Research on the Impact of Rising Labor Cost on Trade between China and Japan

—Based on the perspective of ternary margins

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Abstract—This paper calculated the extensive margin, price margin and quantity margin of trade growth between China and Japan during 2000-2018, and analyzed the impact of rising labor costs on trade between China and Japan based on the perspective of ternary margins. The results show that the rising labor cost has both positive and negative effects on the growth of China's export to Japan, also has different effects on different kinds of products. Specifically, there are significant positive effects on the extensive margin of animal and plant products and textile products, the price margin of chemical products and the quantity margin of textile products. The Government should formulate relevant policies, make the labor factors have reasonable distribution, and promote the long-term and stable development of trade between China and Japan.

1 INTRODUCTION

As the two largest economies in Asia, China and Japan are important trading partners to each other. According to the data in 2017, Japan is China's third largest trading partner, while China is Japan's second largest commodity exporter. Under the framework of RCEP and CPTPP, China-Japan trade relations may play a stabilizing role in Global trade. China and Japan have established direct FTA relations within the framework of RCEP for the first time, the importance of China-Japan trade relations in the future global trade relations is expected to be further highlighted.

Since the reform and opening up, sufficient labor and low labor cost have been one of the driving forces to promote the sustained and rapid development of China's foreign trade. However, China's current population structure is gradually changing. According to the data, since 2011, the number of China's 15-59-year-old labor force has continued to decrease, and by 2018, nearly 40 million labor force has been lost in just seven years. In 2018, the number of working age population (population aged 15-59) in China was 897.29 million, accounting for 64.3% of the total population, falling below 900 million for the first time. At the same time, China's export is facing a new constraint: labor cost constraint. Studying the specific impact of labor cost changes on China's foreign trade is conducive to improving China's foreign trade structure.

According to the research of Hummels and Klenow [1], the ternary margins (the extensive margin, the price margin and the quantity margin) may jointly determine a country's trade flow. From the perspective of ternary margins, this paper discusses the impact of rising labor cost on trade between China-Japan, so as to provide reference and suggestions for promoting trade.

2 LITERATURE REVIEW

About the research on the ternary margins between China and Japan, Yang Fengmin [2] based on data from 1996 to 2013, make a study on China's agricultural products export ternary margins, and found that the mode of "winning by quantity" was still the main mode. Zhong Jianjun [3] based on the trade data from 1995 to 2013, found that China's export of high-tech products to Japan mainly depends on the quantity margin, while the price margin is only 40% of the Japanese level. Zheng Hongling [4] found that China's vegetable export to Japan from 1996 to 2015 mainly rely on price margin. At present, the research on the ternary margins of trade between China and Japan mainly focuses on agricultural products, and lacks the research on the overall trade.

On the impact of rising labor costs, Mao Rui and Zhang Bin [5] selected the wage level to measure the labor cost. The study found that the rise of labor cost was the main reason for the decline of export competitiveness advantage. Tie Ying and Zhang Mingzhi [6] found that there are "human capital effect" and "cost effect" so that influenced export, Ren Zhicheng [7] found there are

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"reverse force" effect and it's different among industries. Chen Wen [8] from the micro perspective of enterprises, found that the rise of labor cost has a significant negative effect on the two margins.

At present, from the perspective of ternary margins to study the the impact of export trade is less, especially the trade between China and Japan. This paper wants to enrich the research in this area.

3 DECOMPOSITION METHOD OF TERNARY MARGINS

This paper mainly refers to the research results of Hummels and Klenow to define and calculate the ternary margins of export growth. Extensive margin means "the breadth of exports", more kinds of goods or more trade partner. The concrete calculating methods are as follows:

$$EM_{jk} = (\sum_{i \in I_{jk}} p_{rki} q_{rki}) / (\sum_{i \in I_{rk}} p_{rki} q_{rki}) \quad (1)$$

Where j, k and r represent China, Japan and the world; i means kinds of products.

Intensive margin means "the depth of exports", more volume of trade in the same commodity category. The concrete calculating methods are as follows:

$$IM_{jk} = (\sum_{i \in I_{jk}} p_{jki} q_{jki}) / (\sum_{i \in I_{jk}} p_{rki} q_{rki}) \quad (2)$$

$$P_{jk} = \prod_{i \in jk} (p_{jki} / p_{rki})^{w_{jki}}, Q_{jk} = \prod_{i \in jk} (q_{jki} / q_{rki})^{w_{jki}} \quad (3)$$

P, Q represents the price index and quantity index of the products, and the weight "w" is calculated as follows:

$$w_{jki} = [(S_{jki} - S_{rki}) / (LnS_{jki} - LnS_{rki})] / [\sum_{i \in I_{jk}} (S_{jki} - S_{rki}) / (LnS_{jki} - LnS_{rki})] \quad (4)$$

Where S means the proportion of commodity exports. At this point, we can decompose a country's export share in a certain market into extensive margin, price margin and quantity margin: $H = EM \times Q \times P$.

This paper selects the trade data from 1998 to 2018 between China and Japan in the UN Comtrade.

Figure 1. The Ratio of Ternary Margins (China/ Japan)

From the perspective of overall trade, the ratio of the three margin is shown in Figure 1. We can see that from 1998 to 2018, the extensive margin change is relatively stable. Compared with Japan, the growth of quantity margin is rapid, while the price margin of China is about half of Japan, and increase slowly.

According to the harmonization system code, we divides products into seven categories: Animal and plant products (Chapter 1-24) , Minerals products (Chapter 25-27, 68-70) , Chemical products (Chapter 28-40) , Textile

products (Chapter 41-67) , Metal products (Chapter 71-83) , Electromechanical products (Chapter 84-93) and Miscellaneous products (Chapter 94-97).

Figure 2. The Ratio of Extensive Margin (China/ Japan-7 kinds)

From Figure 2, we can see that the extensive margin of mineral products (EM2) has the biggest changed, followed by animal and plant products (EM1); the change of the remaining five kinds of products was relatively stable, China and Japan have the same level.

Figure 3. The Ratio of Price Margin (China/ Japan-7 kinds)

From the figure 3, we can see that the change of price margin is relatively small, which is less than 1. Among them, the price margin of chemical products (P3) and animal and plant products (P1) is low, while the price margin of mineral products (P2) and metal products (P5) is relatively higher.

Figure 4. The Ratio of Quantity Margin (China/ Japan-7 kinds)

From the figure 4, we can see that the change of animal and plant products (Q1) is the largest, and there was an obvious gap with the other six categories of products. Secondly, the quantity margin of textile products (Q4) and miscellaneous products (Q7) is larger, while the other four kinds are relatively stable. All kinds are higher than the level of Japan.

4 THEORETICAL ANALYSIS AND MODEL CONSTRUCTION

4.1 The theoretical mechanism of labor cost rising affecting export margin

4.1.1 On the extensive margin: Labor cost may both have positive and negative effects on export extensive margin.

4.1.1.1 Positive effects: On the one hand, the rise of labor cost will directly lead to the reduction of the existing labor cost advantage, that is to say, it will increase the export cost of enterprises, and make enterprises face the situation that the profits of exporting some products or exporting to a certain market will decline, thus forcing some enterprises to give up the existing export products or markets and reduce the export extensive margin.

4.1.1.2 Negative effects: On the other hand, the rise of labor costs forces enterprises to improve their independent innovation capability, develop new products or expand new markets, thus promoting the extensive margin.

4.1.2 On the Intensive margin: Labor cost may also have positive and negative effects on export intensive margin.

4.1.2.1 Positive effects: The positive effect is mainly realized by quality effect and substitution effect.

Quality effect, to improve the quality of export products and production efficiency, the enterprises use more advanced labor, or improve workers' skills through learning and training. Though the labor costs rise, the competitiveness of export products has been enhanced, so the intensive margin rise.

Substitution effect, labor cost changes make enterprises change the proportion of labor/capital investment. When enterprises use capital to replace labor, according to the De La Grandville Hypothesis, intensive margin rise. In addition, it also depends on the substitution elasticity of export products.

4.1.2.2 Negative effects: The negative effects are mainly reflected by price effect and investment effect.

Price effect, because product price is the addition of production cost, labor cost has an impact on export through price mechanism. When the change of labor supply and demand leads to the rise of labor cost and the increase of production cost, in order to obtain profits, export enterprises will correspondingly increase the price

of export products, which will reduce the competitiveness of products in the international market and restrain the intensive margin.

Investment effect, when labor costs rise, enterprises will consider transferring capital to areas with lower labor costs, resulting in lower intensive margins, especially the foreign-funded enterprises. When labor costs reach a certain level, local enterprises will also invest in areas with lower labor costs, further reduce the intensive margin.

4.2 Model building

Referring to the research of Decramer [9] and Ma Shucan [10], combined with the extended gravity model, this paper establishes the following empirical model:

$$\ln M_{it} = a_0 + a_1 \ln W_{it} + a_2 \ln X_{it} \quad (5)$$

Among them, M means the ternary margins (see above), W means the labor cost, and X represents other control variables. We divides the labor cost into W_l and W_s. W_l is the wage level of unskilled labor, expressed by the average wage of urban collective units; W_s is the wage level of skilled labor, expressed by the average wage of state owned enterprises. This paper select the (relative) economic scale (Y and Y_f), relative price (P), fixed cost of domestic production(F), export fixed cost (F_x) as control variables, which are represented by GDP (constant price US dollars in 2010), purchasing power parity ratio between China and Japan, proportion of fixed costs of state-owned enterprises, and index scores of trade freedom.

Due to the objectivity and availability of the data, this paper uses the trade data between China and Japan from 2000 to 2018. All from UN Comtrade database, China Statistics Bureau, China Statistical Yearbook and World Bank.

5 EMPIRICAL ANALYSIS

To determine whether the variable is a stationary sequence, we first test for a unit root to all the variables. All variables pass the ADF test, so we make regression analysis as the model (5).

5.1 Extensive margin

From Table 1, we can see that most of the variables pass the significance test, which means the change of labor cost has an impact on the extensive margin, and on different kinds of products, there are different influences.

TABLE I. REGRESSION RESULTS OF EXTENSIVE MARGIN

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LnY		2.1501* (1.84)		-0.271* (-1.84)	0.6535*** (5.01)		-0.0217*** (-2.27)
LnP	-0.2814*** (-2.79)					0.1602* (2.13)	
LnYf			-0.3037*** (-4.94)	0.4431* (2.1)	-0.7597*** (-4.05)		
LnF				-0.3734*** (-2.57)	0.1996 (1.55)	-0.1632 (-1.43)	0.0254*** (2.91)
LnFx	0.4842** (2.7)	2.0319* (1.6)	-0.1832 (-1.36)				0.0160 (1.56)
LnWl	0.3910*** (3.13)	1.9303** (2.15)	-0.1936 (-1.48)	0.3417* (1.87)	-0.3432* (-2.12)	-0.1275 (-1.38)	0.0232*** (2.85)
LnWs	0.0802* (1.86)	-1.6718* (-1.96)	0.1093*** (5.42)	0.0273 (0.24)	-0.1998* (-2)	-0.0825* (-2.09)	0.0177*** (2.47)
C	-0.5454 (-1.61)	-8.3600* (-1.98)		2.8416*** (3.43)	-3.6341*** (-4.95)	1.4516*** (3.87)	0.7119*** (20.39)

T-statistics in parentheses; ***p<0.01, ** p<0.05, * p<0.1

On the one hand, the rise of labor cost, helps to increase the extensive margin of animal and plant products (1), textile products (4) and miscellaneous products (7), and mainly through unskilled labor. On the other hand, it has a negative impact on metal products (5) and electromechanical products (6). In addition, the increase of Wl make a positive impact on mineral product (2); while the increase of Ws make a positive impact on chemical products (3).

5.2 Price margin

Table 2 shows the regression results of price margin. The change of labor cost makes differentiated impact on price margin. Specifically, it has positive impact on chemical products (3), but a negative impact on miscellaneous products (7). For animal and plant products (1), textile products (4), Ws play a more important role. To mineral products (2), metal products (5) and electromechanical products (6), Wl is more important.

TABLE II. REGRESSION RESULTS OF PRICE MARGIN

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LnP	0.4980 (1.25)	0.3620 (0.77)			0.1949* (1.89)	-0.8233 (-1.38)	1.0122** (2.39)
LnYf	-2.0088** (-2.58)	0.6613 (0.77)		-0.5197** (-2.54)		2.6696** (2.3)	
LnF	-0.8509* (-1.97)	0.8442** (2.5)	0.0393 (0.48)	-0.5579** (-2.18)	-0.5712*** (-3.66)	-0.9560 (-1.48)	-2.7953*** (-4.35)
LnWl	-1.6595** (-2.27)	2.7963*** (3.14)	0.2585* (2.01)	-0.9590** (-2.37)	0.4864*** (3.85)	2.4681** (2.27)	-1.2617** (-2.42)
LnWs	0.3071 (1.55)	-0.2419*** (-3.14)	0.0186** (2.21)	0.1579*** (3.58)	-0.1045* (-1.93)	-0.6025* (-2.04)	-0.6353** (-2.85)
C	-0.6304 (-0.4)				1.1482** (2.24)	4.2783* (1.83)	7.1877*** (3.4)

T-statistics in parentheses; ***p<0.01, ** p<0.05, * p<0.1

5.3 Quantity margin

From Table 3, we can found that the change of labor cost also has a significant impact on quantity margin. The increase of labor cost has a more obvious promoting effect on the textile products (4), but has a more significant negative impact on electromechanical products (6). The increase of Ws may have a positive effect on mineral products (2), while the increase of Wl has a

significant promoting effect on animal and plant products (1), chemical products (3), metal products (5) and miscellaneous products (7).

TABLE III. REGRESSION RESULTS OF QUANTITY MARGIN

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LnP		0.6096 (0.42)	0.4854*** (2.96)		-0.2325 (-0.23)	1.6743* (1.78)	-4.8457** (-2.68)
LnYf	20.6924** (2.57)				4.2325** (2.16)	-2.3076 (-1.34)	9.8588** (2.97)
LnF	-11.7627* (-2.03)	5.7067* (1.91)	-0.8776** (-2.58)	1.7697 (1.71)	-0.0169 (-0.016)	-2.0406*** (-3.02)	2.7236* (2.1)
LnWl	12.9739* (1.84)	-7.3958** (-2.18)	0.9585** (2.49)	1.9124* (2.02)	4.3996** (2.4)	-2.3245 (-1.3)	7.4811** (2.18)
LnWs	-7.1757** (-2.51)	0.3936 (0.99)	-0.0007	0.1717 (1.62)	-1.2520** (-2.52)	0.2674 (1.73)	-0.4870 (-1.64)
C	55.4709** (2.54)			-3.4661* (-2.05)	7.8066* (1.98)		

T-statistics in parentheses; ***p<0.01, ** p<0.05, * p<0.1

6 CONCLUSIONS

Through theoretical analysis and empirical results, we can get the following conclusion: The change of labor cost has a significant impact on the ternary margins on the trade between China and Japan, and for different types of products, there are differences.

Generally speaking, the rise of labor cost has a positive effect on the extensive margin of animal and plant products, textile products and miscellaneous products, the price margin of chemical products and the quantity margin of textile products. Besides, it has a negative impact on the extensive margin of metal and electromechanical products, the price margin of miscellaneous products and the quantity margin of electromechanical products. Specifically, the rise of the wages of unskilled labor is beneficial to the extensive margin of mineral products, the price margin of mineral products, metal products and electromechanical products, and the quantity margin of animal and plant products, chemical products, metal products and miscellaneous products. Also, the increase of the wages of skilled labor has a positive effect on the extensive margin of chemical products, price margin of animal and plant products and textile products, quantity margin of minerals product.

Based on conclusions, this paper puts forward suggestions: First, take measures to promote the growth of population quantity and quality, such as encouraging childbearing and providing corresponding guarantee. Besides, government should increase investment in higher education and training, subsidizing company training, and coordinating the supply and demand of labor market. Second, we should improve the market-oriented allocation of factors, which can selectively coordinate the allocation of labor force between the eastern and western regions and between different industries. Third, we should create a positive environment for innovation and transform innovation capability into manufacturing capability, so as to make it more competitive in participating in the global value chain division of labor.

In 2020, Covid-19 changed our life, China and Japan are facing new challenges and opportunities. In addition to continuing to strengthen the competitiveness of the

external market, we also need to face up to the problems of domestic labor force, and take targeted measures to promote the healthy, long-term and stable development of foreign trade.

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