ISSN 2616-5902 Vol. 5, Issue 1: 155-159, DOI: 10.25236/AJBM.2023.050123

Empirical Study of Coordinated Development of Heilongjiang Province's Border Trade and Language Service Industry with Russia by Big Data Analysis

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Abstract: *The coordinated development of Heilongjiang's border trade with Russia and the language service industry are explored. The research result provides solutions to the current bottleneck of language services in the development of Heilongjiang's trade with Russia. Through big data analysis, we conduct a model analysis of the impact of the service industry on border trade with Russia and the foreign economy on culture. Accordingly, we put forward relevant policy recommendations for the development of the language service industry in Heilongjiang province.*

Keywords: *coordinated development, big data analysis, language service industry, border trade*

1. Introduction

With the rapid development of formalization and globalization, the rapidly growing demand for translation and multilingual information has promoted the development of the language service industry. The development of economic globalization in the era of big data is inseparable from the support of *multilingual services. Western economic powers such as the United States, the United Kingdom, Canada,* and Australia have raised language services to the height of national strategies. They have begun to design national language development plans and formulated language services. Service-related policies and even laws and regulations vigorously support the development of the language service industry and the training of language service talents. Although language service in China is an emerging industry, it is related to the country's economic development and security.

It is necessary to pay attention to the related strategic plan, policy formulation, and industrial management and obtain legislative support and strategic planning guidance at the national level. Several industry research reports, including the "China Language Service Industry Development Report", show that there are many problems that need to be solved in the language service industry. However, the specific aspects of the problems such as seriousness and solution have not been effectively solved in previous studies. It is also revealed that language services play an important role in promoting economic development, especially foreign trade, but there is no interaction between language service development and foreign trade.

Therefore, it is important to formulate appropriate communication and cooperation strategies and avoid differences, misunderstandings, and conflicts in various aspects caused by language differences in the development of border trade with Russia.

2. Research Status

2.1. Review of domestic and foreign research on the economics of language

The economics of language as a field of study in economics began in the mid-1960s. In 1974, Marschak revealed the economic nature of language and believed that language, as an indispensable tool in human economic activities, has the same economic characteristics as other resources, namely value, utility, cost, and benefit. Rubinstein [1] pointed out that there is a close relationship between economics and the search for language optimization, and the analysis of these four aspects and their interrelationships have become an important part of the study of language economics.

As an emerging research field, the economics of language involves multiple research intersections in the fields of linguistics and economics. The focus of research in the field of language economics includes

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(but is not limited to) the following issues: the relationship between language skills and individual job earnings and the relationship between language and trade; the costs and benefits of language policies that promote or limit economic development processes. At this stage, most of the empirical studies on language economics focus on the second relationship. Xu and Zi [2] explored the relationship between language variables and China's foreign trade. Li and Zhao [3] examined the relationship between language variables and China's foreign trade. For the relationship between China's service trade import and export, Zhou [4] analyzed the relationship between language variables and China's service trade export potential.

In short, the economics of language is still at the early stage of development. The research on the economic value of language only stays on theoretical reasoning, and a small amount of empirical research is also difficult to make accurate estimates and judgments due to the lack of data and the limitations of statistical measurement methods.

2.2. Review of domestic and foreign research on language service industry

Yang[5] analyzed the language service industry under the framework of sociological theory. Wang et al.[6] started analyzing the composition of the language service industry chain in China's language service industry from an ecological perspective. Si and Yao [7] believed that China's language service industry has developed rapidly and has become a basic support industry for social and economic development. Based on the SCP paradigm in industrial economics theory, an in-depth analysis of China's language service industry has been conducted. Yao and Si pointed out that research on the language service industry is important for the Institute of Language Economics. As an emerging industry, the related research has problems such as research quality, insufficient research topic depth, and a single research method.

The review of relevant literature shows that empirical research on the impact of language variables and the process of economic development mostly focuses on the relationship between language variables and trade or wage income. The past research lacks an analysis of the economic impact of language variables on the language service industry. The research on the language service industry, whether from the perspective of economics, linguistics, or sociology, lacks empirical research supported by big data analysis.

3. Empirical Analysis Of Industrial Collaborative Development By Big Data Analysis

Based on the index design framework widely used in existing research, we evaluate the degree of synergy between the development of Heilongjiang Province's border trade with Russia and the development of the language service industry through big data analysis and identify the key factors affecting the degree of synergy between the two.

3.1. Model analysis and test of the impact of language service industry on border trade with Russia

3.1.1. Model building and construction

The language service industry has a certain impact on the border trade with Russia, which is not due to purely quantitative factors. However, qualitative factors in nature are dynamic factors. In the actual economy, such qualitative factors cannot be directly and accurately described by data but non-numerical factors illustrate the existence or absence of a certain attribute or state. In order to reflect qualitative factors in the model, we transform language service industry factors into dummy variables.

$$\text{Model building: } Y = \alpha 1 + \alpha 2 D1 + \beta 1 X + u \quad (1)$$

where Y is the gross regional product, X is the total import and export to Russia, and D1 is a dummy variable.

In 2010, Heilongjiang Province proposed the strategy of building language services. In 2016, it reformed the relevant service industry system. In this study, 2010 and 2016 are set as the dividing points, and dummy variables are set to reflect the impact of Heilongjiang's regional language service industry on Heilongjiang's economy in Russia in 2010 and 2016. Dummy variables are set as follows.

D1 = − 1 That is, it is assumed that there is a negative impact of language service factors (before 2010)

D1 = 0 means there is no language service factor (between 2010 and 2016)

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D1 = 1 means there is a language service factor (after 2016)

As shown in Eq. (1), it is assumed that the total trade volume with Russia directly affects the regional GDP, and language services are a qualitative factor affecting economic development. The meaning of Eq. (1) is to assume that other factors (except language services) remain unchanged. The selected explanatory variables in this study include the quantitative variable of import and export volume as the economic index of trade with Russia and the Heilongjiang language service factor as a dummy variable. Considering that the effect of language service on the economy can be directly reflected in the effect of the dependent variable on regional production, the numerical influence of the value is reflected in the impact of the import and export volume as a quantitative variable. The impact on the import and export volume of trade with Russia is reflected in the numerical impact on the dependent variable regional GDP. The model finally chooses Dummy variables to represent regressions with different intercepts.

If language services have a negative impact on the economy,

$$E(Y|D1 = -1) = (\alpha 1-\alpha 2) + \beta 1X \quad (2)$$

If culture does not affect the economy,

$$E(Y| D1 = 0) = \alpha 1 + \beta 1X \quad (3)$$

If culture has an impact on the economy,

$$E(Y | D1 =1) = (\alpha 1 + \alpha 2) + \beta 1X \quad (4)$$

3.1.2. Model regression analysis and testing

The data sample space from 2005 to 2019 was selected for regression analysis. The regression analysis is carried out on the data of Heilongjiang Province's GDP and the import and export volume of trade with Russia.

The result is as follows.

$$Y = 1.373 * X + 24.188 * D1 + 304.128 \quad (5)$$

$$(13.28) \quad (0.27) \quad (2.42)$$

$$t = (17.20) \quad (6.24) \quad (18.75)$$

$$R^2 = 0.9656$$

From the regression results, R^2=0. 9656 indicates that the fitting degree of the sample is good. For a given significance level α=0.04, the F test is significant, tα/2(n-k) = t0.023 (22-3) = 2.098. Thus, language services do have an impact on the economy. The heteroskedasticity test is performed on Eq. (5).

nR^2 = 18.997 according to the White test, the degree of freedom is (n-k)/2-c =4, the χ^2 distribution table is checked under α= 0.04, and the critical value $\chi^2$0.04 (3) = 6.96. Because nR2 =19.796>χ19.79(3)= 7.16., White's test does not prove the existence of homoscedasticity. When D.W. test is carried out on it, the value is 1.50121, n = 19, and k = 1 with dL = 1.19, dU = 1. 42, dL < d < 4-dU, indicating that the equation does not exist automatically related.

Analysis of regression results is as follows.

Y = 1.373* X+249.551D1= -1, there is a negative impact of language service factors (before 2010).

Y = 1.373* X+431.680D1 =0 means that there is no language service factor (2010 to 2016).

Y = 1.373* X+304.128D1 =1 means there is a positive impact of language service factors (after 2016) .

The impact of language services on economic variables is different in the statistical sense of the regression equation in three different situations. On the basis of the same slope, the impact of language services on economic variables is reflected in the difference in intercept coefficients. When no specific measures are proposed for the language service strategy, it is assumed that culture had a negative effect on the economy before 2010, and the model intercept coefficient was 249.55. If culture did not affect economic variables from 2010 to 2016, the distance coefficient was 431.680. If culture had a positive effect on the economic variable from 2010 to 2016, the model intercept coefficient was 304.128.

The assumptions of the two stages in 2010 and 2010 to 2016 can be seen from the model. If there is a negative impact on language services, it restricts the speed of economic development to a certain extent. The results of the two-stage model in 2016 show that if language services have a driving effect on the economy, it greatly promotes economic development. This is consistent with the conditions assumed by

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the model, indicating that the impact of language services on the economy is still obvious. The results of the model analysis show that the increase of foreign economic variables, that is, the increase of import and export volume and the aggravation of language service factors have promoted the economy.

3.2. Model Analysis and Test of Foreign Economy on Culture

3.2.1. Model of the Impact of Russian Trade Economy on Language Services

When the trade economy develops, language services is driven by the growth of the economy. The added value of the language service industry in Heilongjiang Province is used as the explained variable, and the import and export volume of Heilongjiang Province to Russia is used as the explanatory variable to study the impact of the Russian economic index on the language service industry.

The model is,

$$Y1 = \alpha + \beta X1 + u \tag{6}$$

where Y1 is the added value of the Heilongjiang language service industry, and X1 is the import and export volume of Heilongjiang Province. This model is mainly used to explain the role of Heilongjiang Province's trade development with Russia in the development of Heilongjiang's language service industry.

3.2.2. Model regression analysis and testing

We used the added value and total import and export of the language service industry in Heilongjiang from 2005 to 2016 for regression analysis. The regression analysis of the added value of the language service industry in Heilongjiang Province and the data of the total import and export volume to Russia is carried out, and the results are as follows.

$$Y = 0.0598^* X + 2.997 \tag{7}$$

$$t = (9.98)\ (0.32)$$

$$R^2 = 0.90392$$

From the regression results, $R^2 = 0.90392$, indicating that the fitting degree of the sample is good. For a given significance level $\alpha = 0.04$, the F test is significant, $t\alpha/2(n-k) = t0.031(10-3) = 2.311$, the t-test is significant, indicating that the development of Heilongjiang's trade with Russia has an impact on the language service industry in Heilongjiang.

Equation (7) is used for testing heteroscedasticity. From White's test, the degree of freedom is $(n-k)/2-c = 1$. The critical value $\chi^2\ 0.04(2) = 4.889$ was obtained. Since $nR^2 = 9.80 > \chi^2 0.04(2) = 4.889$, White's test cannot prove homoscedasticity. D.W. test value is 1.877893, $n = 11$, $k = 1$, look up the table, $dL = 0.747$, $dU = 1.235$, $dL < d < 4-dU$ at the significance level of 0.04, indicating that there is no autocorrelation in the equation. When Heilongjiang's total import and export volume with Russia increases by 100 million US dollars, the added value of Heilongjiang's language service industry increases by 349.8 million US dollars (Eq. (7)).

The regression results of the model show that the development of Heilongjiang Province's trade economy with Russia has an indelible role in promoting the development of Heilongjiang Province's language service industry. Economic development inevitably leads to the improvement of language services.

4. Conclusion

There is a long-term positive promotion between the Heilongjiang language service industry and trade with Russia, but the direction and magnitude of the effects are different. The role of trade with Russia in promoting language services is obvious, and the development of the economy and trade inevitably leads to the improvement of the language service industry. Language services have played a certain role in promoting the optimization of trade with Russia.

For the role of Heilongjiang's foreign trade development in promoting the level of language services, it is necessary to vigorously develop Heilongjiang's foreign trade, especially trade with Russia. The development of foreign trade drives the overall improvement of the economy of Heilongjiang, and the economic development drives the improvement of the level of language services. Therefore, it is necessary to develop foreign trade in Heilongjiang and introduce new policies for more favorable conditions for the development of Heilongjiang's trade with Russia.

ISSN 2616-5902 Vol. 5, Issue 1: 155-159, DOI: 10.25236/AJBM.2023.050123

Acknowledgment

Funded by Young Innovative Talents Program of Harbin University of Commerce: Research on the Coordinated Development of Heilongjiang Province's Border Trade with Russia and Language Service Industry Ref No.18XN017

Funded by Heilongjiang Province Philosophy and Social Science Research Planning Project: Research on the path and countermeasures for the deep integration of the language service industry in Heilongjiang into the "Belt and Road" construction Ref No.19YYE301

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