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Analysis of the Impact of China's Opening to the Outside World on Wage Distortion: Cases of 28 Provincial Regions

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Abstract This article uses panel data from 28 provincial-level regions from 1994 to 2017 and uses the C-D production function to calculate the degree of labor wage distortion in various provinces of China. It is found that the vast majority of provinces in China have serious downward labor wage distortion, and the actual wages of labor are underestimated, especially in the economically developed eastern region, followed by the central region, and the western region has the lowest degree of wage distortion; From the perspective of time span, China's labor wage distortion shows an overall trend of easing. Through empirical analysis and research, it has been found that in two aspects of China's opening up to the outside world, foreign direct investment has significantly exacerbated labor wage distortions, while foreign trade has significantly alleviated labor wage distortions. In addition, the degree of marketization, government intervention, and industrial restructuring have effectively alleviated labor wage distortions. Based on the above situation, this article proposes policy recommendations such as optimizing the international trade environment, improving the quality of foreign investment access, enhancing the quality of labor force, and deepening the degree of labor marketization reform.

Keywords Foreign Direct Investment, Foreign Trade, Labor Wage Distortion

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1. Introduction

Since the reform and opening up, China has made remarkable achievements in opening up to the outside world. On the one hand, China has made outstanding achievements in the introduction and utilization of foreign capital. In 2020, the actual use of FDI reached 1034.28 billion yuan, becoming the world's largest FDI input country. In addition, by 2020, the total import and export volume of China's trade has reached 32.16 trillion yuan, and the scale of China's foreign trade has expanded year by year. On the other hand, China has coordinated and promoted the establishment of 21 pilot free trade zones to develop and build a new pattern of foreign economic and trade cooperation and opening up; It has signed the "belt and road" strategic cooperation documents with 149 countries and 32 international institutions, and its strategic position in the international cycle has become increasingly prominent. But what can not be ignored is that in the process of China's opening up to the outside world, there has been a downward distortion of labor wages. Shi bingzhan, Xian Guoming (2012), Caiying et al. (2016), an Meng et al. (2019), Gu ran (2020) and other scholars measured the degree of distortion of China's labor wages from different levels, confirming the fact that China's labor wages are distorted downward. Wage distortions have slowed down the pace of sustainable economic development in China. On the one hand, the decline in the real wages of workers has exacerbated the pessimistic attitude of workers towards the stability of future employment. At the same time, workers have fallen into the dilemma of unsatisfied demand and consumption, which has affected the upgrading of domestic consumption structure and the deepening reform of industrial structure. On the other hand, wage distortion is not conducive to the rational distribution of income, affecting the stable and healthy operation of the macro economy and the common prosperity of all people. Under the new development pattern, how to protect people's labor income, promote social income distribution to be more reasonable and orderly, and promote the synchronous growth of per capita income and labor remuneration while the national economy is running smoothly and healthily has become an important practical issue of great concern to the government and the whole society. Wage distortion has posed a severe challenge to the goal of common prosperity for the people of the country. Under the background of economic double cycle, it is of great practical significance to study the impact mechanism of opening-up FDI and foreign trade on China's wage distortion and reduce the downward distortion of wages.

2. Literature Review

The distortion theory originated in the 1950s. Since then, the research and theory on factor price distortion have been continuously deepened, enriched and improved. The existing literature has analyzed the factors affecting labor wage distortion from multiple perspectives. From the perspective of system, Acemoglu (2002a), bentolia & saint Paul (2003) and others believed that the system would affect the bargaining power of labor and capital, the sharing of surplus rent, and the distribution pattern of factors. Lin Yifu and others (1994, 1998) pointed out that the government affected the distortion of labor wages through policy intervention on the wages of enterprise employees; From the perspective of labor market segmentation, zhangguangting (2010), huangyiping and taokunyu (2011) believed that the long-term implementation of the urban-rural dual household registration system led to wage distortion; From the perspective of technological progress, chenxiaohua (2015) found through analysis that technological innovation will aggravate the distortion of labor price. The above analysis mainly focuses on the internal causes of wage price distortion in China.

From the perspective of FDI and foreign trade in the process of opening to the outside world, Shaomin et al. (2012) believed that foreign investment led to the distortion of domestic wages in the host country mainly by entering the labor market and product market, and Xueyuan (2019) believed that the increase of FDI effectively improved the wage level of employees in foreign direct investment units. Lipingping (2014) focused on analyzing the provincial panel data from 1998 to 2012, and believed that the technology spillover effect of FDI showed different characteristics in different periods of the market, and thus had different effects on wage distortion. In terms of foreign trade, wood (1997), lermer (2000), Feenstra and Hanson (1996) all pointed out that international trade would cause wage distortion to varying degrees. Amwar and sun Sizhong (2012) analyzed the panel data at the company level and pointed out that foreign trade would affect the difference of labor wage levels in different sectors of the manufacturing industry. Wenjuan and sunchuren (2009) studied the relationship between foreign trade and the Gini coefficient between regions from 1978 to 1997 and believed that foreign trade was conducive to improving income and alleviating wage distortion. Wu Jun and Wei Hao (2021) used the data of Chinese industrial enterprises and the trade data of China Customs to find that the wage distortion of Chinese enterprises is mainly downward distortion, the import of intermediate goods will inhibit the wage distortion, and the import of capital goods will

promote the wage distortion. Likaijie (2022) clearly pointed out that export trade has a significant positive impact on the wage level of migrant workers.

Scholars have conducted in-depth research on wage distortion, providing a rich reference for future research. From this, we find that there is no consistent conclusion on the impact of FDI and foreign trade on labor wage distortion, and there is a lack of relevant research on the impact of opening up on wage distortion from the overall level. Based on this, on the basis of existing research, this paper will start from the two aspects of opening up FDI and foreign trade, and calculate the degree of wage distortion based on the national 1994-2017 provincial panel data, and conduct an empirical test and analysis. This paper mainly explores the following two aspects: one is the degree of wage distortion of the labor force in China's provinces, and the other is the degree and impact path of opening up - FDI and foreign trade on labor wage distortion.

3. Theoretical Mechanism Analysis

In a fully competitive labor market, labor wage is equal to the marginal output of labor. However, due to the existence of system, technological progress, labor market segmentation and opening-up in the process of economic operation, the actual wage of labor is inconsistent with the marginal output, and the distortion of labor wage level is inevitable. To this end, we will start from the marginal output and real wages of workers to explore the impact of opening up on wage distortion.

3.1 Analysis of the Impact Path of FDI on Labor Wage Distortion

First of all, from the perspective of the marginal production of labor, the funds brought by foreign investment can effectively reduce the financing constraints of enterprises, greatly improve the labor productivity of enterprises, and drive the wage level of employees in the units where foreign investment is located to rise; In addition, the technology spillover effect of foreign capital can improve the production technology level of the host country and promote the technological progress of skilled labor in China's domestic sectors. The relevant preferential policies in China's foreign investment access system have attracted FDI into the domestic market, effectively promoted the institutional reform of the foreign technology sector, and led to the reform of the management system of domestic enterprises, so as to improve labor productivity. From the perspective of capital, technology and system, although FDI can affect the marginal output from the perspective of improving labor productivity, it also makes the marginal output deviate from the actual wage level of labor seriously. It is undeniable that the entry of foreign capital has led to more employment opportunities in the domestic labor market, increased the demand for labor in various industries and sectors, and some labor force has entered the foreign capital inflow sector to work so as to obtain higher remuneration. Therefore, FDI has alleviated the distortion of labor wage to a certain extent.

Secondly, from the perspective of real wages, the inflow of foreign capital can effectively promote the improvement of the production efficiency of enterprises and enable enterprises to obtain more profits. Part of the profits of enterprises will be shared with the labor force, so as to improve the income of the labor force and alleviate the wage distortion. However, the entry of foreign capital also intensifies the competition for factor resources among industries. In order to save production costs and obtain higher profits, enterprises reduce losses by reducing factor investment, resulting in the labor wage level not being significantly improved; On the other hand, the bargaining power of both labor and capital. Due to the effect of wage spillover caused by the entry of foreign capital in the market, enterprises with low productivity are forced to withdraw from the market, and part of the labor force of the enterprise returns to the market and enters other production departments. However, due to its defects in technical proficiency, it is obviously in a weak position in the labor capital game. It does not have bargaining power or its bargaining power is very low, resulting in the actual wage of labor force being depressed by enterprises, aggravating the downward distortion of labor wage.

It can be seen that FDI can improve the marginal output of labor force through its advantages in capital, technological progress and policy preferences; However, the operating profits of enterprises and the bargaining power of labor and capital will exploit the real wages of labor by crowding out the marginal output contribution of labor, and the wage level of labor will be seriously distorted downward.

3.2 Analysis of the Impact Path of Foreign Trade on Labor Wage Distortion

First, foreign trade affects the real wages of labor by changing the relative factor prices. According to S-S theorem and factor equalization theorem, foreign trade affects the price of goods by changing the relationship between supply and

demand of goods, so that producers can increase production, thus affecting the price of production factors, and then changing the income of workers. From the perspective of price transmission mechanism, China's foreign trade, on the one hand, will increase the price of labor factors, on the other hand, will moderately reduce the price of capital factors, thus increasing the real wages of labor and reducing the distortion of labor wages. Chen Hao and zhaochunming (2012) believed that although foreign trade provided more employment opportunities through the effect of expanding the number of employments, the employment quality bias effect would enable departments to absorb more skilled labor, squeeze the labor market of unskilled workers, and further expand the income gap between unskilled and skilled labor.

In addition, the real wage level of workers is also affected by the technology spillover effect brought by foreign trade. On the one hand, workers in various industries and departments can enhance their skill level through technology spillover effect in the process of foreign trade, so as to obtain higher labor remuneration (brown, 2003), thus alleviating the downward distortion of labor wage level. On the other hand, the technology spillover effect brought about by foreign trade may also be "biased technological progress" (Zhang Li et al., 2012; Yin Jinge and Lei Qinli, 2016; Yang Xiang, 2019), which is manifested in the improvement of the bargaining power of capital and the weakening of the bargaining power of labor force, resulting in the decline of the real wage level of labor force. At the same time, Krugman (1990) pointed out that technological progress will increase the demand for new products and raise their prices, but also lead to the expansion of the wage gap between skilled and unskilled workers. For developing countries, the technological progress brought by foreign trade is mainly reflected in the skilled workers in capital intensive industries, which widens the wage gap between skilled workers and non-skilled workers, and the time and degree of its role are also different in industries with different requirements for technological advancement.

The development of foreign trade drives the adjustment of industrial structure and affects the marginal output and real wage level. Foreign trade constantly optimizes and adjusts the industrial structure through competition in capital, technology, system and talents. The adjustment of industrial structure has not only brought about advanced management system, but also led to the continuous improvement of labor productivity. With the continuous improvement of China's foreign trade openness, foreign trade has gradually shifted to the secondary and tertiary industries with comparative advantages. In this way, the different economic development processes and conditions between different industries have also led to the differences in labor wage levels in different degrees. On the other hand, foreign trade helps to optimize industrial allocation, and the industry produces more high-quality goods while also improving the wages of labor. It can be seen that foreign trade affects the marginal output and the real wage level of labor force by changing the relative price of factors, generating technology spillover effect, and driving the adjustment of industrial structure, which distorts the wage of labor force in China to varying degrees.

3.3 Other Factors Affecting Labor Wage Distortion

In addition to FDI and foreign trade, other domestic factors will also cause labor price distortion. First, the average degree of marketization. The higher the degree of marketization in a region, the higher the wage level of migrant workers. Therefore, consolidating and strengthening the degree of Regional Marketization will help to narrow the wage gap between migrant workers' departments and realize the equality of different labor wage levels among various industries. Therefore, continuing to comprehensively deepen the reform of the mechanism and system led by the market economy and reducing the wage level difference among migrant workers' departments will help to alleviate the current downward distortion of labor wages and promote the rational and orderly operation of the labor market. Second, government intervention. China is in the transition period of the socialist system, and the market system is not yet perfect. The government regulates and controls the market through various non-economic macro means, actively encourages employment innovation, promotes employment, and helps the steady growth of the market economy. Third, capital intensity. Capital intensity includes human capital intensity and material capital intensity, that is, the sum of the two. Generally speaking, the higher the capital intensity of an enterprise, the higher the return it requires, and the more emphasis it places on relying on science and technology to promote production efficiency, quality and efficiency. Fourth, the optimization and upgrading of industrial structure. Economic growth and development require continuous innovation of the industrial structure, and the adjustment and innovation of the industrial structure also promote the continuous development of the economy. The improvement of consumption structure and investment structure in the process of industrial structure evolution is conducive to promoting the rationalization of wages, encouraging the continuous transfer of labor force in the labor market to high-efficiency industrial sectors, and further promoting and strengthening the optimization and upgrading of industrial structure. Therefore, there is an obvious two-way relationship between labor wage level and industrial structure. The

improvement of wages promotes the optimization and upgrading of industrial structure, which in turn promotes the improvement of labor wage level, thus improving wage distortion.

4. Calculation of Wage Distortion in China's Provincial Regions

4.1 Measurement of Wage Distortion

The distortion of labor wage shows that the marginal output is inconsistent with the actual wage. Accurate measurement of labor marginal output is the key step for the subsequent measurement of labor wage distortion. Cobb Douglas production function (hereinafter referred to as C-D function) in the production function method is the most widely used function in measuring labor wage distortion. Using C-D function to measure the basic process of labor wage distortion: using the data of factor input and output and relevant measurement methods to estimate the parameters of C-D function, we can get the marginal output. Labor wage distortion is the ratio of labor marginal output and actual output. Because C-D function is simple and intuitive, and can clearly explain the structure of the studied variables, it has high feasibility and is widely used in empirical research. Therefore, this paper uses C-D function to measure labor wage distortion

$$Y_{\mathrm{it}} = A_{it} K_{it}^{\alpha} L_{it}^{\beta} \quad (1)$$

Y_{it} represents the output of province i in year t, A_{it} is the rate of technological progress, K_{it} and L_{it} represents the input of capital and labor respectively, α and β represent the output elasticity of capital and labor respectively, and the marginal output of labor MPL is:

$$MPL = \partial Y / \partial L = \beta A K^{\alpha} L^{\beta-1} = \beta Y / L \quad (2)$$

The expression of labor wage distortion is:

$$Gap_{it} = MPL_{it} / \omega_{it} = (\beta Y_{it}) / (w_{it} L_{it}) \quad (3)$$

Gap_{it} refers to the wage distortion degree of province i in year t, and w_{it} refers to the actual average wage level of province I in year t. From equation (3), if Gap>1, it means that the marginal labor output of workers is greater than their actual wage level, and the wage level of workers is distorted downward; If Gap<1, it means that the marginal output of workers is less than their actual wage level, and the actual wage level of workers is distorted upward; If Gap=1, there is no distortion of wages.

4.2 Data Sources

This paper uses the panel data of 28 provincial regions in China from 1994 to 2017 as the sample interval (except Hong Kong, Macao and Taiwan; Tibet and Hainan are not included in the sample due to incomplete data; Chongqing is incorporated into Sichuan for investigation). The input and output data in equation (1) are from the statistical yearbooks of each province, the website of the National Bureau of statistics, China Statistical Yearbook, China Labor Statistical Yearbook and China Industrial Economic Statistical Yearbook. All variables of price factors are reduced to 1978. The specific input and output data are described as follows: output variable (Y_{it}): the GDP of 28 provincial regions from 1994 to 2017. Taking 1978 as the base period, the corresponding GDP index over the years is calculated, and the corresponding actual GDP of each province over the years is converted with the GDP in 1978 as the constant price. Capital input (K_{it}): the fixed capital stock of each province over the years is calculated by using the method of Shan Haojie (2008) with 1978 as the base period. Labor input (L_{it}): the labor input is expressed by the number of urban employees in each province over the years. Labor remuneration (w_{it}): the average wage of urban employees in each province over the years is used to express labor remuneration. In order to avoid the impact of inflation, the nominal wage is reduced by the CPI of each province over the years (1 in 1978) to obtain the actual wage.

4.3 Calculation Results

According to the estimation results of the regression model, as shown in Table 1, the significant level of the output elasticity of capital and labor is 1%, indicating that the setting of the model is reasonable. This paper continues to use C-D production function to further analyze the characteristics of wage distortion in various provincial regions.

Table 1: Estimation results of C-D production function parameters

Variable	Coefficient
α	0.653***（47.26）
β	0.347***（27.19）
Observed value	672

Note: figures in brackets are standard errors of regression coefficients; ***, * *, and * are significant at 1%, 5%, and 10% levels, respectively.

The average value of wage distortion in each province calculated from equation (2) and equation (3) is shown in Table 2. From the perspective of each province, most provinces in China have the phenomenon of downward distortion of labor wages. This is consistent with the research of zhangmingzhi (2017) and an Meng (2021). The average value of wage distortion in Hebei, Jiangsu, Anhui, Shandong and Hunan all exceeds 3, and the phenomenon of wage distortion is relatively serious; The degree of wage distortion in Beijing, Sichuan, Yunnan, Qinghai, Ningxia and Xinjiang is less than 2, indicating that the degree of wage downward distortion is relatively light; The wage distortion of the remaining 17 provinces lies between the ranges (2, 3), such as Tianjin, Shanxi and other provinces.

Table 2: Average value of wage distortion in 28 provincial regions

Region	Wage distortion	Region	Wage distortion	Region	Wage distortion
beijing	1.15	zhejiang	2.54	sichuan	1.84
tianjing	2.76	anhui	3.03	guizhou	2.03
hebei	3.80	fujian	2.55	yunnan	1.94
shanxi	2.29	jiangxi	2.57	shanxi	2.37
neimenggu	2.57	henan	3.07	gansu	2.53
liaoning	2.56	hubei	2.97	qinghai	1.37
jilin	2.29	hunan	2.34	ningxia	1.50
heilongjiang	2.21	guangdong	2.86	xinjiang	1.40
shanghai	2.84	guangxi	2.12		
jiangsu	3.60	shandong	3.42		

In terms of regions, as shown in Table 3, the downward distortion of wages is the most serious in the developed eastern regions. Although many foreign-funded enterprises choose to invest and build factories here in most eastern provinces due to their superior geographical location and frequent foreign trade, the high wage level is also difficult to effectively alleviate the serious wage distortion due to the serious inconsistency between the marginal output and the actual labor output in the industrial structure of the eastern region; The central part of China is an economically developed region. There are drawbacks in the industrial structure and policy support can not be fully covered, so the wage distortion is more serious; The northeast is an industrial cluster. Due to the lack of government regulation, the market self-regulation is relatively weak, and the wage distortion is also serious; The western region has the smallest degree of wage distortion. Because the state attaches importance to the adjustment of industrial structure in

backward regions, the western region continues to attract a large number of foreign enterprises to invest and build factories. In addition, the gap between its marginal output and actual labor in the western region is not obvious, so the degree of wage distortion is the smallest.

Table 3: Average value of wage distortion in different regions of China

Region	Mean value
Eastern	2.83
Central	2.71
Western	1.97
Northeast	2.35

From the perspective of the time variation trend of wage distortion, the downward distortion of wages shows a gradual easing trend. The wage distortion index of Hebei dropped from 3.96 in 1994 to 2.60 in 2020; The wage distortion index of Shanxi dropped from 2.03 in 1994 to 1.47 in 2020; Jilin, Shanghai, Jiangsu, Zhejiang, Anhui, Ningxia and other provinces have shown an obvious trend of easing the degree of wage distortion. Due to the adjustment and optimization of the industrial structure, the increasing degree of marketization, and the continuous improvement of the Department's internal production and management system, the degree of wage distortion shows a good mitigation trend from the sample interval.

Most provinces in China have labor wage levels, and the distortion phenomenon is particularly significant in economically developed regions; However, from the perspective of time dimension, the wage distortion index of most provinces declined from 1994 to 2017, and the wage distortion has been significantly improved, which to some extent shows that China's income distribution policy to alleviate factor price distortion is effective.

5. Empirical Analysis

Based on the analysis of the above theoretical mechanism, this paper constructs the following econometric model:

$$gap_{it} = \alpha_0 + \alpha_1 fdi_{it} + \alpha_2 trade_{it} + \alpha_3 X_{it} + \varepsilon_{it}$$

gap is the degree of wage distortion, fdi is foreign direct investment, $trade$ is the openness of foreign trade, X is the control variable, i is the province, t is the time, ε is the random interference term.

5.1 Index Selection and Data Source

1. Explained variable: gap is the degree of wage distortion, which is estimated by C-D production function.

2. Core explanatory variable: FDI is expressed by the proportion of foreign direct investment in GDP of each province, and（trade）foreign trade is expressed by the proportion of total import and export (domestic destination or source of goods) in GDP. The data comes from the website of the National Bureau of statistics, the official database of the competition and the statistical yearbooks of each province over the years.

3. Control variable: X is the control variable. Combined with the existing literature research, we take the factors affecting wage distortion such as the degree of marketization, government intervention, capital intensity, industrial structure as the control variables of the model. Among them, the degree of marketization (market) is expressed by the proportion of the output value of state-owned and state-owned holding enterprises in the total output value of each provincial region. The greater the ratio, the lower the degree of marketization. Government intervention (gov) is expressed by the proportion of government fiscal expenditure in the total output value of each provincial region. Capital intensity (lnlk) is expressed by the ratio of the annual average balance of the net fixed assets of each provincial region to the average number of urban employments. Industrial structure (ind), expressed in terms of the proportion of the tertiary industry output value in GDP of each province. The data comes from the website of the National Bureau of statistics, the statistical yearbook of each province and the China Statistical Yearbook. Table 4 is the statistical description of the variables involved in this paper.

Table 4: Descriptive statistics of variables

Variable	definition	observation	mean	standard deviation	maximum	minimum
gap	labor wage distortion	672	2.447	0.909	0.487	5.484
fdi	the proportion of FDI in GDP	672	0.46	0.47	3.12	0.02
trade	Proportion of total import and export trade in GDP	672	0.32	0.40	2.22	0.02
Inlk	Logarithm of capital per capita	672	0.49	0.20	1.75	0.14
gov	government expenditure as a proportion of GDP	672	0.18	0.10	4.26	0.05
market	Proportion of output value of state-owned and state-owned holding enterprises in GDP	672	0.49	0.20	1.75	0.14
ind	proportion of tertiary industry in GDP	672	0.42	0.09	0.83	0.23

5.2 Benchmark Regression

In this paper, the least square regression, fixed effect model and random model are used to estimate the model. Table 5 shows the estimated results, in which, (1) - (6) are stepwise regression results, (7) and (8) are fixed effect and random effect results respectively. According to the Hausman test results, the fixed effect model is selected for estimation because the results of the fixed effect model are significant at the 1% level. From the perspective of the core explanatory variables in this paper, the estimation results show that:

The FDI coefficient is positive and significant at the 1% level, indicating that FDI exacerbates the downward distortion of labor wages. First of all, the technology spillover effect brought by foreign capital entry not only promotes the obvious improvement of production technology level, but also significantly increases the marginal output. Although the labor input is reduced and the production cost is reduced, the continuous increase of marginal output causes the downward distortion of labor wages. Secondly, the entry of foreign capital intensifies the competition among industries, which is conducive to the effective utilization and rational allocation of resources to a certain extent; At this time, market-oriented competition makes enterprises in a weak position bear enormous market pressure, and even face the risk of bankruptcy, leading to the return of part of the labor force to the market. After entering new enterprises, the real wages of these labors will inevitably be weakened due to their weak bargaining power. It can be seen that the capital and technology spillover effects of foreign capital have seriously exploited the real wages of workers, and further worsened from the degree of wage distortion.

2. The coefficient of trade is significantly negative, indicating that foreign trade alleviates the distortion of domestic wages. First of all, foreign trade has effectively promoted technological innovation and institutional reform in terms of technological progress and industrial structure adjustment, increased marginal output, and increased the profits of enterprises. Part of the profits are shared by workers, easing the downward distortion of labor wages. Secondly, the government uses various non-economic means to carry out macro-control on the market, one is to increase employment opportunities, the other is to regulate commodity prices, so as to increase the real income of workers. Finally, as foreign trade makes the competition between enterprises more intense, enterprises with high wage level and low production efficiency are kicked out of the market in the competition, while enterprises with low wage level and high production efficiency continue to innovate and develop in the market, enhancing the dominant position of enterprises in the competition. As a result, the wage gap between enterprises' workers is continuously narrowed, and the degree of income inequality is gradually reduced, so as to alleviate the distortion of labor wage.

Table 5: Empirical results of wage distortion caused by foreign direct investment and foreign trade

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	FE	RE

fdi	0.523*** (7.25)	1.275*** (11.44)	1.111*** (9.81)	0.97*** (10.45)	0.946*** (10.24)	0.835*** (9.56)	0.574*** (5.70)	0.689*** (7.39)
trade		-1.127*** (-8.56)	-0.902*** (-6.66)	-1.269*** (-11.28)	-1.27*** (-11.39)	-0.683*** (-5.64)	-0.647*** (-4.40)	-0.54*** (-4.11)
Inlk			-0.222*** (-5.44)	0.207*** (5.08)	0.241*** (5.80)	0.275*** (7.03)	-0.072 (-1.32)	0.008 (0.15)
gov				-5.887*** (-18.28)	-6.392*** (-18.24)	-4.982*** (-13.85)	-1.939*** (-3.94)	-2.766*** (-6.16)
market					0.498*** (3.49)	0.236* (1.73)	-0.053 (-0.28)	-0.053 (-0.30)
ind						-3.684*** (-9.63)	-4.333*** (-7.66)	-4.074*** (-8.38)
Constant	2.205*** (46.37)	2.214*** (48.99)	4.621*** (10.39)	1.237*** (3.04)	0.728* (1.69)	1.637*** (3.96)	5.361*** (10.52)	4.455*** (9.35)
N	672	672	672	672	672	672	672	672
R^2	0.073	0.164	0.200	0.467	0.476	0.541	0.454	0.449
hausman	—						17.919***	

Note: * * *, ** *, * are significant at the level of 1%, 5% and 10%, respectively. The numbers in brackets are the corresponding T values.

3. from the perspective of control variables, the coefficient of government intervention is significantly negative, indicating that government intervention can effectively alleviate the wage distortion of labor force. In the process of constantly building a new development pattern in China, the government has continuously improved the price mechanism and policy formulation, strengthened the rational allocation and supervision of various elements of the market, achieved a high degree of cooperation between the effective market and the promising government, made the income distribution more reasonable and orderly, promoted employment, and alleviated the downward distortion of the labor wage level. The index coefficient of the degree of marketization is positive, which is consistent with expectations. The lower the degree of marketization, the smaller the proportion of state-owned and state-controlled enterprises, and the higher the distortion of wages; The market has improved the average level of the market by equalizing labor wages, which can narrow the income gap. The coefficient of industrial structure is negative and holds at the significance level of 1%, indicating that the increase in the proportion of the tertiary industry and the continuous optimization of the industrial structure have alleviated the downward distortion of labor wages. With the rapid development of emerging producer services market players based on Internet information technology, the number of relevant employees has increased significantly and the scale of the industry has expanded significantly, the real wages have increased, and the downward distortion of labor wages has been improved.

5.3 Robustness Test

In order to further test the core explanatory variable of this paper, that is, whether the distortion of domestic labor wage under the interaction of FDI and foreign trade is consistent with the original regression result, so as to obtain a more robust estimation result, we will analyze it from the following two aspects.

1. endogenous test. Since the impact path of the core explanatory variables FDI and foreign trade on labor wage distortion is not single, there are overlapping parts between them. In order to solve this endogenous problem, we will use the lag period of FDI and trade as instrumental variables to test the robustness. The estimation results are shown in columns (1) and (2) of table 7. After overcoming the endogenous problem, the estimation coefficient of FDI is significantly positive and that of trade is significantly negative. At the same time, the limited information maximum likelihood method, which is more insensitive to weak instrumental variables, is used to estimate, as shown in columns (3) and (4) of table 7. The estimation result is the same as that of 2SLS, which indicates that there are no weak instrumental variables to a certain extent, proving that the previous conclusion is robust.

2. eliminate the influence of abnormal sample size. Considering that the estimation results may be affected by the sample points with abnormally high or low average wage distortion within the sample interval, we eliminated the sample points with the average wage distortion within the sample interval less than 10% quantile and greater than 90% quantile, and re regressed the remaining samples. The estimation results are shown in table (5). After eliminating the possible abnormal sample points, the coefficient of FDI is still significantly positive, and the coefficient of foreign trade is significantly negative. This result supports the core conclusion of this paper, that is, FDI exacerbates the downward distortion of the wage level of domestic workers, while foreign trade alleviates the downward distortion of labor wages.

Table 6: Robustness test

	（1）	（2）	（3）	（4）	（5）
	2SLS	2SLS	LIML	LIML	Median
trade	-0.71*** (-5.61)	-0.77*** (4.58)	-0.71*** (-5.61)	-0.77*** (-6.28)	-0.433*** (-4.01)
fdi	0.918*** (9.73)	0.913*** (11.26)	0.918*** (9.73)	0.913*** (11.26)	0.584*** (6.85)
Inlk	0.241*** (5.96)	0.247*** (5.63)	0.241*** (5.96)	0.247*** (5.63)	0.17*** (4.96)
gov	-4.903*** (-13.48)	-5.052*** (-8.88)	-4.903*** (-13.48)	-5.052*** (-8.88)	-4.256*** (-9.71)
market	0.345** (2.45)	0.365** (2.53)	0.345** (2.45)	0.365** (2.53)	0.345*** (2.97)
ind	-3.765*** (-9.72)	-3.591*** (-10.14)	-3.765*** (-9.72)	-3.591*** (-10.14)	-1.862*** (-4.54)
Constant	1.966*** (4.58)	1.857*** (4.14)	1.966*** (4.58)	1.857*** (4.14)	1.77* (5.06)
N	644	644	644	644	537

Note: * * *, ** *, * are significant at the level of 1%, 5% and 10%, respectively. The figures in brackets are the corresponding T values.

6. Conclusions and Policy Recommendations

Based on the C-D production function, this paper uses the panel data of 28 provinces from 1994 to 2017 to measure the degree of wage distortion in each province, and examines the impact of FDI and foreign trade on China's labor wage distortion. The basic conclusions are as follows:

First, wage downward distortions of varying degrees are common in most provinces of China, especially in the economically prosperous eastern region, which is the most prominent, the central region is slightly slower, and the western region is the least distorted. Although the developed eastern region is obviously superior to the economically backward western region in terms of capital, technology, system, equipment and talents, the unreasonable arrangement of industrial structure in the eastern region is prominent, coupled with fierce competition in the industry, and the actual labor wage is far lower than the labor frontier output, resulting in serious downward

distortion of wages. It is worth noting that although there are different degrees of wage downward distortion in all provinces, from the time span, the wage distortion shows a good trend of easing year by year, indicating that the optimization and adjustment of industrial structure and the intervention of national policies have alleviated the wage distortion of labor force.

Second, although the capital, technology and institutional spillover effects brought by FDI play a positive role in stimulating the adjustment and innovation of the industrial structure in the domestic market, the crowding out effect brought by foreign investment also intensifies the competition in the domestic labor market, resulting in uneven income distribution among industries; In addition, China has adopted preferential welfare policies for foreign investment, which makes the policy support and welfare strength of domestic departments have a large gap with foreign-funded enterprises, leading to wage distortion to a certain extent. On the whole, FDI aggravates the wage distortion in the domestic labor market; On the contrary, foreign trade has significantly alleviated the labor wage distortion and improved the distortion, indicating that the relative factor price impact, the increase of employment, technological progress and the adjustment of industrial structure brought by foreign trade are conducive to easing the wage distortion.

In order to alleviate the downward distortion of wages of China's labor force and promote the stable and healthy operation of China's economy, we will provide relevant suggestions from the following three aspects.

First, the government needs to continue to optimize the domestic and foreign business environment, promote the development of China's foreign trade and improve the quality of development in a stable scale. At the same time, we should accelerate the innovation, exchange, cooperation, development, transformation and upgrading of China's import and export enterprises, switch economic growth and development to the track of development relying on improving the rate of technological progress, and strengthen the competitiveness of enterprises in the international market.

Second, the government should actively encourage and promote foreign direct investment, improve and perfect the review and access mechanism and service system for foreign direct investment, and ensure that foreign capital can enter the domestic market equally to participate in economic activities in accordance with the law on the premise of improving the quality of foreign capital access, so as to better promote the stable and healthy operation of China's economy, and promote the construction of an innovative development pattern with the domestic circular economy as the main body and the domestic and international dual cycle structure complementing each other.

Third, enterprises need to carry out fundamental strategic transformation and abandon the competition mode relying on low labor costs. The core is to regard employees as the core capital to improve efficiency and innovation, rather than a simple cost. Enterprises should actively invest in technology upgrading and automation, and create profit space to pay higher wages by improving total factor productivity. At the same time, a fair and competitive compensation system must be established and closely linked with skills and performance. Investing in staff training and development can not only enhance the value of human capital, but also enhance cohesion and loyalty, and ultimately build a harmonious labor relationship and form a sustainable competitive advantage.

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