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Examining the Economic Effects of Logistics Infrastructure: The Case of New Western Land-Sea Corridor in China*

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Abstract

Purpose: To examine the economic effects of logistics under the influence of policies. **Research design, data and methodology:** This study is the first to use the panel data of 31 provinces and municipalities in China from 2012 to 2021, and use the OLS and DID models to evaluate whether the New Western Land-Sea Corridor (NWLSC) has promoted the economic development of the regions along the corridor. **Results:** The NWLSC has stimulated local economic growth by promoting the development of transportation, postal, and telecommunications industries along the corridor. Further, considering the locational differences of the regions along the NWLSC, we examined the differences in economic effects between regions along the Yangtze River and those not along the Yangtze River under the background of NWLSC implementation. We found that waterway and airway transport located along the NWLSC and in the Yangtze River Economic Belt (YREB) region can significantly promote economic growth. However, for regions located along the NWLSC but not in the YREB region, the impact of roadway, railway, and airway transport in these regions on economic growth is more significant. **Conclusions:** This study has important reference value on how to use logistics to promote the economic and cross-border commerce development of landlocked countries or regions.

Keywords : New Western Land-Sea Corridor, Logistics facilities, Economic growth, Western development, Regional development

JEL Classification Code : E60, F15, H40

1. Introduction

In order to achieve regional economic integration and promote the development of cross-border commerce, China is accelerating the development process of the western region. In 2017, the inland regions of western China proposed the construction of the "New Western Land-Sea Corridor" (NWLSC)[1]. The purpose is to enhance connectivity between western China and ASEAN and Central Asian countries through roadway, railway, and waterway transport or multimodal transport, to promote inland opening up, and to drive regional development (NDRC, 2019; Zhang et al., 2023). The corridor is also considered as "the most promising economic corridor" (Zhang et al., 2023) because it improves the connectivity

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between the underdeveloped western region of shipping and ASEAN and Central Asia. On one hand, according to the master plan by the National Development and Reform Commission, China aims to build an economical, efficient, convenient, green and safe land-sea corridor for the western region by 2025, with rail-sea multimodal shipments reaching 500,000 standard containers a year. On the other hand, with the RCEP coming into effect, the corridor has played a bigger role in boosting trade between China and ASEAN for slashing the time required for goods from ASEAN to reach China's western provinces by about 10 days to around 20 days.

The spatial layout of NWLSC consists of three parts: the main corridor, the core coverage area, and the radiation extension zone (NDRC, 2019). Among them, the three main corridors are Chongqing via Guizhou and Guangxi to the Beibu Gulf outlet (Guangxi); Chongqing via Huaihua (Hunan) and Liuzhou (Guangxi) to the Beibu Gulf outlet; and Chengdu via Luzhou (Sichuan) and Baise (Guangxi) to the Beibu Gulf outlet. The core coverage area includes Chongqing, Guangxi, Guizhou, and Gansu provinces and municipalities. The radiation extension zone includes Yunnan, Hainan, Sichuan, Ningxia, Shaanxi, Inner Mongolia, Tibet, Qinghai, and Xinjiang, achieving full coverage of western China. See Figure 1 for a schematic diagram of the corridor route.

Figure 1: New Western Land-Sea Corridor Route Map (Source: Zhu et al., 2023)

In China, the logistics industry is considered an accelerator of the economy (Chu, 2012). And logistics infrastructure is not only an important component of the logistics industry but also directly influences the level of development of the logistics industry (Hooi Lean et al., 2014). As the key to economic growth and an important tool to narrow regional gaps and promote regional economic growth, the economic impact of transportation infrastructure has been the focus of attention and analysis by economists and policymakers (Elburz et al., 2017). On the one hand, from the supply side, the construction of logistics infrastructure is conducive to enhancing the connectivity of various interdependent production sectors, expanding the scope of production and distribution, increasing the regional capital stock while forming economies of scale, and achieving increased supply (Gani, 2017). On the other hand, from the demand side, logistics infrastructure investments can stimulate aggregate demand by expanding the scale of employment, increasing demand for goods and services, etc. (Purwanto et al., 2017). In other words, logistics infrastructure can drive economic growth by affecting both the supply side and the demand side. In addition, the completed logistics infrastructure can improve spatial accessibility, enhance regional connectivity, and promote economic and trade exchanges (Li et al., 2018). Especially for the field of cross-border e-commerce, the role of logistics infrastructure is becoming more and more obvious. Because logistics service, as a key service of e-commerce,

is an important competitive lever for e-commerce operations (Niu et al., 2019; Ren et al., 2020).

So, since the proposal of NWLSC in 2017, as the most important logistics corridor emerging in western China and connecting Central Asia and Southeast Asia, has NWLSC promoted the economic growth of the regions along the route? Does NWLSC play the same role in regions with developed waterway transport and those with less developed ones? Although these questions deserve discussion, there is currently no research addressing them. This study, aiming at examining the economic effects of logistics infrastructure under the influence of policies, is the first to use the panel data of 31 provinces and municipalities in China from 2012 to 2021, and use the OLS and DID models to evaluate whether the NWLSC has promoted the economic development of the regions along the corridor.

First, the existing literature mostly focuses on specific measures to promote the development of NWLSC (Fu, 2019; Ma, 2021; Quan, 2021) and pays little attention to the impact of NWLSC. Secondly, most of the existing literature is a qualitative analysis of NWLSC, lacking a quantitative analysis of the economic impact of the logistics corridor (Lan et al., 2017). Finally, among the few pieces of literature that analyze the economic impact of NWLSC, scholars mostly analyzed the impact of NWLSC on the economic and trade exchanges between China and Singapore, China and ASEAN, and China and Europe (Jiang et al., 2020), lacking attention to the domestic economic impact. Therefore, in order to correct the imbalance existing in related research, we collected panel data from 31 provinces and municipalities in China from 2012 to 2021, and analyzed the economic effects of the construction of NWLSC on the regions along the corridor using OLS and DID models respectively. Considering the heterogeneity of the development level of logistics infrastructure in regions along the NWLSC, we further analyzed the differences in the economic effects between regions along the Yangtze River with developed shipping and regions not along the Yangtze River.

This study makes new progress in understanding the economic effects of the NWLSC in the following aspects: First, this study quantitatively analyzes the economic effects of the transportation, postal, and telecommunication industries on the provinces and municipalities along the corridor, which is an important supplement to the extensive qualitative analysis. Furthermore, this study divides two sub-samples according to whether the provinces and municipalities along the corridor belong to the Yangtze River area, and conducts a heterogeneity analysis to enhance the credibility of the research results. Secondly, the study uses the DID model to test the economic impact of the construction of NWLSC on the 13 provinces and municipalities along the corridor, which verifies the reliability of the benchmark model results. Finally, this study provides policy implications for China's further development of the west and provides empirical evidence from China for other landlocked countries to achieve economic development through the construction of logistics infrastructure.

The remainder of this study is structured as follows: Part 2 is a literature review, which mainly sorts out the relevant studies on the economic effects of logistics infrastructure and the NWLSC. Part 3 is the variables, data, and analysis methods. Part 4 is the empirical analysis and results discussion. Part 5 is the research conclusions and policy implications.

2. Literature Review

The logistics industry plays a key role in a country's economic development, and its efficient operation is critical to a country's industrial development and economic growth. According to the International Transport Forum (ITF), the logistics sector provides employment for 6% of the global labor market, and its economic output accounts for 10% of the global GDP (ITF, 2016). With the construction of modern logistics infrastructure, public infrastructure is playing an increasingly important role in stimulating the national economy so much, so that the World Bank refers to infrastructure as the "wheel" of any economic activity (Farhadi, 2015). Based on this, the role of logistics infrastructure in promoting the spatial redistribution of economic activities has also attracted the research interest of scholars (Saidi et al., 2020).

Since the early 1970s, numerous studies have examined the relationship between general public infrastructure and regional growth (Elburz et al., 2017). In terms of communication infrastructure, investment in telecommunications infrastructure has become the most effective type of infrastructure in all countries (Elburz et al., 2017), and was the first to receive scholarly attention. Ding et al. (2008) used the panel data of 29 provinces and municipalities in China from 1986 to 2002 to analyze the role of telecommunications infrastructure in China's regional economic growth, and found that there is a significant positive correlation between China's telecommunications infrastructure and regional economic growth. With the increase in global seaborne cargo trade, scholars have focused their attention on the relationship between port logistics and economic growth. For the European region, Bottasso et al. (2013) used the systematic GMM method to study port activity and employment in 560 regions of 10 Western European countries from 2000 to 2006, demonstrating that port throughput is positively correlated with regional employment and proving that

increased port throughput promotes regional economic development. For the Asian region, Deng et al. (2013) studied the relationship between port demand, port supply, and port value-added activities and the regional economy in the port municipalities of five coastal port clusters in China using the SEM model and found that port value-added activities have a positive impact on the development of the regional economy. Similarly, Shan et al. (2014) analyzed the impact of ports on the economic development of the cities based on the data of 41 major port cities in China from 2003 to 2010, and found that the cargo throughput of the ports has a positive impact on the economic growth of the cities where they are located. In addition, Park and Seo (2016) collected panel data for all regions in South Korea from 2000 to 2013 to analyze the economic impact of seaport economic activities on South Korea, and the results confirmed that cargo port throughput, container port activities, and port investments all contributed to regional economic growth.

The consensus of most previous studies is that there is a positive relationship between transportation infrastructure spending and economic output (Agbelie, 2014). Because transportation infrastructure can reduce transportation costs, reduce congestion and thus shorten transportation time, and increase economic output. In addition, the large labor force required to build infrastructure can reduce unemployment and increase personal income and GDP. In other words, transportation infrastructure makes an important contribution to national and regional economic development by enhancing accessibility and improving connectivity (Agbelie, 2014; Farhadi, 2015; Purwanto et al., 2017). But besides ports, do other transportation infrastructures have the same effect on economic growth? Wang et al. (2020) used panel data to investigate the impact of railway and highway transportation infrastructure on the economic growth of countries along the “Belt and Road”, confirming that it plays an important role in promoting economic growth. In addition, Magazzino and Mele (2021) used the panel data of 28 provinces and municipalities in China from 1990 to 2017 to explore the contribution of transportation investment to economic growth and found similar conclusions.

The NWLSC is an important project to achieve high-level economic development in the inland areas of western China. Supported by various types of transportation arteries such as railway, highway, inland waterway, and airline, the NWLSC can be a channelized and hubbed logistics network by developing multimodal transportation such as rail-sea, road-rail, and river-rail intermodal transportation, making it a comprehensive transportation corridor. This is because multimodal transportation can take advantage of various transportation modes and reduce transportation costs (Chen & Liu, 2021), thereby promoting sustained regional economic growth (NDRC, 2019).

So, since the construction of NWLSC, has it played a key role in promoting economic growth in western China? Given that many past studies on the impact of logistics infrastructure have mainly focused on discussing the economic impact of one mode of transportation, such as highways, without considering the economic impact of other modes of transportation (Agbelie, 2014). In our study related to NWLSC, we extended our analysis to four major modes of transportation, namely, railway, highway, inland waterway, and aviation. In addition, we also considered the economic impact of the telecommunications and postal industries, which are important subsectors of the logistics industry to improve this research bias and obtain more credible results. Based on the above discussion, the following hypothesis is proposed for the development of logistics infrastructure in provinces and municipalities along NWLSC.

H1: The development of the logistics infrastructure of NWLSC has contributed to the economic growth of the regions along the corridor.

The Yangtze River Economic Belt is a coordinated development belt that coordinates cooperation between eastern, central, and western China, and it is also an inland river economic belt with global influence (NDRC, 2020). As the operation and organization center of NWLSC, Chongqing has unique location advantages. It is not only a transportation hub for channel logistics, but also the intersection of "One Belt, One Road" and the YREB (NDRC, 2019). Similarly, provinces along the NWLSC that also belong to YREB include Guizhou, Yunnan, and Sichuan. This provokes us to think: does NWLSC have the same economic effect in areas along the Yangtze River (developed waterway transport) and non-Yangtze River coastal areas (underdeveloped waterway transport)? Because ports play a crucial role in the development of the YREB (LIU et al., 2021). That is, under the background of NWLSC, the areas along the Yangtze River may mainly coordinate the development of the YREB through waterway transport. In addition, since the development of dry ports can lead to an increase in trade (LIU et al., 2021), for non-Yangtze River regions, NWLSC is likely to play an active economic role by virtue of land-based freight transport modes. Based on the above analysis, the following hypothesis is proposed for the economic impact of the construction of NWLSC.

H2: The NWLSC coordinates the development of the YREB, and at the same time has more positive economic effects on areas not along the Yangtze River.

3. Research Methods and Materials

3.1. Data

This study collected logistics-related panel data from 2012 to 2021 in 31 provinces (municipalities) in China. The data comes from the statistical yearbooks of various provinces and municipalities, and part of the data comes from the CSMAR (China Stock Market & Accounting Research) Database. Compared with other statistical data, the statistical yearbook has the following advantages: (1) The statistical yearbook is the official data of each provincial and municipal government, and the data are more authoritative. (2) The statistical yearbook basically covers the relevant information on a variety of logistics infrastructures, which provides data support for this study to test the economic impact of different logistics infrastructures. The data description is shown in Table 1.

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
LperGDP	310	10.84	0.42	9.96	11.67
LRoadway	310	11.25	1.05	7.55	12.47
LRailway	310	8.73	1.40	4.02	11.16
LWaterway	310	6.95	4.13	0.00	11.53
LCA	310	2.01	1.54	-0.17	5.16
LEdu	310	2.75	1.41	0.00	4.04
LEmpl	310	10.41	1.01	7.67	11.84
LPost	310	4.52	1.52	0.54	7.11
LTelecom	310	6.64	1.15	3.83	8.63

3.2. Variables

3.2.1. Explained Variable

GDP per capita (denoted as LperGDP)

A country's economic development and development potential are usually measured by GDP per capita (Ding et al., 2008; Chu, 2012; Deng et al., 2013; Park & Seo, 2016; Lan & Tseng, 2018; Wang et al., 2020). We use the logarithmic form of GDP per capita of 31 Chinese provinces (municipalities) from 2012 to 2021 as a proxy indicator for regional economic development.

3.2.2. Explanatory Variables

Transportation (denoted as Trans)

Considering that different logistics infrastructures have different impacts on economic growth (Hooi Lean et al., 2014), we take into account the impacts of four different modes of transportation on the regional economy: highway, railway, waterway, and aviation, and use the logarithmic form of the cargo transportation volume under different modes of transportation (denoted as LRoadway, LRailway. LWaterway, LCA) as a proxy indicator for measuring the economic impact of transportation infrastructure development in the logistics industry.

The total business volume of the postal industry (denoted as LPost)

The development scale of the postal industry is usually measured by the total business volume of the postal industry (Xu & Wang, 2017; Lan & Tseng, 2018). We use the logarithmic form of the total business volume of the postal industry in 31 provinces and municipalities in China from 2012 to 2021 as a proxy indicator for the development scale of the postal industry.

The total business volume of the telecommunications industry (denoted as LTelecom).

As an important component of the communication infrastructure, the total business volume of the telecom industry is commonly used in academia to measure the scale of development of a region's telecom industry (Xu & Wang, 2017). The logarithmic form of the total business volume of the telecom industry in 31 provinces and municipalities in China from 2012 to 2021 is used as a proxy indicator of the development scale of the telecommunications industry.

3.2.3. Control Variables

Employment in the logistics industry (denoted as LEmpl)

The level of development of the logistics industry can be represented to some extent by the number of employees in the logistics industry (Chu, 2012. Li et al., 2018; Lan & Tseng, 2018; Wang et al., 2020; Yang et al., 2020; Ali, 2021). The more people employed in the logistics industry, the larger the scale of the logistics industry, and vice versa, the smaller the scale of the logistics industry. And the larger the scale of the logistics industry, it often produces better economic effects. We use the logarithmic form of the number of employees in the logistics industry as a proxy variable for the size of the logistics industry to measure the economic impact of the scale effect of the logistics industry.

Share of employees with high school and above education in the total population (denoted as LEdu)

Human capital input is an important influencing factor for economic development, and increasing human capital input can effectively stimulate regional economic development. Most of the existing literature uses the degree of labor force input with higher education to measure the size of human capital (Ding et al., 2008; Chu, 2012; Shan et al., 2014). We introduce the natural logarithm form of the share of employees with high school and above education in the total population as a proxy variable to measure the size of regional human capital input, and to measure the human capital input impact on economic growth.

Detailed variables and data sources are listed in Table A1 of Appendix A. The list of variable correlation coefficient matrix and VIF test are shown in Table A2 and A3 of Appendix A, respectively.

3.3. Analysis Methods

The OLS model is a useful tool for assessing economic impacts and has been used widely in previous studies assessing the economic impacts of transportation infrastructure within or across counties/states/nations (Agbelie, 2014). To examine the economic effects of logistics development in NWLSC, this study develops the following model to empirically test the economic effects of logistics development in the corridor.

$$L_n perGDP_{jt} = \alpha + \beta_1 L_n Tele_{jt} + \beta_2 L_n Post_{jt} + \boldsymbol{\eta Trans_{jt}} + \boldsymbol{\xi C_{jt}} + \gamma_j + \varepsilon_{jt} \quad (1)$$

$$\boldsymbol{Trans_{jt}} = \eta_1 L_n Roadway_{jt} + \eta_2 L_n Railway_{jt} + \eta_3 L_n Waterway_{jt} + \eta_4 L_n CA_{jt} \quad (2)$$

$$\boldsymbol{C_{jt}} = \xi_1 L_n Edu_{jt} + \xi_2 L_n Empl_{jt} \quad (3)$$

Where j denotes the province and t denotes the time. $L_n Tele_{jt}$, $L_n Post_{jt}$ represent the logarithms of the telecommunications and postal business volumes, respectively. $\boldsymbol{Trans_{jt}}$ are the explanatory variables of different transportation modes. $L_n Roadway_{jt}$, $L_n Railway_{jt}$, $L_n Waterway_{jt}$, $L_n CA_{jt}$ are the logarithms of the freight volumes of roadways, railways, waterways (inland waterways), and aviation, respectively. $\boldsymbol{C_{jt}}$ are control variables that capture other factors that may affect economic growth ($L_n Edu_{jt}$, $L_n Empl_{jt}$ denote the log form of the share of employees with high school and above education in the total population, and the employment in the logistics industry, respectively). γ_j represents province fixed effects, and ε_{jt} is the error term.

To further test whether NWLSC plays a key role in the economic growth of the provinces and municipalities along the route, this study draws on the research of Jia et al. (2017) and Carbo et al. (2019), and constructs the following DID model for testing. The DID model can accurately assess the impact of policy effects while avoiding endogeneity problems caused by omitted variables, etc. (Zhao et al., 2022).

$$L_n perGDP_{jt} = \alpha + \beta_1 DID + \beta_2 RGN + \beta_3 Time + \beta_4 L_n Tele_{jt} + \beta_5 L_n Post_{jt} + \boldsymbol{\eta Trans_{jt}} + \boldsymbol{\xi C_{jt}} + \gamma_j + \varepsilon_{jt} \quad (4)$$

Where DID is a dummy variable (=RGN*Time), and its coefficient β_1 represents the economic effect of building NWLSC, which is the focus of our attention. RGN represents the provinces and municipalities along the NWLSC (provinces and municipalities along the corridor = 1, non-corridor provinces and municipalities = 0), and $Time$ represents the year when each province and city joined the construction of the NWLSC (after joining = 1, before joining = 0). The rest of the settings are consistent with Equation (1).

4. Results and Discussion

4.1. Baseline Regression

To initially examine the economic effects of logistics development, we conducted OLS regressions on panel data of 13 provinces and municipalities along NWLSC from 2012 to 2021. Further, to focus on whether the economic effects of NWLSC are affected by geographical differences, we divided the provinces and municipalities along the corridor into regions along the Yangtze River (Chongqing. Guizhou, Yunnan, and Sichuan) and the non-Yangtze River coastal regions (Guangxi, Gansu, Qinghai, Xinjiang, Ningxia, Shaanxi, Inner Mongolia, Tibet, and Hainan), to compare the economic effects of the NWLSC on the provinces and municipalities belonging to the two different regions. The regression results are shown in Table 2.

Table 2: Regression Result of OLS Model

Variables	NWLSC & Non-Yangtze	NWLSC & Yangtze
LRoadway	0.301***	0.017
	(4.80)	(0.38)
LRailway	0.152***	0.017
	(2.78)	(0.62)
LWaterway	0.010	0.107*
	(0.48)	(1.71)
LCA	0.049**	0.211***
	(2.32)	(3.07)
LPost	0.209***	0.322***
	(6.81)	(11.31)
LTelecom	0.043**	-0.006
	(2.87)	(-0.35)
LEdu	-0.031***	-0.033***
	(-3.45)	(-3.89)
LEmpl	0.040	-0.014
	(0.72)	(-0.31)
_cons	4.385***	7.937***
	(4.51)	(9.33)
Province FE	Yes	Yes
N	90	40
R-sq	0.711	0.554

t statistics in parentheses; * p<0.1, ** p<0.05, *** p<0.01; NWLSC=New Western Land-Sea Corridor; Yangtze = Region along the Yangtze River

Column (1) of Table 2 reports the impact of the NWLSC on non-Yangtze River coastal areas. It can be seen that the NWLSC plays an important role in the economic development of non-Yangtze River coastal provinces and municipalities. H2 is confirmed.

In terms of the transportation industry, LRoadway and LRailway are significantly positive at the 1% level, and LCA is significantly positive at the 5% level, indicating that the NWLSC drives the development of roadway, railway, and air transportation industries, i.e., non-waterway transport industries, in non-Yangtze River coastal provinces and municipalities. The increase in dry port cargo transportation has promoted the growth of per capita GDP in the relevant provinces and municipalities (Agbelie, 2014; Farhadi, 2015). In terms of the post and telecommunications industries, LPost and LTelecom are significantly positive at the 1% and 5% levels, respectively, indicating that the NWLSC has stimulated the demand for post and telecommunications services in non-Yangtze River provinces and municipalities, while expanding the size of the post and telecommunications industry, showing a positive effect on economic growth (Ding et al., 2008).

Column (2) of Table 2 reports the impact of the NWLSC on the Yangtze River coastline. The coefficients of LCA, LWaterway, and LPost are significantly positive, indicating that the NWLSC mainly promotes the development of waterways, air transport industry, and postal industry in the provinces and municipalities along the Yangtze River, which in turn has a positive effect on economic development. Because the provinces and municipalities along the Yangtze River mainly rely on the Yangtze River for inland waterway transportation, the demand for dry ports such as roadways and railways is relatively small, making the economic contribution of dry ports insignificant (NDRC, 2020). This also reflects the important role played by water ports in coordinating the development of the YREB in the context of the NWLSC (NDRC, 2019). The coefficients of the remaining variables are insignificant and not sufficiently economically significant.

Interestingly, the control variable LEdu is significantly negative at the 1% level, contrary to our expectation. Because the augmented Solow model suggests that increased investment in human capital will promote economic development (Mankiw et al., 1992), but the results show that there is a negative correlation between human capital and economic growth in provinces and municipalities along the NWLSC. A potential reason may lie in the presence of a large amount of low-quality human capital in the provinces and municipalities along the corridor. According to the theoretical paradigm of new structural economics, high-quality human capital promotes economic development, while low-quality human capital has a depressive effect on economic growth (Jun & Mingfeng, 2019).

4.2. Further Analysis

In order to further analyze the role of the NWLSC on the economic development of the region, we conducted the DID model for analysis. The analysis results are shown in Table 3.

Table 3: Regression Result of DID Model

Variables	(1) LperGDP	(2) LperGDP
DID	0.403***	0.120***
	(11.55)	(6.78)
LRoadway		0.127***
		(4.22)
LRailway		0.052**
		(2.25)
LWaterway		0.004
		(0.44)
LCA		0.051***
		(3.47)
LPost		0.250***
		(20.02)
LTelecom		-0.006
		(-0.71)
LEdu		-0.017***
		(-4.14)
LEmpl		0.010
		(1.02)
_cons	10.754***	7.326***
	(184.04)	(16.37)
Province FE	Yes	Yes
N	308	308
R-sq	0.330	0.798

t statistics in parentheses; * p<0.1, ** p<0.05, *** p<0.01

Columns (1) and (2) of Table 3 report the results of the DID analysis without and with control variables, respectively. It can be found that the key variable DID is significantly positive at the 1% level with or without control variables, indicating that the construction of the NWLSC has a strong positive effect on the GDP per capita of the provinces and municipalities along the route, i.e., the NWLSC indeed play a key role in promoting the economic growth of the provinces and municipalities along the corridor. *H1* is confirmed.

In terms of explanatory variables, LRoadway, LRailway, and LCA are all significantly positive at 5% and above levels under different modes of transportation, indicating that logistics is the key to promoting economic growth in provinces and municipalities along the corridor. The

NWLSC has promoted the increase of roadway, railway, and airway freight volume, thus driving the economic growth of the provinces and municipalities along the route. This is in line with the findings of Agbelie (2014), Farhadi (2015), Purwanto et al. (2017), and Wang et al. (2020).

However, it is noteworthy that the coefficient of LWaterway is positive but not significant. The reason for this may be that the provinces and municipalities along the NWLSC cover a wide range and a large span, and the natural resource endowment of each province is different. Some provinces (i.e., Xinjiang, Ningxia, Inner Mongolia, and Tibet) lack inland waterways and waterway freight volume data are missing, which affects the regression results.

LPost is significantly positive at the 1% level, indicating that the expansion of postal business volume has played a key role in the economic growth of provinces and municipalities along the corridor. Because the postal industry, as a public service industry, is a fundamental indicator of logistics development and can contribute to economic growth by expanding business areas and market shares (Lan & Tseng, 2018). In addition, the coefficients of LTelecom and LEmpl are insignificant and not fully economically significant.

4.3. Robustness Tests

4.3.1. Parallel Trend Test

To ensure that the analysis results of the DID model are credible, we conducted the necessary parallel trend test on the data. An important premise of the DID model is that the change trends of the experimental and control groups are similar before the policy event (Zhao et al., 2022). Therefore, we tested the changing trend from four years before to four years after the proposed policy for the construction of the NWLSC with the following model:

$$L_n perGDP_{jt} = \alpha + \sum_{m=0}^{4} \tau_m \, beforem + \sum_{n=1}^{4} \theta_n \, aftern + \boldsymbol{\beta C_{jt}} + \gamma_j + \varepsilon_{jt} \quad (5)$$

In equation (5), the $beforem$ is a dummy variable, obtained by advancing the dummy variable DID (=RGN*Time) for m years, respectively (m=1.....4). τ_m and θ_n represent a range of forecast values from 2013 to 2021. Similarly, when the sample is in the nth year of being affected by the policy of constructing the NWLSC, the $aftern$ is assigned the value of 1, and the opposite is 0 (n=1.....4). $\boldsymbol{C_{jt}}$ represents a vector of control variables. The rest of the settings are the same as before. The analysis results are shown in Figure 2.

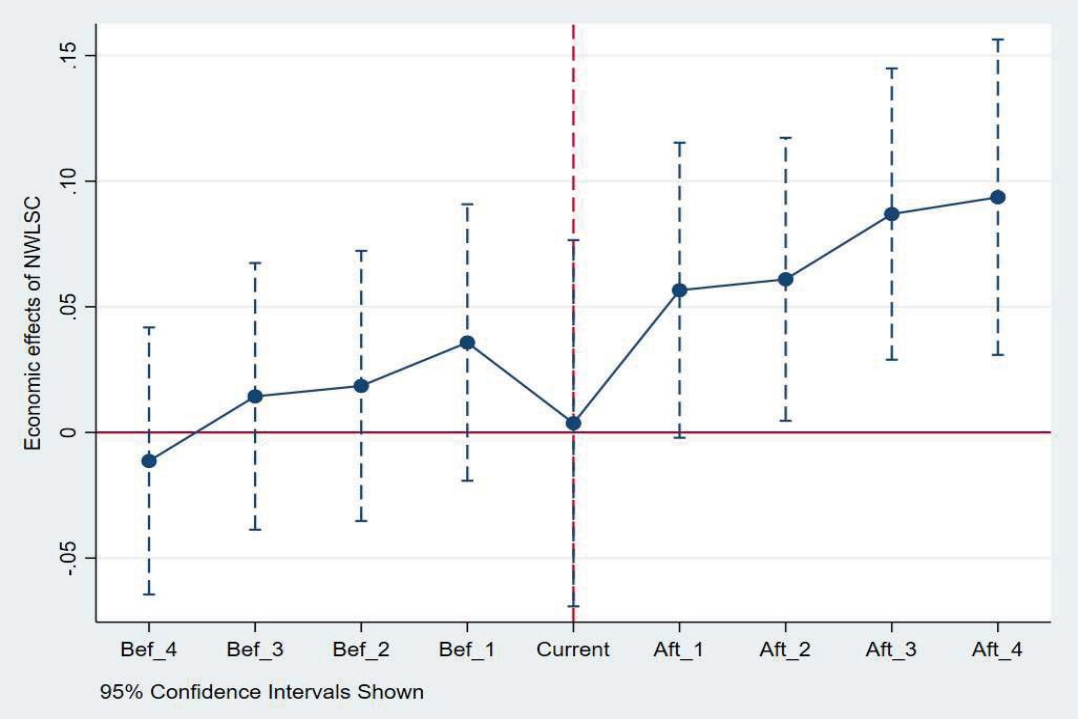

Figure 2: Common Trend Test for DID Model

Figure 2 reports the results of the coefficient estimation with 95% confidence interval. It can be found that there is no significant difference between the experimental group and the control group before the policy implementation, and the DID model passed the parallel trend test, proving the robustness of the results. In addition, after the implementation of the policy, the estimated coefficients of the variables show an upward trend year by year, indicating that the proposal of the policy of constructing the NWLSC has indeed had an impact on the economic development of the provinces and municipalities along the corridor. The estimated coefficients of the variables from the second to the fourth year (i.e., 2019-2021) after the implementation of the policy are significant but do not increase significantly, indicating that the outbreak of COVID-19 may have affected the economic effects of the NWLSC. It also indicates that further discussion with the exclusion of the effect of COVID-19 is necessary.

4.3.2. Excluding the Impact of COVID-19

COVID-19 had a significant impact on the world economy, and China's domestic lockdown measures have suspended almost all production activities, severely hitting the Chinese economy (World Bank, 2022). In order to exclude the interference of COVID-19, we excluded the data for 2020 and 2021 and re-regressed the data from 2012 to 2019 using the DID model to analyze the economic effects of the NWLSC on the provinces and municipalities along the corridor without the influence of COVID-19. Regression results are shown in Table 4.

Table 4: Regression Result of Excluding the Impact of COVID-19

Variables	NWLSC
DID	0.334***
	(7.85)
Control Variables	Yes
_cons	10.761***
	(184.11)
Province FE	Yes
N	104
R-sq	0.723

Note: t statistics in parentheses; * p<0.1, ** p<0.05, *** p<0.01; NWLSC=New Western Land-Sea Corridor

The results show that after excluding the data for 2020 and 2021, the key variable DID is still significant at the 1% level, indicating that the NWLSC does have a positive effect on the economic development of the provinces and municipalities along the corridor, proving that the results are robust.

5. Conclusions

5.1. Research Conclusion

This study collected panel data for 31 provinces (municipalities) in China from 2012 to 2021, and used the OLS and DID models to analyze the impact of the New Western Land-Sea Corridor on the economic development of the provinces (municipalities) along the corridor. We found that the NWLSC played an important role in the economic growth of the provinces and municipalities along the corridor by promoting the development of the logistics industry (i.e., transportation, postal, and telecommunication industries) and achieving the agglomeration and diffusion of freight logistics to the provinces and municipalities along the corridor. In addition, the results of the DID model indicate that the construction of the NWLSC has a strong positive effect on the GDP per capita of the provinces and municipalities along the corridor, i.e., the NWLSC does play a key role in promoting the economic growth of the provinces and municipalities along the corridor.

Further, considering the geographic heterogeneity of provinces along the NWLSC, we divided the provinces and municipalities along the corridor into two sub-samples: Yangtze River coastal provinces and non-Yangtze River coastal provinces, and examined the differences in the implementation of the NWLSC on the developed and underdeveloped regions of the shipping industry. The results show that two modes of transportation, waterway transport, and airway transport, have important effects in the provinces and municipalities along the Yangtze River. The NWLSC drives the development of the non-Yangtze River provinces and cities' roadway, railway, and airway transport industries, i.e., the non-water transport industry, and the increase in dry port cargo transportation promotes the growth of per capita GDP in relevant provinces and cities. It reflects the key role of the NWLSC, an emerging logistics corridor, in promoting the economic development of inland regions (non-water transport developed areas) and strengthening international economic cooperation.

5.2. Policy Implications

Based on the above empirical results, this study proposes the following policy implications. First, accelerate the construction of logistics facilities related to the NWLSC. For the western inland areas where shipping is underdeveloped, it is not only necessary to pay equal attention to roadways, railways, waterways, and aviation in terms of transportation infrastructure, but also to speed up the development of telecommunications and postal infrastructure in terms of communication infrastructure. At the same time, policy makers should give specific support

plans and allocate special funds to promote the formation of a comprehensive transportation system for the NWLSC, drive trade aggregation through a complete logistics industry, and then make it to well connect the 21st Century Maritime Silk Road to the south, to connect with the Yangtze River Economic Belt to the east. Second, since the increase in dry port freight volume can boost the economic growth of the regions along the NWLSC, it is necessary to strengthen the cross-border commerce links between the shipping underdeveloped regions along the corridor and Central Asia and Southeast Asia, so as to promote the sustainable economic growth of the regions along the route (Jia, 2020; Zhao, 2020). Third, create an efficient and convenient logistics corridor network, and give full play to the core role of NWLSC in the coordinated development of the western region, so as to promote the high-level development of the western region of China. Fourth, this empirical evidence from China's development of inland logistics to achieve economic growth provides an important reference for policymakers in other coastal countries' inland regions and inland countries to build logistics corridor networks and develop cross-border commerce.

5.3. Limitations and Future Research

This study has the following limitations: First, we analyzed the economic effects of the transportation, postal, and telecommunication industries, focusing on the economic role of logistics infrastructure under different transportation modes, but did not take the whole logistics industry into consideration. Second, we considered the possible differences in economic effects caused by regional heterogeneity along the NWLSC, but did not analyze the heterogeneity of other possible potential heterogeneous factors (e.g., natural resource endowment heterogeneity). Finally, we used data from 2012-2021 to analyze the economic effects of the NWLSC, which has a relatively short time span. Therefore, future research can take the NWLSC as a reference to examine the impact of the implementation of logistics-related policies on economic development in a longer time dimension to further enrich the existing literature.

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Endnotes:

1. The New Western Land-Sea Corridor is a comprehensive international trade corridor that runs through the western region of China, connecting Southeast Asia, Central Asia, Europe, and other regions, concentrates regional production chains and supply chains, and realizes the integration of land and sea gathering and customs clearance (Fu, 2019). It specifically includes Chongqing, Guangxi, Guizhou, Gansu, Qinghai, Xinjiang, Yunnan, Ningxia, Shaanxi, Sichuan, Inner Mongolia, Tibet, and Hainan.

Appendix A

Table A1: Data Interpretations and Sources Used in this Study

Variable	Description	Unit	Source
perGDP	GDP per capita	CNY	Statistics Yearbooks
Roadway	Roadway freight volume	10000 Tons	Statistics Yearbooks
Railway	Railway freight volume	10000 Tons	Statistics Yearbooks
Waterway	Waterway freight volume	10000 Tons	Statistics Yearbooks
CA	Civil aviation freight volume	10000 Tons	Statistics Yearbooks
Post	The total business volume of the postal industry	100 million CNY	Statistics Yearbooks
Telecom	The total business volume of the telecommunications industry	100 million CNY	Statistics Yearbooks
Empl	Employment in the logistics industry	Person	CSMAR
Edu	Share of employees with high school and above education in the total population	%	CSMAR

Table A2: Correlation Coefficient Matrix of Variables

Variables	LperGDP	LRoadway	LRailway	LWaterway	LCA	LEdu
LperGDP	1					
LRoadway	0.089	1				
LRailway	-0.175	0.678	1			
LWaterway	0.231	0.561	0.044	1		
LCA	0.458	-0.046	-0.237	0.195	1	
LEdu	-0.189	-0.010	-0.021	0.029	0.055	1
LEmpl	0.475	0.570	0.220	0.552	0.427	0.034
LPost	0.679	0.654	0.186	0.645	0.371	-0.142
LTelecom	0.461	0.615	0.306	0.399	0.216	-0.201
	LEmpl	LPost	LTelecom			
LEmpl	1					
LPost	0.746	1				
LTelecom	0.546	0.782	1			

Table A3: Variance Inflation Factor Test

Variable	VIF
LRoadway	5.78
LRailway	2.93
LWaterway	2.43
LCA	1.62
LTelecom	3.09
LEmpl	2.75
LEdu	1.13
LPost	5.92
Mean VIF	3.21