Dynamic Relationship Between Air-Rrailways Transportation and Economic Growth in Pakistan: Evidence from Robust Least Squares Regression Estimator

Alia Rani[1] and Khalid Zaman[2]

Abstract

The objective of the study is to examine the dynamic linkages between air-railways transportation and Pakistan's economic growth under Asian and Global financial crisis. The study selected a time period from 1980-2016 for robust inferences. The results confirmed the inverted U-shaped relationship between air transportation and economic growth while monotonic decreasing relationship found between railways transportation and country's economic growth. The result implies that air-railways transportation perform in a limited capacity that not contributed in optimized way to generate sufficient income in service value added for a country. The Asian and Global financial crisis, however, not confined its significant impact on Pakistan's transportation sector. The study emphasized the need of re-corrective measures to promote air-railways transportation with improve service quality dimensions, reduced complex networking, less freight charges, reduced long-queued booking schedules, comfortable seats, good working environment, provide technical and financial assistance, etc., these measures would helpful to improve Pakistan's transportation sector in order to contribute in country's development projects. The study has a no vel contribution in the existing literature by including Asian and global financial crisis in air-railways transportation that translated into country's economic growth. Further, the non-linear relationship was found between country's per capita income and air-railways transportation to verify either of the three alternatives and plausible hypothesis, i.e., inverted U-shaped relationship, U-shaped relationship, and/or flat relationship between them. We believe that this study is first in its kind, as per authors knowledge, which included financial crisis in transportation modeling to proposed robust policy inferences in a given country context.

Keywords: Air transportation; Railways transportation; Financial crisis; Robust least square regression; Pakistan.

1. Introduction

1.1. Transport and Communication

There are numbers of transportation modes available for mass communication including air transportation, railways transportation, ship transport and road transportation etc. These modes of communication have a vital role in economic development of a country. Government may raise substantial revenue from transportation sector and correct their balance of payment deficit. Modern and efficient transportation and communication system plays a vital role to increase economic growth especially in developing countries. In Pakistan, almost use all transportation modes like air, road, railways, and ship transportation. But there is need to facilitate these modes of communication to increase economic activities (Economic Survey of Pakistan 2013).

According to Greene and Wegener (1997), transportation system plays a very important role in development of any country. It also increases the education, linkages between the markets, tourism, health care, and employment level etc. Transportations system directly linked with country's socio-economic issues, i.e., lack of transportation system in any country lead to

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[1] Department of Economics and Agricultural, PMAS-Arid Agriculture University, Rawalpindi, Pakistan.
[2] Department of Economics, University of Wah, Pakistan. E-mail: Khalid_zaman786@yahoo.com

increases the unemployment level in the economy. It is considered that better transportation modes increase the economic activities, which promote employment level in a country. Better transportation system leads to sustainable development but on the other hand it leaves the negative impact on environment in the form of high mass carbon emissions across countries (Bakker, 2017).

1.2.   Railways Transportation System in Pakistan

History of transportation modes is as old as man himself. There are many land transportation modes like railways and roads etc. In 1825, first time railway mode introduce for general goods. In Pakistan, in the year 1961, first time introduce railways transportation mode from Karachi to Kotri. Through the railway mode of transportation any country gets lots of economically and culturally benefits. It is considered that railway is the cheapest mode of transportation with in the country. Pakistan is the developing country, there is need to investment in this sector to provide better facility for the general public (Leighton, 1972). Imran (2009) critically overviewed the failure causes of public transportation in Pakistan. Pakistan is a developing country and facing the problem of high mass population, and it facing the problem of poverty, inequality, political insatiability and other basic requirements. On the other side, distances between the cities raise the problem of unemployment, poverty and low level of education especially in the women. There is a substantial need to take action regarding socioeconomic and environmental problems at government and semi government level (Adeel et al. 2016). Modes of traveling and tourism directly related to economic growth, and it will lead to increase the country's economic growth, i.e., if tourism increases it also increases the employment level, exports, investment etc. Traveling and tourism increases the current and future investment activities. It also increases the domestic purchases of goods and services market.

1.3.   Airline Transportation System in Pakistan

Air line services domestic and international both support country's economic growth. There is a need to provide better facilities related to generate revenue from this mode of transportation (Qasim, 2015). In 1955, introduce the international air line in Pakistan. It is the 16th largest airline in Pakistan, which provides almost 73 destinations in Asia, Middle East, Europe and North America and also provides 24th destination services domestically. There is a need to promote international air line to increase employment level, government revenue, improve services and focused the better quality.

With the help of technology, mass communication, route transportation and air transportation system world become a global village. With the affordable cost of air transportation it provides the peoples comfort. It is positively increases exports and trade sector. Although from last few years, air line industry face severs challenges of uncertainty and political instability (Deen and Arshad 2007).

1.4.   Objectives of the Study

The following are the objectives of the study, i.e.,

> ➢ To examine the impact of air transportation on country's economic growth,
> ➢ To analyze the role of railways transportation on country's economic growth, and
> ➢ To asses Asian financial crisis and global financial crises on Pakistan's economic growth.

The study is divided in to the following sub-sections, i.e., literature review is presented after introduction section that described the latest and significant studies on air transportation, railways transportation, economic growth, and financial crisis across countries. Section 3 shows methodology and data source. Results discussed in section 4, while conclusion is shown at the end.

2.   Literature Review

2.1.   Literature on Air Transportation and Economic Growth

According to Jin et al. (2004), better, comfortable and easy accessible mode of air transportation facility leads to increase country's economic growth. The study considered a case study of China to evaluate the performance of air transportation for a period of 1980 to 1998 and found three interesting results, i.e., i) economic transformation is achieved by the development of air transportation through receipts substantial revenues, ii) reduce regional disparities, and iii) large network developments. The results conclude with the favor of extension of transportation in medium and small cities, which could achieve economic transformation, develop large network, and reduce regional disparities. Marazzo et al. (2010) describes the relationship between the air transportation demand and economic development by considering a case study of Brazil economy for a period of 1966 to 2006. The results show that there is positive and significant relationship between air demand transportation and country's economic growth. Saboori et al. (2014) shows the relationship between transportation, environment and economic growth in a panel of OECD countries for a period of 1960 to 2008. The results reveal that there is a positive and long run relationship exists between the studied variables. Adler et al. (2014) concluded that amplify need to increase air and railways transportation facilities leads to increase trade and pricing policies across countries. For this analysis, the study used counter factual approach in Northeast Asia. The results suggest that better air and railway transportation facilities within the country and across the country increases country's economic growth. Hakim and Merkert (2016) describes the relationship between air transportation system and economic development in the South Asian region. The study used panel data ranging from 1973 to 2014 and found that there is a long run and positive association between air transportation and economic development in the region. Jelilov and Kachallah (2017) investigated the relationship between road transportation and economic growth in Nigeria by using a time series data from 1995 to 2014. The results conclude that government should adopt fair transportation policies to promote public transportation services with sustainable protection.

2.2.   Literature on Railways Transportation and Economic Growth

Agbelie (2014) investigated the long-run relationship between transport infrastructure and economic growth in a panel of countries by using a time period from 1992 to 2012. The results show that both the variables have a significant relationship between them. Deng et al. (2014) used regional panel data from 1987 to 2010 to investigate the relationship between transportation infrastructure and economic development in China and found a positive relationship between them. Achour and Belloumi (2016) describe the relationship between rail and road transportation infrastructure in Tunisia. The study argued that better transport facilities lead to economic growth, especially in the developing countries, where transport sector is the major service sector to contribute in country's sectoral value added. Hussain et al. (2015) confirmed the positive association between railways passengers carried and economic revenue generation when controlled to oil and diesel prices. Saidi et al. (2018) investigated the impact of transport consumption and transportation infrastructure on economic growth and found the positive association between the stated factors.

2.3.   Impact of Financial Crises on Economic Growth

Baumbach and Gulis (2014) showed the impact of financial crises on human health in Europe. The results although could not establish a positive association between the two factors, however, it has an indirect linkages via to increase unemployment level that leads to human sufferings in the form of health related mortalities ad morbidities. Tayebi and Yazdani (2014) discussed financial crises effect on oil prices all over the world and especially import and export of oil in East west Asia. For this analysis ARDL technique were used while selected time period from 1980 to 2008. The results show the positive effect of financial

crisis on oil prices in the short-run, while no visible impact found in the long-run. Ang and Mackibbin (2007) examined the impact of financial development on Malaysian economic growth and found that financial depth largely promote country's economic growth, while growth led financial development exists under causal framework. Timilsina and Shrestha (2009) investigated the relationship between transportation emissions and economic development in Asian region and found a significant relationship between the two factors. Table 1 shows the recent literature on air-railway transportation and Pakistan's economic growth

Table 1: Current literature on Pakistan's Economy

Authors' Name	Time Period	Results
Lin and Ahmed (2015)	1980-2013	There is a positive association between transportation and GDP via the channel of technology progress in a country. increases
Mohmand et al (2016)	1982-2010	There is significant association between transportation infrastructure and development of a country. It increases accessibility, trade, investment and employment level in a country.
Hameed and Anjum (2016)	2004 and 2009	There is positive link between transportation and economic development, which need to take care environment by sustainable policy instruments.
Zaman and Moemen (2017)	1975-2015	Economic development and growth are interlinked with each other, which need sustainable action plans to reduce socio economic and environmental degradation issues.
Baloch and Saud (2018)	1990-2015	Better transportation always leads to economic growth, however, the policies should be nature friendly.
Saleem et al. (2018)	1975-2015	Air-railways transportation increases resource rents and carbon emissions across country.
Khan et al. (2018)	1990-2015	Air-railways transportation supports country's economic growth via energy demand and custom duty.
Choudhary and Sultana	1991-2015	Railways transportation required more policy actions in order to support country's economic growth.
Nasreen et al. (2018)	1990-2016	Freight transportation, energy demand, and economic growth established causality relationships between them.
Saidi et al. (2018)	2000-2016	Transportation infrastructure have a positive impact on country's economic growth.

2.4.   Hypothesis of the study
The followings are the hypothesis of the study

H1 : Higher economic growth increases air-railways transportation to generate sufficient revenue.

H2 : Financial crises lead to decrease economic growth via the channel of decrease income share from air-railways transportation system, and

H3 : There exists an inverted U-shaped relationship between air-railways transportation and country's economic growth.

3.   Data and Methodology

3.1.   List of variables

Table 2 shows the list of variables.

Table 2: List of Variables

Variables	Symbols	Measurements	Data source
Dependent Variables			
Air transport freight	AT	million ton-km	World Bank (2017)
Railways goods transported	RT	million ton-km	World Bank (2017)
Independent Variables			
GDP per capita	GDPc	constant 2010 US$	World Bank (2017)
Asian Financial Crises Dummy$_{1997-1998}$	AFC	1 for 1997-2000 0 otherwise	World Bank (2017)
Global Financial Crises Dummy$_{2007-2007}$	GFC	1 for 2007-2010 O otherwise	World Bank (2017)

3.2.   Data Source

The data is taken from World Development Indicators published by World Bank (2017).

3.3.   Econometric Modeling by Robust Least Square Regression Estimator

The study followed the some out breaking recent scholarly work, which is inspired to make a design to find air-railways transportation modeling framework for robust inferences, including Saleem et al. 2018, Khan et al. 2018, and Khan et al. 2017. The following are the equations for empirical illustration, i.e.,

$$AT=\beta_0+\beta_1 GDPpc+\beta_2 SQGDPpc+ \beta_3 AFC+ \beta_4 GFC+ E \qquad (1)$$
$$RT= \beta_0+\beta_1 GDPpc+\beta_2 SQGDPpc+ \beta_3 AFC+ \beta_4 GFC+ E \qquad (2)$$

Where AT shows air transportation, RT shows railways transportation, GDPpc shows per capita GDP, SQGDPpc shows square of GDP per capita, AFC shows Asian financial crisis dummy, GFC shows global financial crisis dummy, and E shows error term.

3.3.1.   Robust Least Square Regression Estimator

The robust least square regression is the best alternate of ordinary least square regression. It provides the better and clear picture of coefficient estimation when outliers are exist in the data set. Robust least square regression identifies the outliers in the data set and minimizes their impact on coefficient estimation. It is well recognized fact that OLS estimator has some crucial assumptions that violate under the presence of outside lie observations in the regression model, which gives spurious regression coefficients in statistical relationship between regressand and regressors. Huber (1973) overcomes this limitation by limiting regressand outliers through 'maximum likelihood estimator-like (M)'to minimize aggregate functional values of the error term. This method gives a unique parameter estimates that minimizes the possible outliers from the regressand. However, in some cases regressors cause

serious issues in terms of highly volatility in observations due to structural changes, the parameter coefficients may give biased results. To overcome this situation, Rousseeuw and Yohai (1984) proposed 'S-estimator' that minimizes the deviation of outliers from a given models. Yohai (1987) further proposed a new method of coefficient estimates that simultaneously address possible outliers both from regressand and the regressors. This complete specification gives sound inferences that distinct it from conventional OLS estimator.

The robust least square regression is a desirable econometric technique, which has a sound standing in conventional using econometric techniques, i.e., Johansen cointegration work under the same order of integration, ARDL-Bound testing approach is used for mixture of integrated orders, GMM is used to remove simultaneity issues from the given models, etc., however, these econometric applications largely missing to handle possible outliers, which substantially handle robust least square regression and gives sound inferences.

Basically there are three common estimations used in robust least square regression.

1) M-estimation
2) S-estimation
3) MM -estimation

M-estimation

M-estimation is used when there is need to minimize the possible outliers from the dependent variable. It assumes that remaining explanatory variables has no possible outliers in the data set. Equations (1) and (2) have a following changes that incorporated lagged term of dependent variable for removing possible outliers, i.e.,

$$(AT)_{t-1} = \beta_0 + \beta_1 GDPpc_t + \beta_2 SQGDPpc_t + \beta_3 AFC + \beta_4 GFC + E \qquad (1.1)$$
$$(RT)_{t-1} = \beta_0 + \beta_1 GDPpc_t + \beta_2 SQGDPpc_t + \beta_3 AFC + \beta_4 GFC + E \qquad (2.1)$$

Where, t-1 shows lagged term.

S-estimation

It is used when dependent variable ise assumed to constant having no possible outliers; while on the other hand, explanatory variables have some deviation towards its actual steady state. The following changes been shown in equations (1) and (2) with S- estimation, i.e.,

$$AT = \beta_0 + \beta_1 GDPpc_{t-1} + \beta_2 SQGDPpc_{t-1} + \beta_3 AFC + \beta_4 GFC + E \qquad (1.2)$$
$$RT = \beta_0 + \beta_1 GDPpc_{t-1} + \beta_2 SQGDPpc_{t-1} + \beta_3 AFC + \beta_4 GFC + E \qquad (2.2)$$

MM -estimation

It minimizes outliers from both the dependent and explanatory variables from the given data set. The M-estimation shows the following changes in equations (1) and (2), i.e.,

$$(AT)_{t-1} = \beta_0 + \beta_1 GDPpc_{t-1} + \beta_2 SQGDPpc_{t-1} + \beta_3 AFC + \beta_4 GFC + E \qquad (1.3)$$
$$(RT)_{t-1} = \beta_0 + \beta_1 GDPpc_{t-1} + \beta_2 SQGDPpc_{t-1} + \beta_3 AFC + \beta_4 GFC + E \qquad (2.3)$$

4. Results and Discussion

Table 3 shows the estimation results of robust least square regression for ready reference.

Table 3: Robust Least Square Regression Estimates

Variables	D.V = AT	D.V=AT	D.V=RT	D.V=RT
Constant	-1301.932*	335.875*	17767.24*	5805.767*
GDPpc	4.018*	-----	-20.130[b]***	-----
SQGDPpc	-0.002*	-----	0.005	-----
AFC	-----	38.347[a]	-----	-1611.173[a]
GFC	-----	-18.246[a]	-----	311.306[a]
Statistical Tests				
R^2	0.674	0.034	0.387	0.086
Adjusted R^2	0.654	0.022[c]	0.348	0.031

Note: 'a' shows 'M' estimation. 'b' shows first lag of the explanatory variable. 'c' shows absolute value. * and *** shows 1% and 10% significance level.

The results confirmed the inverted U-shaped relationship between air transportation and country's economic growth, i.e., per capita income initially support to country's air transportation, while at the later stages, it substantially goes down due to low adaptable program to better off country's air transportation system. The impact of financial crisis on air and railways transportation is largely invisible, which does not signify its significant impact on different transportation systems in a country. The results verify the monotonic decreasing relationship between railways transportation and country's economic growth, as railways transportation does not provide sufficient revenue to support country's economic growth, while its second order coefficient is insignificant. Hence, it is desirable to re-consider our air-railways transportation policies and initiate economic programmes in order to do better transportation system in a country. The results are consistent with the previous studies of Ali et al. (2015), Nawaz et al. (2012), Alvi et al. (2013), Imran and Low (2017), Mohmand and Wang (2014), etc., these studies argued that Pakistan's transportation sector need substantial reforms in order to contribute in the economy through sound regulatory framework.

4.   Conclusions

This study critically reviewed Pakistan's transportation sector in order to observe its contribution in service value added of a country. The study considered air transportation and railways transportation for this purpose and collected a time series data from 1980-2016. The study used robust least square regression to minimize the possible outliers from the regressand and regressors by using MM-estimation technique. The results show that air transportation first increases country's per capita income while it substantially decline at the later stages of economic development, thus it verified the existence of inverted U-shaped relationship between them. The impact of railways transportation on Pakistan's per capita income is negative, while its second order coefficient value becomes insignificant, which substantiate the monotonic decreasing relationship between them. The Asian and global financial crisis remains insignificant during the study estimation period. The study proposed the following possible implications to improve Pakistan's transportation sector in order to contribute to country's development, i.e.,

 i) Improve service quality dimension indicators

ii) Optimum resource allocation

iii) Promote law and accountability

iv) Say 'No' to corruption

v) Avoid from nepotism

vi) Improve working condition with health and safety

vii) Promote green vehicles and electrified trains for environment protection, etc.

These policies would be helpful to promote sound transportation system in a country.

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