

The Value of Connectivity: Evolution of Global Shipping Services Networks and the Dynamics of Global Value Chains

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Abstract: With the rapid development of economic globalization, international shipping is playing a more critical role in global economic activities. The original port facilities and service capacity are difficult to adapt to the new situation of international shipping development. How to speed up the construction of interconnected global shipping service network has become an important global issue. Based on the data of shipping services networks and the global value chain of major economies, this paper discusses the impact of global shipping services networks on the dynamics of global value chain of an economy. The empirical result shows that the improving global shipping services network can help to significantly promote the labor division of global value chain. The sub sample test shows that the promoting effect is more significant in the samples of developed economies compared with developing economies. The global shipping services networks can promote the upgrading of global value chain by the channels increasing human capital accumulation and enhancing innovation ability. It is necessary to expand maritime channel, improve inter-modal channel, strengthen shipping service cooperation mechanism between different ports, and build up interconnected and efficient international shipping service networks.

Keywords: Global shipping services networks, Global value chains, Maritime connectivity.

1. Introduction

The shipping service industry is a set of service activities directly or in directly related to port and logistics activities, including logistics services, shipping services, trade services, finance services, information services, port management and other services. In the context of economic globalization, the role of traditional production factors such as natural resources and labor force tends to weaken, while the role of modern shipping service elements tends to strengthen. These service elements show a high degree of international mobility and global distribution. In order to better adapt to the wave of economic globalization and the new characteristics of fragmented production brought by the global value chain, major economies are committed to building an interconnected global shipping service network through a new generation of information technology, so as to connect the major participants in the shipping industry chain, including shipping, logistics, terminals, cargo owners, finance, manufacturing, technology and supervision. The comprehensive capacity of shipping service has become an important index to evaluate the development level of ports. Therefore, the construction of efficient international shipping service network is of great significance to the construction of international shipping center.

The relationship between shipping service and international trade has been discussed in depth and abundant research achievements have been obtained. For example, Lam et al. (2011) had discussed the dynamics of liner shipping network and port connectivity in supply chain systems of East Asia. Fugazza et al. (2017) had investigated the role of liner shipping connectivity in the international trade activities. Hoffmann et al. (2019) had explored the impact of liner

shipping bilateral connectivity on the South Africa's bilateral trade flows. Lin et al. (2020) had discussed the direct and spillover effects of liner shipping connectivity on the merchandise trade.

In recent years, the global shipping service industry has experienced a rapid expansion. However, in the context of global health emergencies and the complex international situation, the normal operation of the global shipping service network has been greatly affected. The current division of services level between the main hubs and the global network structure is not optimized. The coupling degree between shipping service and local economy is not high, the multimodal transport connection between different modes of transport is insufficient, and the modern shipping service function between different ports is still lagging behind, which exposes the problems of low development quality and lack of inclusiveness in the current international shipping service system. However, the existing literature on the relationship between the global shipping service network and the evolution of the global value chain is not clear enough, which needs further research. In view of this, based on the theoretical framework of international production division, combined with the data of OECD and World Bank database, this paper discusses the impact of shipping service networks on the division of labor of global value chain, and puts forward the optimization path to drive the upgrading of global value chain by constructing global shipping service network.

2. Literature Review and Theoretical Development

In the traditional shipping service system, various economies have not yet fully established a mechanism for interconnection and efficient collaboration. It might lead to

poor linkage and integration between different departments and ports, and they are still scattered and fragmented. Therefore, a close linkage system has not yet formed between the various service processes. In the era without cloud interconnection, lagging technical means, scattered industrial resources, and a single business model make the phenomenon of information islands serious. As the new generation of information technology is widely used in international shipping, the global shipping

industry is also exploring new development models, shifting from the traditional single link competition to the A chain and B chain (logistics chain), C network and D network

(ecological network) competition. With the improvement of the global shipping service network, the use of “internet plus” and other technology to penetrate the traditional shipping industry can reconstruct the shipping supply chain and global value chain, promote the collaboration of the internet and the shipping industry. It can form a new business model of “reasonable allocation of online resources, efficient and high-quality offline operation” to accelerate the transformation and upgrading of shipping industry from a traditional mode to a modern service mode, which in turn contributes to the upgrading of the economy’s labor division of global value chain.

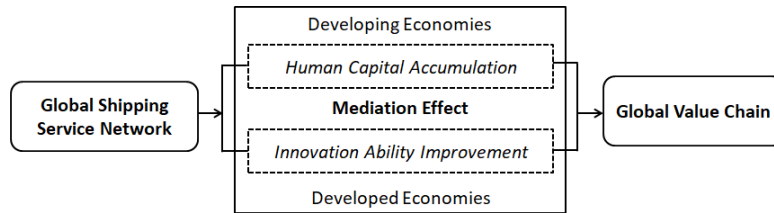


Figure 1. Evolution of Global Shipping Services Networks and the Dynamics of Global Value Chains

3. Empirical Design

3.1. Empirical Model

To test the impact of global shipping service network on the evolution of global value chain, this paper constructs an econometric model as follows.

$$GVC_{sit} = \alpha_0 + \beta_1 lsci_{it} + \beta_2 X_{it} + \varepsilon_{it} \quad (1)$$

GVC_{sit} represents the global value chain, $lsci_{it}$ represents the global shipping service network, X_{it} represents the control variables, and ε_{it} represents the random error term.

3.2. Variable Selection and Data Description

The explained variable of global value chain was calculated referring to the method of Koopman et al.(2010). Based on the world input-output table data, the global value chain index is measured by constructing the backward and forward vertical specialization rate to more comprehensively reflect the changes in the labor division of an economy participating in the global value chain. The core explanatory variable of global shipping service network can be measured by the liner shipping connectivity index proposed by the UNCTAD. To

prevent the endogenous problems leading to missing information to deduce false causality, this paper also introduces other control variables that might affect the global value chains, including: percentage of college students (higheduratio), tax burden (tax), number of internet used per 10,000 people (internet), percentage of immigrants (migrant), log of GDP per capita (lnpgdp). The data of GVCs, Liner Shipping Connectivity Index and the control variables are obtained from the OECD database, the UNCTAD database and the World Bank Database respectively.

4. Analysis of Empirical Results

The baseline regression results are reported in the first column Table 1. The coefficient of the core explanatory variable is significantly positive, indicating that the global shipping service network significantly improves the labor division of economies in the global value chain. In order to relieve the interference of other factors on the empirical results, a series of control variables are added in the rest column of Table 1. It is found that the significance of the coefficient of global shipping service network has been increased, which confirms the conclusion that the global shipping service network promotes the dynamic upgrading of global value chain is robust.

Table 1. Benchmark Regression Results

lsci	0.026** (2.06)	0.045*** (2.58)	0.095*** (5.26)	0.087*** (4.33)	0.072*** (3.80)	0.069*** (3.55)
higheduratio		0.121* (1.75)	0.134** (2.02)	0.113 (1.51)	0.097 (1.47)	0.080 (1.11)
tax			-0.184*** (-11.16)	-0.178*** (-10.55)	-0.200*** (-11.95)	-0.201*** (-11.59)
internet				0.019 (1.26)	0.080*** (5.59)	0.068** (2.40)
migrant					-0.357*** (-7.83)	-0.375*** (-6.59)
lnpgdp						0.442 (0.59)
_cons	43.52*** (76.18)	32.75*** (5.64)	37.99*** (6.51)	38.58*** (6.33)	40.97*** (7.63)	39.07*** (6.41)
N	570	390	390	390	390	390

Notes: t statistics in parentheses, *p< 0.10, **p< 0.05, ***p< 0.01.

To alleviate the endogenous problem caused by the reverse impact of the global value chain on the shipping service network, this paper uses two-step lag explanatory variables to alleviate the potential endogenous problems. The results in

Table 2 show that the coefficient of global shipping service network is significantly positive, which confirms the robustness of the above conclusions.

Table 2. Robust Regression Results

L.lsci		0.068***				
		(3.35)				
L2.lsci		0.066***				
		(3.03)				
lsci		0.045*	-0.101**	-0.115**	0.093***	
		(1.72)	(-2.23)	(-2.30)	(4.01)	
L.higheduratio		0.083				
		(1.13)				
L2.higheduratio		0.077				
		(0.98)				
higheduratio		0.524***	-0.041	-0.312***	0.262**	
		(3.67)	(-0.62)	(-4.23)	(2.34)	
L.tax		-0.204***				
		(-10.60)				
L2.tax		-0.207***				
		(-9.30)				
tax		-0.048	-0.184***	-0.310***	-0.176***	
		(-1.19)	(-9.99)	(-9.39)	(-6.77)	
L.internet		0.075**				
		(2.47)				
L2.internet		0.075**				
		(2.20)				
internet			0.126**	0.072**	-0.035	0.055*
			(2.43)	(2.08)	(-0.98)	(1.72)
L.migrant	-0.378***					
	(-6.26)					
L2.migrant		-0.375***				
		(-5.77)				
migrant			-0.470***	-0.420***	-1.443***	-0.370***
			(-5.16)	(-7.54)	(-9.15)	(-6.25)
L.lnpgdp	0.401					
	(0.50)					
L2.lnpgdp		0.462				
		(0.52)				
lnpgdp			-9.599***	0.764	4.528***	-1.300
			(-4.47)	(0.92)	(4.41)	(-1.31)
_cons	39.12***	39.31***	102.1***	48.03***	48.12***	41.85***
	(6.19)	(5.66)	(6.24)	(8.17)	(9.84)	(3.96)
N	351	312	181	209	90	300

Table 3 reports the empirical results of the influence mechanism using the mediation effect model. The results show that the coefficients of the mediating variables are significantly positive, indicating that there is a mediating effect. In other words, the global shipping service network can

influence the dynamics of the global value chain of an economy by promoting the accumulation of human capital and enhancing innovation capabilities. There may be an influence chain of “global shipping service network→human capital / innovation ability→upgrading of global value chain”.

Table 3. Mechanism Test Results

	Intermediary Variables	
	Human Capital Accumulation	Innovation Ability Improvement
_bs_1	0.005***	0.003*
	(2.70)	(1.84)
_bs_2	0.014	0.016
	(1.13)	(1.25)
N	560	560

5. Conclusions and Implications

The formation and evolution of shipping service network is vital to the comprehensive competitiveness of international shipping center. Therefore, based on the data of global shipping service network and global value chain, this paper analyzes the impact of global shipping service network on the labor division of global value chain. The results show that the global shipping service network promotes the labor division of global value chain of sample economies. Moreover, due to the heterogeneity of the development foundation and external environment of shipping services, the role of global shipping service network in promoting the upgrading of global value chain is more obvious in the samples of developed economies than in developing economies. Furthermore, the global shipping service network can promote the labor division of global value chain by improving innovation capacity and human capital accumulation.

On basis of the above conclusions, it is necessary to expand the maritime channel, improve the inter-modal channel, speed up the construction of key nodes and service centers, and build up an interconnected, efficient and convenient shipping service network. Specific implications are as follows. Firstly, explore the maritime opening policy and institutional system that is consistent with the international common rules, better participate in the construction of global maritime industry chain, and accelerate the formation of modern shipping transportation system and service system. Secondly, to promote the development and application demonstration of intelligent shipping, promote the integrated application of navigation system, internet of things, cloud computing, big data and other information technologies in the field of water transportation, promote the research and application of global shipping service network platform based on block chain, and create a modern shipping service industry. It is necessary to comprehensively promote the upgrading of traditional shipping services, promote the “internet plus shipping” and promote the innovation of shipping service mode. It is needed to further improve the service capacity of shipping trading, support the service functions of shipping exchanges and

create regional shipping trading institutions. To promote the docking of service rules in shipping payment and settlement, financing, leasing, insurance, legal services and other aspects of the world's economies is needed to be on the agenda. Thirdly, strengthen the personnel training of shipping service and the coupling degree between software and hardware, optimize the port business environment, and improve the level of shipping service facilitation, so as to provide favorable supporting policies and social environment for promoting the upgrading of global value chain.

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