia Press.
32. Todaro, M. P. (1969). A model of labor migration and urban unemployment in less developed countries. The American Economic Review, 59(1), 138–148.
33. Adeniran, A. O. (2016), Impacts of the fourth industrial revolution on transportation in the developing nations, International Educational Scientific Research Journal, 2(11), 56-60.
34. Dicken, P., & Lloyd, P. (1990), Location in space: Theoretical perspectives in economic geography. New York: Harper Collins Publishers.
35. Hirschman, A. (1958), The strategy of economic development, New Haven, CT: Yale University Press.
36. Martin, R. & Sunley, P. (1998), Slow convergence? The new endogenous growth theory and regional development", Economic Geography, 74(3), 201- 227.
37. Myrdal, G. (1957), Economic Theory and Under-developed regions, London: Duckworth.
38. Perroux, F. (1950). Economic space: theory and applications. The Quarterly Journal of Economics, 64(1), 89-104.
39. Sheppard, E. (2000), Competition in space and between places", In: Sheppard, E. and Barnes, T. J. Companion to Economic Geography, MA: Blackwell.
40. Solow, R. M. (1956). A contribution to the theory of economic growth. The quarterly Journal of Economics, 70(1), 65-94.

41. Weber, A. (1909), Theory of the Location of Industries, Chicago: Center for Spatially Integrated Social Science, 1-4, University of Chicago Press.