Inter-Provincial Trade and Resource Curse: A Study Based on GMM Method

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Abstract: **Objective**: To verify the impact of inter-provincial trade on the resource curse. **Process**: Use GMM estimation to systematically test the data from 1997 to 2019 from different dimensions such as full sample, intensity, region and time. **Result**: (1)From the full sample test, the inter-provincial railway freight transport will increase the negative impact of resource industries on economic growth and aggravate the resource curse; (2) From the strength and regional heterogeneity test, the inter-provincial trade will promote the economic growth of the eastern region and the regions with low resource dependence, but make the central and western regions and regions with high resource dependence fall into the resource curse trap; (3) Resource development will promote the development of inter-provincial railway trade and fixed asset investment, but it will crowd out innovation and human capital, and there is a potential crowding out effect on inter-provincial highway trade, manufacturing, opening to the outside world, urban individual and private economy.

1 INTRODUCTION

China gives full play to its super large market advantage and domestic demand potential, and constructs a new development pattern of domestic and international double circulation and mutual promotion. Inter-provincial trade is important support to realize domestic circulation, so it is necessary to conduct in-depth study the role of regional economy.

The practice of world economic development shows that the economic development of some resource-rich areas is not always good, and even compared with resource-poor areas, their development is slower. This negative correlation between natural resources and economic development is called the "resource curse" phenomenon (Auty, 1993), and remains one of the key issues of academic research since its inception.

A large number of scholars have discussed the causes of the resource curse from different levels and formed many insights and policy implications, including: (1) The Dutch disease effect (Arezki & Ismail, 2013); (2) Extruding effect (Li et al., 2020); (3) System weakening effect (Zhan et al., 2021). (4) Bad conditions of trade (Al-Shammari & AL-Obaid, 2018), etc. The deterioration of trade conditions theory mainly focuses on international trade, the exchange of regional products, namely inter-provincial trade, is ignored. This is not in line with the practical model of "double cycle" of China's current economic development. Inter provincial trade has two impacts on regional economy: (1) Improve the competitiveness of local economy. Inter provincial trade can ease the local economic fluctuations, improve the efficiency of resource allocation, and then improve the comparative advantage of China's products, achieve economies of scale, reduce production costs, and improve the international competitiveness of the industry. And as time goes on, the contribution of inter provincial trade to the regional economy will continue to increase, and the role of inter provincial trade in regional economic development will also be increasingly enhanced. (2) Widen the regional economic gap. The asymmetry and imbalance of inter provincial trade in terms of outflow and inflow are not conducive to the coordinated development of China's regional economy. The eastern region requires open markets,

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while the central and western regions require closed markets to enhance their economic initiative in China. The benefits of China's interregional trade are mostly obtained by developed regions, while the underdeveloped regions benefit little from such trade, even suffer damage to varying degrees.

Taking coal, oil and gas, non-metallic mining and other resource industries as examples, in the input-output analysis method, through the calculation of intermediate input rate and intermediate demand rate, these resource industries are intermediate product based basic industries, with large intermediate demand rate and small intermediate input rate. That is to say, in the development process of these industries, their dependence on other industries is relatively low. On the contrary, their products are used as intermediate inputs of other industries, resulting in great demand from other industries. During the development of the coal industry, in addition to the local production, the use of intermediate products is more from the purchase from other provinces. In addition, the products produced by the coal industry may also flow out, which has not played a real role in promoting regional economic growth (Xiang & Meng, 2011).

As China's economy enters a stage of high-quality development, investment and export can no longer effectively promote the high-quality development of China's economy. China has vast territory, and the division of labor and trade among various provinces is enough to support high-quality economic development. However, it is unclear whether, for resource-rich provinces, inter-provincial trade will aggravate the local resource curse. Therefore, it is necessary to clarify the impact of inter provincial trade openness on regional economic growth, and on this basis, study whether the development of resource-based industries is a blessing or a curse to regional economic growth, and to what extent.

2 VERIFICATION OF THE IMPACT OF INTER-PROVINCIAL TRADE ON THE RESOURCE CURSE

In view of the lack of data on domestic inter-provincial trade volume, only inter-provincial freight volume can best represent inter-provincial trade, so from the inter-provincial freight volume, data from 1997-2019 from 30 provincial regions were used to re-verify the impact of inter-provincial trade on the resource curse.

2.1 Model Selection

In order to further analyze the influence degree of inter-provincial trade in resource industry on regional economy, this paper constructs the following panel model to verify the relationship between resource dependence and economic growth. The specific formula is as follows:

$$Y_{i,t}=\alpha+\beta_1 ED_{i,t}+\beta_2 Intra_{i,t}+\theta_1 Res_{i,t}+\theta_2 Hum_{i,t}+\theta_3 Pe_{i,t}+\theta_4 Made_{i,t}+\theta_5 Fiv_{i,t}+\theta_6 Tra_{i,t}+\eta+\mu+\xi_{i,t} \quad (1)$$

Y (Economic growth rate) is calculated from the per capital GDP growth rate. Ed (Resource development intensity) is measured by the proportion of energy production to total national production. Intra (Inter-provincial trade) is measured by the proportion of inter-provincial railway trade (TL) and inter-provincial highway trade (GL). Res (Technology innovation investment level) is measured by the proportion of financial technology allocation in total fiscal expenditure. Hum (Human capital accumulation level) is measured by the proportion of students in ordinary middle schools. Pe (Urban private and individual economic development level) is measured by the proportion of urban private and individual-employed people in the total number of people employed. Made (Manufacturing Development Level) is measured by the proportion of manufacturing employees in total employment. Fiv (Material capital investment level) is measured by the proportion of the total social fixed asset investment in GDP. Tra (Intensity of opening) is measured by the proportion of total import and export trade in GDP, among which the total import and export trade is converted by the annual exchange rate over the years.

2.2 Test Results of the Whole Sample

First, all models were suitable for fixed effects by F test, LM test and Hausman test, and then the endogeneity of the models was tested by DWH test, which found the endogeneity of models 3 and 4. Generalized matrix estimation (GMM) can effectively solve the model endogeneity problem, and it is more robust. The specific results of the GMM estimation are detailed in Table 1. The first order difference perturbation auto-correlation and second order difference perturbation are unrelated corresponding to model 3 and 4, and the P value of Sargan test is greater than 0.1, indicating that the selection of tool variables is valid. Detailed results are analyzed as follows:

(1) The resource development intensity coefficient in model 1 was -0.5056, which is significant at 1%, indicating that resource

development has a negative impact on economic growth, but the lack of control variables, only as a comparative reference.

(2) Models 2 and 3 show the effects of inter-provincial railway trade and inter-provincial highway trade on regional economic growth, respectively. Both are significantly positive at the 1% level, and the coefficient of inter-provincial highway trade is greater than that of inter-provincial railway trade. This shows that inter-provincial trade can promote regional economic growth, and inter-provincial road trade plays a greater role.

(3) After model 4 adds control variables, the coefficient of resource development intensity becomes-0.3633, which is significant at the level of 1%. However, the absolute value is significantly lower than model 1, indicating that control variables such as innovation and human capital can curb the curse phenomenon to a certain extent.

(4) Model 5 adds inter-provincial railway trade, whose model coefficient is -0.2995, but not significant, indicating that inter-provincial railway trade does not effectively promote regional economic growth; the coefficient of resource development intensity becomes-0.4237, significant at 1%. Compared with model 4, resource development intensity coefficient increases, and innovation, human capital, urban private and individual economy coefficient is greatly reduced, shows that inter-provincial railway trade not only not effectively promote regional economic growth, but squeezed out the other elements of promoting economic growth, exacerbated the regional resources curse.

(5) Model 6 added inter-provincial highway trade with a coefficient of 0.1767, significant at 5%, which indicates that the resource development intensity coefficient is -0.1911, despite the absolute increase, it shows that inter-provincial highway trade can slow down the regional resource curse.

The above analysis shows that inter-provincial railway transportation will aggravate the negative impact of regional resource development intensity on economic growth, while inter-provincial highway transportation will weaken the negative impact of resource intensity on economic growth. The possible reason is that the regional industrial structure causes different modes of transportation. Primary resource products represented by coal in transportation are the way of railway transportation, and due to the requirements of clean transportation, "coal", "ore" highway transportation resources is banned, railway freight more on behalf of the regional resources, the increase of railway freight volume represents the region out more resource products, illustrates the regional industry is still concentrated in the development of resources, such as a single heavy industry.

To ensure the robustness of the test results, this paper replaces the resource development intensity expressed by the employee ratio Rd to estimate the resource development intensity. The specific results are shown in model 7 and model 8. The coefficients of the core explanatory variables did not change greatly, which shows that the test in this paper is robust.

Table 1: Effects of inter-provincial trade on the regional resource curse (model 1-4).

variable	model 1	model 2	model 3	model 4
Ed/Rd	-0.5056* (-3.02)			-0.3633* (6.26)
Tl		0.1517* (7.61)		
Gl			0.5224* (13.40)	
Res				0.7162* (3.06)
Hum				0.7674* (5.80)
Pe				0.2137* (2.64)
Made				0.5839** (2.22)
Fiv				0.5164* (10.74)
Tra				0.4918* (11.07)
cons				9.38 (37.24)

R2	0.23	0.31	0.23	0.64
F	8.73 (0.00)	20.6 (0.00)	35.54 (0.00)	23.05 (0.00)
LM	210.43 (0.00)	266.24 (0.00)	487.08 (0.00)	451.4 (0.00)
Hausman test	36.91 (0.00)	130.33 (0.00)	92.31 (0.00)	44.28 (0.00)
model	FE	FE	FE	FE

Note: t value in parentheses, *, **, *** are significant at 1%, 5% and 10% respectively, the same below.

Table 2: Effects of inter-provincial trade on the regional resource curse (model 5-8).

variable	model 5	model 6	model 7	model 8
Ed/Rd	-0.4237* (-4.45)	-0.1911*** (-1.72)	-0.1264* (-2.81)	-0.5237* (-4.45)
Tl	-0.2995 (-1.52)		-0.5447*** (-1.75)	
Gl		0.1767** (2.81)		0.3992* (3.74)
Res	0.2772 (0.39)	0.7391** (2.56)	0.1431* (2.86)	0.6610 (1.05)
Hum	0.1653* (12.69)	0.6610* (4.79)	0.8707 (0.53)	1.2409 (0.22)
Pe	-0.0178** (-2.56)	0.2409* (3.22)	0.8677*** (1.86)	0.6128* (3.14)
Made	0.6162 (0.32)	0.5128* (3.14)	0.6539* (8.94)	1.0713* (2.60)
Fiv	0.7494* (11.26)	0. 7013* (12.60)	0.1886* (3.28)	0.3204* (3.64)
Tra	0.4018* (10.53)	0.3204* (13.64)	0.1858* (3.92)	0.7494* (11.26)
cons	9.47* (34.62)	9.93* (26.01)	9.31** (22.49)	9.04* (21.53)
R2	0.97	0.96	0.89	0.96
F	38.31 (0.00)	42.40 (0.00)		
LM	441.98 (0.00)	388.29 (0.00)		
Hausman test	105.29 (0.00)	91.9 (0.00)		
DWH	6.05 (0.00)	5.95 (0.01)		
AR (1)	-4.02 (0.00)	-4.21 (0.00)		
AR (2)	0.14 (0.89)	-0.75 (0.453)		
Sargan's test	2.22 (0.82)	3.80 (0.80)		
model	GMM	GMM	OLS	OLS

2.3 Resource-Dependent Strength Heterogeneity Test

Due to the unbalanced distribution of resources in China, there are also different resource dependence strengths in different regions. Will the different resource dependence strengths cause the different effects of regional inter-provincial trade on the regional resource curse? This paper introduces the analysis in the form of virtual variables according to the resource dependence heterogeneity. The specific formula is set as follows:

$$Y_{i,t}=\alpha+\alpha_1 ED_{i,t}*RD+\alpha_2 Intra_{i,t}*RD+\eta i+\mu_i+\xi_{i,t} \quad (2)$$

Among them, RD is the heterogeneity index of resource development degree, which is calculated according to the average resource development intensity (the resource dependence intensity is calculated by the ratio of employees in the mining industry to all employees.) The 30 provinces are divided into resource dependence group (RD_d) and resource development intensity group (RD_n). When investigating the group with high resource dependency, set RD_d to 1 and RD_n to 0; When investigating the low resource dependency group, set RD_d to 0 and RD_n to 1. See Table 3 for specific inspection results.

According to the Table 3, there is a large negative impact on the high resource-dependence group, while inter-provincial trade is not significant to the low resource-dependence group, especially inter-provincial trade. The main reason for this regional heterogeneity is the difference in the structure of cargo transfer and transfer. The areas with high resource dependence strength are mainly transferred from mineral resources and primary processing products with low added value, and mainly rely on the large batch transfer mode of railway transportation, especially in the provinces with large coal resources. State-owned coal enterprises in the transportation process, although facing slightly higher railway transportation costs, they still adhere to railway transportation.

Table 3: Resource-dependent intensity heterogeneity in inter-provincial trade.

variable	high group		low group	
RD	-1. 4018** (-1.89)	-1.1008* (-2.77)	-0.0450 (-0.75)	0.0724 (0.04)
Tl	-0.6086* (-4.46)		0.7029 (1.22)	
Gl		-0.0605 (1.21)		0.7926* (4.94)

2.4 Test of Regional Heterogeneity

In order to distinguish the different effects of inter-provincial trade in the east, central and western regions on the curse of regional resources, the regional heterogeneity is also introduced in the way of virtual variables. The specific formula is set as follows:

$$Y_{i,t}=\alpha+\alpha_1 ED_{i,t}*area+\alpha_2 Intra_{i,t}*area+\eta i+\mu_i+\xi_{i,t} \quad (3)$$

Among them, area is the regional heterogeneity index. According to the regional distribution, 30 provinces are divided into three regions: eastern ($area_e$), central ($area_m$) and western ($area_w$). When visiting the eastern region, set $area_e$ to 1, $area_m$ and $area_w$ to 0, when visiting the central region, $area_m$ to 1, $area_e$, $area_w$ to 0, when visiting the western region, $area_w$ to 1, $area_e$, $area_m$ to 0, specific test results are shown in Table 4.

Table 4: Test of Regional Heterogeneity in Interprovincial Trade.

variable	east	middle	west
RD	-0.6804* (-5.34)	-1.4027* (-4.67)	-2.8278*** (-1.79)
Tl	0.1359* (10.69)	-0.0894 (-0.64)	-0.0338* (-2.47)
RD	-0.2576 (-1.59)	-0.4691*** (-1.93)	-1.1354*** (-1.92)
Gl	0.1003* (10.77)	-0.0045 (-0.41)	-0.0285* (-2.43)

As can be seen from Table 4, except for inter-provincial highway trade in the eastern region, all other tests show that the intensity of resource development will hinder regional economic growth, while inter-provincial trade in the eastern region has

significantly promoted the regional economic growth. Although the central region is not significant, inter-provincial trade has a potential negative impact on regional economic growth; inter-provincial trade on regional economy is significant. Moreover, the negative impact of inter-provincial railway trade in central and western China on regional economic growth is obviously stronger than that of inter-provincial highway trade. The test results and resource dependence intensity heterogeneity inspection, the central and western regions of China for resource-dependent areas, with minerals, energy and other primary products or primary processing products, need to enter industrial products from the eastern region, lead to long-term inter-provincial trade deficit, cannot effectively promote regional economic growth, but further intensified the dependence on resource development.

3 THE CROWDING OUT EFFECT

The formation of the resource curse is due to the crowding out of other production factors to promote economic development by the development of resources. Next, this paper analyzes the relationship between the intensity of resource development and provincial trade by using the classic model to test the transmission mechanism of the resource curse, and also analyzes the crowding out effect of the intensity of resource development on other factors. The specific formula is as follows:

$$TRANS=\beta_0+\beta ED+\beta RGDP_{t,i-1}+\varepsilon \quad (4)$$

Where, TRANS is the transmission mechanism variable, that is, the control variable above.

Table 5: Results.

Trans	ED
Tl	0.5775*(15.17)
Gl	-0.1973(-0.36)
Made	-0.5219(-0.19)
Hum	-0.6270*(-3.63)
Fiv	0.7272*(-3.33)
Res	-0.1659*(-3.73)
Tra	-0.7071(-0.43)
Pe	-0.4726(-0.30)

It can be seen from Table 5 that resource development has a significant role in promoting inter-provincial railway trade (0.5775), but it has no significant impact on inter-provincial highway trade, but the coefficient is negative (-0.1973), indicating that resource development has a potential negative impact on inter-provincial highway trade. That is, inter-provincial trade is one of the transmission mechanisms of the resource curse. This paper also analyzes the impact of the intensity of resource development on other transmission mechanisms. The intensity of resource development will have a significant crowding out effect on human capital and innovation, but it has no significant impact on manufacturing, opening up, urban private and individual economic development, but there is a potential crowding out effect.

4 CONCLUSIONS

The conclusions of this paper are as follows: (1) From the full sample test, inter-provincial railway trade will increase the negative impact of resource industries on economic growth, further increase the dependence of economies on resource factors, hinder the benign growth of resource regions, and intensify the "resource curse" effect; (2) From the strength and regional heterogeneity tests, Inter-provincial trade will drive further economic growth in the east and low-resource-dependent regions, But the Midwest and highly resource-dependent regions will fall into the "resource curse" trap; (3) The crowding out effect of resource development proves that resource development will promote the development of inter-provincial railway trade and fixed asset investment, but it has a significant crowding out effect on innovation, human capital and other production factors, and there is also a potential crowding out effect on inter-provincial road trade, manufacturing, opening up, urban private sector and individual economy.

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