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Article

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TRANSPORTATION INFRASTRUCTURE AND HIGH-TECH MANUFACTURED EXPORTS: An Analysis in BRICS Countries

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Abstract

Transport infrastructure has become one of the prominent components of trade facilitation in recent years to improve trade among economies. Therefore, this paper empirically investigates the effect of transport infrastructure on high-tech manufactured exports among Brazil, Russia, India, China, and South Africa (BRICS) countries for the period 2009-2020. The paper applied the panel autoregressive distributed lag (PARDL) to investigate the objective of the study. The results show a negative impact of transport infrastructure on high-tech manufactured exports. The paper suggests that countries should consider improving transport infrastructure through investment by erecting new transport networks such as roads and seaports and upgrading existing links and technology.

Keywords: BRICS, Transport Infrastructure, High-Tech Manufactured Exports.
JEL Classification: F1, R4, J1.

I. Introduction

A sound and wide-ranging infrastructure is considered one of the key requirements in transportation and goods forwarding worldwide. Therefore, meeting the demands for quality infrastructure, both physical and social, is a priority agenda for the authorities in many regions. Organisation for Economic Cooperation and Development (2013) describes transport infrastructure as ‘all routes and fixed installations of the three modes of transport are routes and installations necessary for the circulation and safety of traffic’. Fourie (2007) explained that there are some positive attributes related to infrastructure to stimulate international trade. The first attribute is that quality infrastructure can reduce trade costs and can be divided into search costs, the cost of enforcing contracts, transport costs, tariffs and the cost of delays and uncertainties of delivery [Nordås and Piermartini (2004)]. Also, quality transport infrastructure has direct benefits on reduced costs of inputs into the production process and indirectly,

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productivity improves [Fourie (2006)]. According to OECD (2013), transport infrastructure is a crucial input into the production of transport services which, in turn, are necessary to allow for the market exchange of final goods and inputs or for broader welfare benefits such as travel time savings.

Recently, the promotion of regional free trade of imports and exports has lowered tariffs in most economies. This strategy enables the economies to trade goods and services without barriers and enhances over-border transactions. However, it has been observed that economies need to work on trade facilitation to escalate the trade of goods among the countries. Sakyi, et al., (2018) describe trade facilitation as the simplification and harmonisation of international trade procedures aimed at reducing transaction costs and arrangements associated with trade. It is evidenced that poor transport infrastructure adds around 30-40 per cent to the costs of goods traded among African countries [OECD (2019)].

As noticeably, efficient operation of the transportation system is crucial for international trade and integration in global production chains. Hence, the BRICS strategy indicates that a balanced and dynamic transnational transportation and logistics system is essential for growth within the five countries. BRICS is a dialogue and cooperation platform among (Brazil, Russia, India, China and South Africa) which together account for 26 per cent of global land, 42 per cent of the global population and 27 per cent of the world's Gross Domestic Product (GDP), 17.3 per cent of global merchandise trade [Global Economy (2019)].

Empirically limited studies have been conducted within BRICS countries, for example, Durmaz and Yildiz (2020) and Ying, et al., (2014), whereby their focuses were more on assessing the performance of high-tech exports in relation to research and innovation. As a result, this study is conducted to fill the gap that exists within the empirical literature by assessing the role of transport infrastructure in accelerating exports of high-tech manufactured products. Therefore, the aim of this study is to analyse transport infrastructure and high-tech exports using panel data from 2009 to 2020.

The study is organised as follows. Section II provides the study's literature review—Section III provides model specification and data analysis, respectively. The study results are presented in Section IV, whereas the conclusion is presented in Section VIII.

II. Literature Review

Transport infrastructure is widely seen as a factor in promoting trade relations and growth across countries. Within the theoretical framework, Krugman (1979) and Helpman and Grossman (1991) postulated that the variety of technological products available within different countries promotes foreign trade within countries if those countries are accessible. Noticeably, the link between transport infrastructure and trade has intrigued most researchers for decades. As a result, this literature review section will first review studies on country groups and then later review cases of specific countries. In reviewing group countries' studies, Gani (2017) studied the impact of logistics performance on international trade using a sample of 60 countries. The results show that the advanced performance of logistics is positively correlated with trade. Celbis, et al., (2014) investigated the quality and importance of infrastructure on trade for the period 1999 to 2012 for OECD countries using meta-analysis. The paper presented evidence that most countries that lack proper infrastructure could greatly losses on trade opportunities. According to Hulten (2005), the possible effects of infrastructure investment differ according to the level of development and the extent to which existing infrastructure networks have already been built. The paper by Grigorious (2007) studied the impact of infrastructure and land-lock on trade for the period 1992 to 2004. The study provides evidence obtained from a sample of 167 countries that road construction infrastructure within a landlocked country may not be adequate to enhance trade. Similarly, the work of Wilson and Shepherd (2006) in their analysis of road quality on intraregional trade of 138 cities and 27 countries across Europe and Central Asia proves that upgrading road infrastructure has the possibility of increasing trade by 50 per cent over baseline. Nordås and Piermartini (2004) investigated the impact of the quality of infrastructure (road, airport, and telecommunication, and the time required for customs clearance) on total bilateral trade and trade in the automotive, clothing and textile sectors in the least developed countries. The study found that port efficiency appears to have the largest impact on trade among all indicators of infrastructure in least-developed countries. It can be viewed that the literature above on group studies shows that infrastructure, in general, and especially transport has a very inconsistent effect on trade.

Martinez-Zarzoso and Nowak-Lehmann (2002) studied the Mercosur-European Union bilateral trade flows, employing the gravity trade model using panel data from 1988 to 1996. The study concludes that investing in a trade partner's infrastructure is not beneficial because only the exporter's infrastructure enhances trade but not the importer's infrastructure. Edmonds and Fugimura (2006) model the marginal effect of cross-border road infrastructure on trade and foreign direct investment in the Greater Mekong Sub-region in South-East Asia using panel data from 1981 to 2003. The study showed that the improvement of cross-border road infrastructure in the Greater Mekong Sub-region could promote and increase exports. They further explained that promoting trade may require a shift of policies to attract and invest in roads and border infrastructure. Muuse, et al., (2010), in their study, investigated transport infrastructure, intraregional trade and economic growth for 12 South American countries for the time period 1993 to 1999. The gravity model was employed, and the study found that transport infrastructure quantity increases intraregional trade. Furthermore, the study did not find any evidence that the quality of infrastructure could promote intraregional trade.

Simwaka (2011) examined the trade potential expected from the Southern African Development Community Free Trade Agreement using the gravity model. The study found that transportation costs, captured by the quality of infrastructure, have negatively correlated with trade. Another study in Africa is that of Lawrence and Martin (2008) focused on Sub-Saharan Africa. The study investigated the quality of infrastructure on export. According to their study, improving the quality of infrastructure has a positive effect on export. The paper by Yushi and Borojo (2018) examined the impact of economic, institutional quality, border and transport efficiency, and physical and communication infrastructure on the trade flow of African countries. The study covered 44 African countries as hosts and 173 trade partner countries. The study found that physical infrastructure and institutional quality variables are significant determinants of trade flow in Africa. The study by Shinyeka and Ntale (2017) examined the impact of economic infrastructure on exports of manufactured products for East African countries (EAC). The gravity model was employed for the period 2001 to 2014. Their results show that complex infrastructure improves the country's gains in terms of exporting manufactured products from EAC. The study further elaborated that hard infrastructure has a greater impact on improving trade when compared to soft infrastructure. The work of Simwaka (2011), Lawrence and Martin (2008), Yushi and Borojo (2018) Shinyeka and Ntale (2017) studied the various components of transport infrastructure on trade in African countries. The general impression from these African studies is that transport infrastructure in various forms seems to have a positive effect on trade.

Following is the review of specific countries, Albarren, et al., (2011) investigate Spanish manufacturing firms using panel data of 4177 firms for the period from 1990 to 2005. They analysed the firms' entry probability into exporting, focusing on domestic road transport using the progressive estimation strategy. The study concluded that export market entry is mostly conditioned by the firm's size, and it proves that domestic transport infrastructure improves and encourages small and medium-sized firms to export. Granato (2008), covering Argentina's regions between 2003 and 2005, concluded that improving the quality of infrastructure has a positive impact on export by lowering the transport cost faced by exporters. The study was then supported by Tong, et al., (2014) when analysing the dynamics of transport infrastructure, exports and economic growth using a multivariate time series analysis covering the period 1950 to 2006. With a similar conclusion to Granato (2008) and Albarren, et al., (2011), the study concluded that improvements in road infrastructure increase economic growth by enhancing the capital stock of non-transport infrastructure, and it also shows a positive impact on economic outputs and exports. Sahoo and Dash (2011), using the period from 1980 to 2005 employing panel cointegration for South Asia, also revealed that variables such as expenditure on human capital, labour force and export promote a positive contribution to output and increasing exports. More importantly, infrastructure development contributes significantly to output growth in South Asia.

Regarding the studies related to individual country members, recent evidence by Wu and Kang (2021) examined the impact of transport infrastructure on export trade from 31 provinces in China. The results indicated that improving the transport infrastructure in China may promote export development and increase freight turnover. Similarly, Li, et al., (2019) conducted a study on transport infrastructure on trade using panel data of provinces in China from 2009 to 2017. The results concluded that improved infrastructure could contribute to promoting the country's trade. They further detailed that railways, highways, and ports have strong connections as transport infrastructure in promoting trade across the provinces. As far as BRICS countries are concerned, Durmaz and Yildiz (2020) studied the effect of innovation on high-tech exports within BRICS countries. The authors focused on R&D as an innovative tool to improve high-tech exports. Using panel data, the study revealed that innovation activities play an important role in growing the export patterns of those high-tech exports. Ying, et al., (2014) also revealed similar conclusions as the authors analysed the competitive high-technology exports from BRICS countries to the United States. The study shows that investing in R&D has a positive relation in promoting high-tech exports to the U.S. market. The studies for BRICS countries lack the direct focus of what the current study aims to achieve, hence the rationale for the study at hand.

Through a careful review of studies in BRICS countries, this paper contributes to the existing literature in the following ways. For example, firstly, unlike other studies in BRICS countries, this study will narrow the investigation into analysing transport infrastructure and high-tech manufactured exports. This is different compared to the existing work of Durmaz and Yildiz (2020). This approach is very crucial in the sense that it will integrate the role and availability of transport infrastructure to provide much robust knowledge, and this will guide the specific policy recommendation. Secondly, the paper explores the use of two measures to capture the effect of transport infrastructure, container port traffic and linear shipping connectivity index, following the study by Ismail and Mahyideen (2015). This effort is to counter the previous studies, which only used one measure for transport infrastructure. Therefore, the existing studies in BRICS countries make this current paper novel in that regard. Lastly, this paper uses the data span from 2009 to 2020; this duration is taken to consider the establishment of BRICS as an organisation. The BRIC grouping's first formal summit, also held in Yekaterinburg, commenced on 16 June 2009. This might provide a sense of 'progress' since the establishment of the organisation. Considering all factors mentioned above, this gives an advantage and necessity for this study to be conducted and contribute to the existing literature. Concluding that, the study will investigate the transport infrastructure's effect on high-tech manufactured exports within BRICS as these countries are known to promote a sustainable and accelerated competitive advancement of developing economies through the implementation of multilateral trade mechanisms [Mokonyana, et al., (2013)].

III. Model Specification and Data Source

1. Model Specification

Studies on transport infrastructure and trade have been generally classified into two groups based on their models. The first category of studies relies upon gravity modelling, which concentrates much on the flow of goods within a particular trade region. On the other hand, the second groups of studies rely much on non-stationary models, which investigate the cointegration among the variables. Therefore, for the current paper, after following the extant literature, the below Model is specified in Equation (1):

$$HXP_{it} = \gamma_{ij} + \theta_1 WGDP_{it} + \theta_2 XR_{it} + \theta_3 LNCOR_{it} + \theta_4 LNTRNS_{it} + \theta_{it} \qquad (1)$$

Where HXP_{it} is a high tech-manufactured export from BRICS countries to rest of the world. $WGDP_{it}$ represents world gross domestic product, XR_{it} is the exchange rate for each country, $LNCOR_{it}$ is the proxy for corruption and lastly $LNTRNS_{it}$ present the proxy for transport infrastructure. For this study, there are two measures used, which is CPT_{it} (Air transport freight) and LSC_{it} (Liner shipping connectivity index). The selected proxies for transport infrastructure are regressed separately to avoid the problem of multi-collinearity. The above Model (1) is estimated using 2 variations of Equations, and they are presented as follows in Equation (2) and (3):

$$HXP_{it} = \gamma_{ij} + \theta_1 WNGDP_{it} + \theta_2 XR_{it} + \theta_3 LNCOR_{it} + \theta_4 CPT_{it} + \theta_{it} \qquad (2)$$

$$LNHXP_{it} = \gamma_{ij} + \theta_1 LNGDPW_{it} + \theta_2 XR_{it} + \theta_3 LNCOR_{it} + \theta_4 LSC_{it} + \theta_{it} \qquad (3)$$

The study assumes that world GDP ($WGDPW_{it}$), can be viewed as the income of importing country represents representing the potential capacity for their imports, given there is some demand in between. A high level of world GDP of importing countries implies high imports of high-tech-manufactured exports from BRICS countries. Therefore, there is an expected positive coefficient of the world GDP of importing countries.

For exchange rate (XR_{it}) there is an expected negative relationship between high-tech-manufactured exports and transport infrastructure. This expectation depends on the fact that the real exchange rate can capture a relative price advantage of BRICS countries over their competitors. A fall in the relative BRICS prices due to exchange rate depreciation makes exports cheaper in international markets resulting in an increased demand for high-tech-manufactured exports.

$LNCOR_{it}$ present the measure for corruption in BRICS countries. According to Gil-Pareja, Llorca-Vivero and Martínez-Serrano (2019), the improper functioning of the legal framework can hinder the effectiveness of the contracts, a fact that discourages international transactions by increasing the cost of exporting. Therefore, this study expects a negative relationship between corruption and high-tech-manufactured exports.

$LNTRNS_{it}$ proxy the quality of transport infrastructure in BRICS countries. The higher the scale of quality in terms of transport infrastructure, the more supply of high-tech-manufactured exports. The selected proxies for transport infrastructure are regressed separately to avoid the problem of multi-collinearity. The above Equation (2) to (3) are estimated using analysis of panel autoregressive regression (PARDL) pioneered by Pesaran, et al., (1999). However, prior to that, the study will perform the preliminary test such as descriptive statistics, correlation analysis and panel unit root tests.

2. *Data Source*

This study employs the panel of 5 countries which form BRICS, i.e., Brazil, Russia, India, China, and South Africa, for the period 2009 to 2020. The motivation for this period was based on the availability of data and the establishment of BRIC in 2009. Variables descriptions for the study are presented in Table 1 below:

TABLE 1

Data Description of the Study

Variable	Variable description	Source of data
HMX	Median and high-tech manufactured exports	World Bank national accounts data
WGDPP	GDP (constant 2010 US$)	World Bank national accounts data,
XR	Real effective exchange rate index (2010 = 100)	World Bank national accounts data and PENN World TABLES
LNCOR	Corruption index	Governance indicators, World Bank
CPT	Container port traffic (TEU: 20 foot equivalent units)	World Bank national accounts data
LSC	Linear shipping connectivity index	World Bank national accounts data

Source: Authors'estimation.

TABLE 2

Descriptive Statistics for BRICS Countries

	HXP	WGDP	XR	LNCOR	CPT	LSC
Mean	2.490	9.217	4.417	0.779	2.791	3.941
Minimum	1.588	9.110	3.822	0.405	2.688	3.274
Std. Dev.	0.560	0.059	0.253	0.199	0.078	0.540

Source: Authors'estimation.

IV. Empirical Results

Firstly the descriptive statistics were estimated, then the correlation analysis was reported. Preliminary results of unit root tests are also presented. The paper presents the Pedroni cointegration results followed by Pool Mean Group (PMG) results. Lastly, the study concluded with diagnostic tests.

Table 2 presents the descriptive statistics of all variables used in the Model for BRICS countries. The results show that, on average, the variable of the study which has the highest mean is WGDP, followed by XR, and the smallest is LNCOR. On standard deviation, the variable with the highest variance is WGDP, and the smallest is LNCOR. However, the descriptive statistics alone are not enough to come to a certain conclusion.

TABLE 3

Correlation results for BRICS countries

Correlation (Probability)	HXP	WGDP	XR	LNCOR	CPT	LSC
HXP	1.000					

WGDP	-0.058	1.000				
	(0.659)	-----				
XR	0.555	-0.085	1.000			
	(0.000)	(0.518)	-----			
LNCOR	-0.335	-0.310	-0.231	1.000		
	(0.009)	(0.016)	(0.077)	-----		
CPT	0.787	0.102	0.424	-0.075	1.000	
	(0.000)	(0.437)	(0.000)	(0.567)	-----	
LSC	-0.104	0.151	0.096	-0.750	-0.317	1.000
	(0.431)	(0.252)	(0.467)	(0.000)	(0.014)	-----

Source: Authors'estimation.

Table 3 indicates a linear relationship between two variables by measure of direction and strength. The correlation between HXP and its explanatory variables some sync with the theoretical predictions except for WGDP, LNCOR and LSC, which show a negative correlation with HXP. The results indicate that XR and CPT have a positive impact on HMX.

The study applies Levin, et al., (2002), which assumes the common unit root process among the system. The panel unit root tests consist of the following variables; high-tech-manufactured exports (HXP), world gross domestic product (WGDP), the exchange rate (XR), corruption (LNCOR), container port transport (CPT) and linear shipping connectivity index (LSC). As shown in Table 4, our sampled variables are all stationary in both the individual unit root process tests and are integrated of order zero I(0), except for variable HXP, which is integrated of order 1 I(1). Therefore, since the variables mix in order of integration, we can proceed to investigate cointegration among the variables under study.

Having established the order of integration among the variables under study in our panel unit root tests, we go further to test the null of no cointegration link to establish a long-run relationship between our sampled variables. The Pedroni cointegration test [Pedroni (1999)] was applied as presented in Table 5 and Table 6. Pedroni cointegration test highlights the characteristics of the residual-based tests for the null hypothesis of no cointegration for long-run and short-run. Pedroni test also considers group mean among dimension tests with independent intercept in the test and pooled within dimension tests. As shown in the Pedroni cointegration test in Table 5 for Model (2), 4 out of the 7 findings significantly reject the null hypothesis of no cointegration. Also, it can be observed in Table 6 for Model (3) that 4 out of the 7 findings significantly reject the null hypothesis of no cointegration. Therefore, based on the findings of Pedroni cointegration tests, the paper can conclude that a strong long-run relationship exists between high-tech-manufactured exports, world GDP, exchange rate, corruption and transport infrastructure measured by container

TABLE 4

Unit root results for Levin, Lin and Chu

Variables	Statistics	Probability	Order of integration
HXP	-0.023	0.4905	
ΔHXP	-4.456	0.000***	I(1)
WGDP	-3.718	0.000***	I(0)
XR	-2.770	0.002***	I(0)
LNCOR	-1.525	0.063*	I(0)
CPT	-4.440	0.000***	I(0)
LSC	-2.091	0.018**	I(0)

Source: Authors'estimation.

TABLE 5

Pedroni cointegration for Model 2

Within-dimension statistics	Panel -statistic	Panel probability
Panel v-statistic	0.638	0.261
Panel rho-statistic	2.547	0.994
Panel PP-statistic	-4.713	0.000***
Panel ADF-statistic	-2.025	0.021**
Between dimension statistics		
Group rho-Statistic	2.945	0.998
Group PP-Statistic	-10.354	0.000***
Group ADF-Statistic	-4.465	0.000***

Source: Authors'estimation.

port traffic and linear shipping index in BRICS countries. As the presence of cointegrations in the long-run equilibrium is established, the study then proceeds to estimate the parameters of the independent variables using PARDL.

Table 7 shows two Models used to estimate the impact of transport infrastructure on high-tech-manufactured exports in BRICS countries. The paper used various indicators to represent transport infrastructure, such as container port transport and linear shipping connectivity index. Equation (2) parameters were estimated with PARDL, and the results are presented in column 2. The variable world gross domestic product (WGDP) has a significant positive impact on high-tech-manufactured exports indicating that an increase in WGDP would stimulate high-tech-manufactured products being exported by BRICS countries to the rest of the world. These results suggest that a 1 per cent increase in WGDP will result in an increase in high-tech-manufactured exports. These findings are consistent with the results of Güneş, et al., (2020), who found

TABLE 6

Pedroni cointegration for Model 3

Within-dimension statistics	Panel -statistic	Panel probability
Panel v-statistic	0.342	0.366
Panel rho-statistic	2.313	0.989
Panel PP-statistic	-5.754	0.000***
Panel ADF-statistic	-2.818	0.002***
Between dimension statistics		
Group rho-Statistic	3.171	0.999
Group PP-Statistic	-11.737	0.000***
Group ADF-Statistic	-3.303	0.000***

Source: Authors'estimation.

a positive relationship between GDP per capita and high-tech-manufactured exports. In terms of the exchange rate, the results show a negative and statistically significant impact on high-tech-manufactured exports. This implies that when the exchange rates of BRICS countries increase, automatically, the price seems to be high and manufactured exports will decrease. The results are in line with the work of Sahoo and Dash

TABLE 7

Long run and short results for Models (2) and (3)

Long run	Model 1 parameters	Model 2 parameters
WGDP	10.425	16.678
	(0.000)***	(0.000)***
XR	-1.125	-1.719
	(0.000)***	(0.000)***
LNCOR	-0.954	-1.587
	(0.000)***	(0.000)***
CPT	-6.89	--------
	(0.000)***	
LSC	--------	-1.831
		(0.000)***
Short run		
ECT	-0.681	-0.675
	(0.005)***	(0.054)**
D(WGDP)	-4.798	-10.033
	(0.005)***	(0.089)*
D(XR)	0.339	0.49
	(0.058)**	(0.178)
D(LNCOR)	0.411	0.833
	(0.130)	(0.102)
D(CPT)	-2.313	--------
	(0.216)	
D(LSC)	--------	1.001
		(0.141)
Intercept	-46.352	-89.652
	(0.005)***	(0.052)*
trend	-0.143	-0.223
	(0.017)**	(0.063)*

Source: Authors'estimation.

(2011). The study also considered the effect of corruption on stimulating high-tech-manufactured exports in BRICS countries. The results show that corruption has a significant negative impact on high tech-manufacture exports. This result implies that as corruption increases in BRICS countries, this will lead to a decrease in stimulating high-tech-manufactured exports—these results align with the theory and the study by Gil-Pareja, et al., (2019). The study also captured transport infrastructure using container port transport (CPT). The results indicate a negative and significant impact of container port transport on high-tech-manufactured exports. These findings are inconsistent with the theoretical expectations. However, these findings are consistent with the empirical study by Muuse, et al., (2010).

Another more interesting result from short-run pooled mean group estimation is that the error correction term (ECT) with a coefficient of -0.68 is negative and statistically significant, which shows that periodical deviations in the long-run series have disappeared; a long-run relationship exists among the variables. The paper is interested on the long-run coefficients of the models since the study deals with the long-run relationship between high-tech-manufactured exports and transport infrastructure. Table 3 also presents results estimated from Model (3). The results exhibit that world GDP has a significant positive impact on high-tech-manufactured exports. Whereas exchange rate and corruption exhibit a negative significant impact on high-tech-manufactured exports.

The variable of interest transport infrastructure measured as linear shipping connectivity index shows a coefficient of -1.83 per cent on high-tech-manufactured exports. These findings are inconsistent with the results of Gani (2017), who found that logistic performance is positively correlated with trade. The results also show that in the short run, the long-run deviation is corrected at the speed of 67 per cent. Overall, findings presented under PARDL long-run estimations show that WGDP has a positive impact on high-tech-manufactured exports in both Model (2) and Model (3). Exchange rate and corruption showed a negative interaction with high-tech manufactured exports in both models. All measures of transport infrastructure measured with container port traffic in Models (2) and (3) showed a negative impact on high-tech-manufactured exports. These results are robust and consistent in all models.

V. Conclusion of the Study

The role of transport infrastructure to promote trade has been recognised over decades. Therefore, this study analysed the impact of transport infrastructure on high-tech-manufactured exports in BRICS. It has been a study of interest as BRICS countries have always been known to assist countries in gaining an advantage in trade and promoting infrastructure. Therefore, the motivation of this study was to analyse how different measures of transport infrastructure affect high-tech-manufactured exports using panel data from 2009 to 2020.

The study has concluded that the results are significant in the case of all estimations, showing that WGDP in all models appeared to have a positive relationship with high-tech-manufactured exports in BRICS countries. However, as the study identified measures of transport infrastructure which are container port transport and linear shipping connectivity, those variables showed a negative relationship with high-tech manufactured exports. It may be due to the poor quality and quantity of maritime transport infrastructure among BRICS countries. In other perspectives, it may be that when observing, the geographical distance among the countries is large, and it can be a barrier to trade.

These findings imply that BRICS countries should consider improving transport infrastructure through investment by erecting new transport networks, such as roads from inland to the seaport and upgrading existing links and technology. In conclusion, further research should focus more on the inclusion of other variables such as productivity, energy, financial infrastructure and trade agreements that may support the improvement of transport infrastructure and promotion of trade.

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