

# Research on Optimization of International Trade Added Value Estimation Based on Kernel Density Estimation Under Digital Background

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**Abstract.** The kernel density estimation algorithm has the feature of starting entirely from data, which provides a new path for the optimization of trade value-added measurement. This paper first analyzes the trade value-added model and international competitiveness measurement indicators and constructs a kernel density estimation algorithm model based on the digitalization context. Secondly, we analyze the basic situation and location distribution of trade value added in China in the digital context. The trade value-added and value-added rate are measured, and the development pattern is analyzed and explored. Finally, based on the qualitative analysis, we analyze the impact response of trade value added to the degree of vertical specialization of the international division of labor and measure and optimize the international trade value added based on the kernel density estimation method. The analysis results find that the index of the degree of vertical specialization is positively correlated with the export trade addition rate. In the short run, the export trade addition rate has a greater impact on its own changes. In the long run, nearly 36.2% of the fluctuating changes in the export trade addition rate are influenced by the degree of vertical specialization. From period 3 onward, its impact on the export trade addition rate accounts for 37.2% of the level. The optimization of international trade value-added measurement based on kernel density estimation algorithm is an inevitable trend of digital development.

## 1. Introduction

Added value, also known as value-added, is from the new value above the original value of the product due to labor compensation, tariffs, or profits in international trade [1–3]. The value-added statistics method is a method to count international trade data based on value-added [4]. Trade value added is the increase in the value of imported inputs such as foreign intermediate products and foreign final products used in a country's exports, which are made after a variety of inter-industry cycles within the country and exported

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outside the country [5–6]. The essence of this is an embodiment of trade benefits, i.e., the benefits that domestic manufacturers obtain from attaching domestic factors to imported factors in export trade [7–8].

Jeon, J. K. established value-added import and export data without double counting [9]. Choi, M. S. uses value-added data on the basis of existing data, confirming the currency's retro prediction rules for exports and trade balances [10]. Ceglowski, J., on the other hand, argues that some countries seem to be more competitive on a value-added basis than on the traditional measure of total exports [11].

The literature [12–13] states that among the three commonly used parameter-free estimation methods, the kernel density estimation method is widely used because of its advantage of starting entirely from the data and making no assumptions about the data distribution. The KDE method is a typical parameter-free p.d.f estimation method [14]. The literature [15–16] uses the average of the kernel function superposition to refit the true probability density function of the data. For p.d.f estimation, how to determine the window width parameter is a very important issue. In the literature [17–18] academic studies on KDE focus on the selection of the optimal window width parameter; if the window width parameter is too large, it will lead to the estimated p.d.f being too smooth. Conversely, if the window width parameter is too small, it will make the estimated p.d.f less smooth. In order to determine the optimal window width parameter, the literature [19] designed a reasonably valid objective function to measure the estimation error. The integrated mean square error is a classical and often used error measure, which refers to the expected value of the integrated variance between the estimated obtained p.d.f and the true p.d.f [20]. The literature [21–22] points out that in determining the optimal window width parameter, different approximation heuristics need to be chosen to replace the unknown term associated with the true p.d.f. according to different application scenarios. There are many research works based on MISE, among which the more representative ones are bootstrap kernel density estimation, unbiased cross-validated kernel density estimation, and biased cross-validated kernel density estimation.

This paper focuses on the optimization of international trade value-added measurement. First, the conceptual definition and definition of the research object involved in this paper are studied. We analyze the trade value-added model and international competitiveness measurement indicators and construct a kernel density estimation algorithm model based on the digitalization context. Secondly, the basic situation and location distribution of China's trade value added in the digitalization context are analyzed. The trade value-added and value-added rate are measured, and the development pattern is analyzed and explored. Finally, the method of empirical research is applied, based on the collection of data, qualitative analysis is combined with quantitative analysis, and the results are empirically tested to describe the relationship between each variable. Based on the qualitative analysis, the impact response of the trade value-added rate to the degree of vertical specialization in the international division of labor is analyzed, and the value added of international trade based on the kernel density estimation method is measured and optimized.

## 2. International Trade Added Value

### 2.1. Model of Trade Value-Added

Assume a world in which only two countries exist, each producing only one tradable good. The product produced is either used directly for consumption or as an indirect input required for production. Each country exports both intermediate and manufactured goods. All of the country  $s$ 's output, whether at home or abroad, is either used as an intermediate good or becomes a final good. Thus, the total output of country  $s$ ,  $x_s$ , must satisfy the following relationship:

$$x_s = a_{ss}x_s + a_{sr}x_r + y_{ss} + y_{sr}, \quad r, s = 1, 2 \quad (1)$$

The production-trade system of the two countries can be written as a two-country input-output model as follows:

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} y_{11} + y_{12} \\ y_{21} + y_{22} \end{bmatrix} \quad (2)$$

After rewriting, we can obtain:

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} I - a_{11} & -a_{12} \\ -a_{21} & I - a_{22} \end{bmatrix}^{-1} \begin{bmatrix} y_{11} + y_{12} \\ y_{21} + y_{22} \end{bmatrix} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \end{bmatrix} \quad (3)$$

Equation (3) takes into account the process by which the output of one country participates as an intermediate good in the production of final goods in its own and other countries, either directly or indirectly. Thus the coefficients  $b_{rs}$  in the matrix are called aggregate demand coefficients.

In this way, by rearranging the final demand of both countries according to source and destination to form a matrix form, the total output of a country can be decomposed and observe how it is absorbed and consumed. Rewrite equation (3) in the following form:

$$\begin{bmatrix} x_{11} & x_{12} \\ x_{21} & x_{22} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} = \begin{bmatrix} b_{11}y_{11} + b_{12}y_{21} & b_{11}y_{12} + b_{12}y_{22} \\ b_{21}y_{11} + b_{22}y_{21} & b_{21}y_{12} + b_{22}y_{22} \end{bmatrix} \quad (4)$$

The final demand matrix in this equation is a 2×2 matrix, and summing along the matrix horizontally yields  $y_s$ , which represents the amount of final product consumed by the world. The leftmost 2×2 matrix in the equation becomes the gross output decomposition matrix, where  $x_{sr}$  represents the total output required to be input in country  $s$ , in order to maintain the final demand in country  $r$ , the destination country, i.e.,  $x_1 = x_{11} + x_{12}$ , while the rightmost matrix in the equation further decomposes into two parts.

By definition, country 1 consumes  $a_{11}$  units of domestic intermediate goods and  $a_{21}$  units of foreign intermediate goods for each unit of product produced. Therefore, the value added component that represents the total output of the country generated in the country can be expressed as follows:  $v_1 = 1 - a_{11} + a_{21}$  and, similarly,  $v_2 = 1 - a_{12} + a_{22}$  represents the value added in the country of the total output of country 2.

Thus, the direct value-added coefficient matrix can be defined as

$$V = \begin{bmatrix} v_1 & 0 \\ 0 & v_2 \end{bmatrix} \quad (5)$$

Multiplying this with the Leontief inverse matrix  $B$  yields the value-added share matrix:

$$VB = \begin{bmatrix} v_1b_{11} & v_1b_{12} \\ v_2b_{21} & v_2b_{22} \end{bmatrix} \quad (6)$$

Since the value added is either domestic or foreign, the sum of each column of the matrix is 1:

$$v_1b_{11} + v_2b_{21} = v_1b_{12} + v_2b_{22} = 1 \quad (7)$$

The value added of country 1 and country 2 exports are:

$$\begin{aligned} VT_{12} &= v_1x_{12} = v_1b_{11}y_{12} + v_1b_{21}y_{22} \\ VT_{21} &= v_2x_{21} = v_2b_{21}y_{11} + v_2b_{22}y_{21} \end{aligned} \quad (8)$$

Let the total exports of country 1 be:

$$e_{12} = y_{12} + a_{12}x_2 \quad (9)$$

Denotes that the export component of country 1 includes both intermediate and final products. The joint equations (8) and (9) lead to:

$$\begin{aligned} e_{12} &= (v_1b_{11} + v_2b_{21})(y_{12} + a_{12}x_2) \\ &= v_1b_{11}y_{12} + v_2b_{21}y_{12} + v_1b_{12}y_{22} \\ &\quad + v_1b_{12}y_{21} + v_1b_{12}a_{21}x_1 + v_2b_{21}a_{12}x_2 \end{aligned} \quad (10)$$

This formula indicates that country 1's exports of intermediate goods consist of two components. One component is the added value of the portion imported by country 1 from country 2, and the other component

is the added value produced in country 1 but put into the final product by country 2 as an intermediate good, i.e.,  $v_1 b_{12} y_{22}$ .

From  $x_1 = a_{11}x_1 + y_{11} + e_{12}$  and  $x_2 = a_{22}x_2 + y_{22} + e_{21}$ , combined with the Leontief inverse matrix, we have

$$\begin{aligned} x_1 &= (1 - a_{11})^{-1} y_{11} + (1 - a_{11})^{-1} e_{12} \\ x_2 &= (1 - a_{22})^{-1} y_{22} + (1 - a_{22})^{-1} e_{21} \end{aligned} \quad (11)$$

The joint equation (10) yields:

$$\begin{aligned} e_{12} &= v_1 b_{11} e_{12} + v_2 b_{21} e_{12} \\ &= (v_1 b_{11} y_{12} + v_1 b_{12} y_{22}) \\ &\quad + [v_1 b_{12} y_{21} + v_1 b_{12} a_{21} (1 - a_{11})^{-1} y_{11}] \\ &\quad + v_1 b_{12} a_{21} (1 - a_{11})^{-1} e_{12} \\ &\quad + [v_2 b_{21} y_{12} + v_2 b_{21} a_{12} (1 - a_{22})^{-1} y_{22}] \\ &\quad + v_2 b_{21} a_{12} (1 - a_{22})^{-1} e_{21} \end{aligned} \quad (12)$$

$(v_1 b_{11} y_{12} + v_1 b_{12} y_{22})$  denotes the fraction of value added that is exported, e.g., the fraction of value added generated in country 1 that is consumed in country 2.  $v_1 b_{12} y_{21}$  denotes the fraction of value added in country 1 that is embedded in intermediate goods exported to country 2 and made into final products in country 2 that are then imported by country 1.  $v_1 b_{12} a_{21} (1 - a_{11})^{-1} y_{11}$  is still the part of country 1's own value-added that is exported to country 2 as intermediate goods and embedded in the intermediate goods imported from country 2 and made into final products in the country. Both  $v_1 b_{12} y_{21}$  and  $v_1 b_{12} a_{21} (1 - a_{11})^{-1} y_{11}$  are counted twice in transit.  $v_1 b_{12} a_{21} (1 - a_{11})^{-1} e_{12}$  is said to be a pure double-counting term. This term exists when, and only when, both countries export intermediate goods. Similarly, a similar formula can be derived for country 2.

A further precise calculation shows that a country's GDP is equal to the sum of the added value of its exports plus the added value consumed in its own country. The calculation formula is as follows:

$$\begin{aligned} GDP_1 &= v_1 x_1 = (v_1 b_{11} y_{12} + v_1 b_{12} y_{22} + v_1 b_{12} y_{21} + v_1 b_{11} y_{11}) \\ &= v_1 \{b_{11} y_{12} + b_{12} y_{22} + [b_{12} y_{21} + b_{12} a_{21} (1 - a_{11})^{-1} y_{11}]\} \\ &\quad + v_1 (1 - a_{11})^{-1} y_{11} \end{aligned} \quad (13)$$

$$\begin{aligned} GDP_2 &= v_2 x_2 = (v_2 b_{21} y_{11} + v_2 b_{22} y_{21} + v_2 b_{21} y_{12} + v_2 b_{22} y_{22}) \\ &= v_2 \{b_{21} y_{11} + b_{22} y_{21} + [b_{21} y_{12} + b_{21} a_{12} (1 - a_{22})^{-1} y_{22}]\} \\ &\quad + v_2 (1 - a_{22})^{-1} y_{22} \end{aligned} \quad (14)$$

The output GDP of the entire world is also easy to calculate:

$$\begin{aligned} GDP &= GDP_1 + GDP_2 = v_1 x_1 + v_2 x_2 \\ &= (1 - a_{11} - a_{21})x_1 + (1 - a_{12} - a_{22})x_2 \\ &= y_1 + y_2 \end{aligned} \quad (15)$$

## 2.2. Measurement Indicators of International Competitiveness

### 2.2.1. Traditional International Competitiveness Measurement Indicators

1. The international market share is:

$$IMS_{ab} = X_{ab} / X_{wb} \quad (16)$$

This indicator measures a country's total exports of a certain type of product, reflecting a country's share in international trade exports and international status and competitiveness.

2. The trade competitiveness index is:

$$TC_{ab} = (X_{ab} - M_{ab}) / (X_{ab} + M_{ab}) \quad (17)$$

In equation (17),  $M_{ab}$  is the total imports of  $b$  products in  $a$  countries, and the size fluctuates between  $\pm 1$ . It is most competitive when it is equal to 1 and weakest when it is equal to  $-1$ .

Table 1 shows the criteria for judging the trade competitiveness index. When the value is greater than 0, it indicates that the country's products have a competitive advantage, and greater than 0.8, the competitive advantage is very obvious. When the value is less than 0, the country's products have a competitive disadvantage, less than  $-0.8$ , the competitive disadvantage is very obvious.

Table 1: Judgment criteria of the trade competitiveness index

| Judgment Criteria        | Degree of competitiveness                   |
|--------------------------|---------------------------------------------|
| $TC > 0.8$               | Very clear competitive advantage            |
| $0.5 \leq TC \leq 0.8$   | More obvious competitive advantage          |
| $0 < TC < 0.5$           | Competitive advantage, but not obvious      |
| $-0.5 < TC < 0$          | Competitive disadvantage, but not obvious   |
| $-0.8 \leq TC \leq -0.5$ | Relatively obvious competitive disadvantage |
| $TC < -0.8$              | Very obvious competitive disadvantage       |

3. The index of revealed comparative advantage is:

$$RCA_{ab} = (X_{ab}/X_a) / (X_{wb}/X_w) \quad (18)$$

In equation (18),  $X_a$  is the total exports of all goods and services in country  $a$ , and  $X_w$  is the total exports of all goods and services in the world.

Table 2 shows the criteria for judging the indicative comparative advantage index. When the value exceeds 2.5, it means that the country's products are highly competitive internationally. A value between 2.5 and 1.25 indicates that the country's products are internationally competitive. A value between 1.25 and 0.8 indicates that the country's products are generally competitive internationally. If the value is lower than 0.8, it means the competitiveness is weak.

Table 2: Judgment criteria of the index of indicative comparative advantage

| Judgment Criteria        | Competitiveness degree                |
|--------------------------|---------------------------------------|
| $RCA > 2.5$              | Extremely competitive internationally |
| $1.25 \leq RCA \leq 2.5$ | Strong international competitiveness  |
| $0.8 \leq RCA \leq 1.25$ | Medium international competitiveness  |
| $RCA < 0.8$              | Weak international competitiveness    |

4. The net export indicative comparative advantage index is:

$$NRCA_{ab} = (X_{ab}/X_a) - (M_{ab}/M_a) \quad (19)$$

In equation (19), a result greater than 0 indicates international competitiveness and a result less than 0 indicates no international competitiveness.

(5) Although the international market share, the index of revealed comparative advantage, the trade competitiveness index, and the index of net exported revealed comparative advantage are commonly used to measure international competitiveness, these four indicators are different. The international market share and the indicative comparative advantage index are selected by the export value. The net export revealed comparative advantage index and the trade competitiveness index are selected by the number of

imports and exports. The difference in data selection makes the analysis results of these four indicators may be different.

All four indicators can make a scientific evaluation of international competitiveness, but the scope of application of each indicator is different and each has its own shortcomings, so the international competitiveness of a country's trade cannot be judged based on the size of one of the indicators. In order to objectively and accurately measure a country's international competitiveness, it is necessary to use all four indicators together.

### 2.2.2. Measurement Indicators Based on the International Competitiveness of Value-Added Trade

1. The international market share under value-added trade is

$$IMS_{ab}^{TiVA} = X_{ab}^{TiVA} / X_{wb}^{TiVA} \quad (20)$$

2. The trade competitiveness index under value-added trade is

$$TC_{ab}^{TiVA} = (X_{ab}^{TiVA} - M_{ab}^{TiVA}) / (X_{ab}^{TiVA} + M_{ab}^{TiVA}) \quad (21)$$

$M_{ab}^{TiVA}$  is the domestic value added of industries or products of category  $b$  in country  $a$  reflected in final demand, i.e., the value added of imports of industries or products of category  $b$  in country  $a$ .

3. The index of revealed comparative advantage under value-added trade is

$$RCA_{ab}^{TiVA} = (X_{ab}^{TiVA} / X_a^{TiVA}) / (X_{wb}^{TiVA} / X_w^{TiVA}) \quad (22)$$

4. The index of net export revealed comparative advantage under value-added trade is

$$NRCA_{ab}^{TiVA} = (X_{ab}^{TiVA} / X_a^{TiVA}) - (M_{ab}^{TiVA} / M_a^{TiVA}) \quad (23)$$

## 3. Kernel Density Estimation Method

### 3.1. Kernel Density Estimation

Kernel density estimation is a method of nonparametric probability density estimation, i.e., for problems where the distribution of the observed data is unknown, no distribution assumptions are made about it, and the probability density function is modeled based on the observed data itself. The details are as follows:

Suppose  $Y_1, Y_2, \dots, Y_n$  is  $n$  sample data taking values in the continuous distribution  $f(y)$ ,  $y \in \mathbb{R}$  and let function  $\hat{f}(y)$  be the kernel density estimate of  $f(y)$ , then the expression of  $\hat{f}(y)$  is:

$$\hat{f}(y) = \frac{1}{nh} \sum_{i=1}^n K\left(\frac{y - Y_i}{h}\right), \quad y \in \mathbb{R} \quad (24)$$

That is, the corresponding probability density functions can be obtained separately for different known sample data  $Y_i (i = 1, 2, \dots, n)$ , and then the  $n$  obtained probability density functions are summed and averaged to obtain the kernel density estimate of the continuous distribution  $f(y)$ . In equation (24),  $n$  is the number of samples of known independent identically distributed random variables.  $K(\cdot)$  is called the kernel function, which determines the role played by each sample data point in the density estimation of the random variable  $y$ .  $h$  is the window width, which affects the smoothness of the probability density estimate.

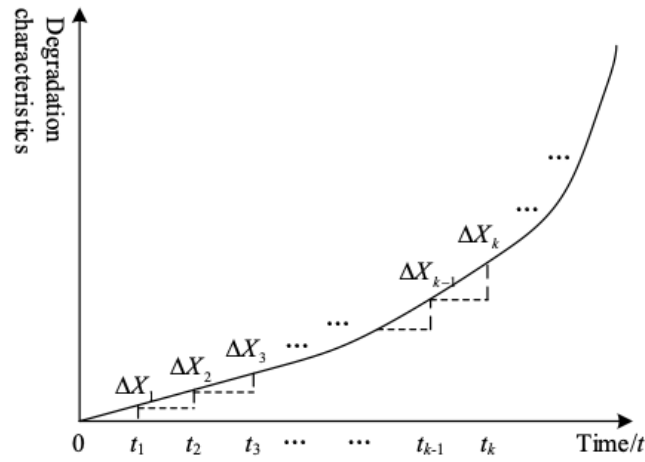


Figure 1: Degradation characteristic curve schematic diagram

### 3.2. Construction of Kernel Density Estimation Model

In practical application, let  $t_k$  be the currently monitorable moment and the monitoring data of  $[0, t_k]$  be the currently receivable equipment degradation data, then the trend of the corresponding equipment degradation characteristics with monitoring time can be obtained. The degradation characteristic curve is shown in Figure 1.

Let  $\Delta X_1, \Delta X_2, \dots, \Delta X_k$  be  $k$  samples of independently and identically distributed randomly degenerate characteristic increments sampled at time  $[0, t_k]$ , and the probability density function it obeys is denoted  $f_k(\Delta x)$ . The kernel density estimate  $\hat{f}_k(\Delta x)$  of the unknown density function  $f_k(\Delta x)$  can be expressed as

$$\hat{f}_k(\Delta x) = \frac{1}{kh_k} \sum_{i=1}^k K\left(\frac{\Delta x - \Delta X_i}{h_k}\right) \quad (25)$$

## 4. Optimization Analysis of International Trade Value-Added Measurement in the Context of Digitalization

### 4.1. Value Added in International Trade in the Context of Digitalization

#### 4.1.1. Development of China's Foreign Trade Value Added

China's foreign trade value-added share in the world has been rising rapidly from 2005 to 2011. Currently, China's trade value-added share in the world ranks second in the world, after the United States. Data on the development of China's value-added in export trade are shown in Table 3. The average annual growth rate from 2005 to 2011 reached 16.57%, which is higher than the US's 16.13% and much higher than Japan's 4.02%.

#### 4.1.2. China's Foreign Trade Value-Added Location Distribution

The value added to China's export trade is mainly distributed in developed countries, and from 2005 to 2011, the proportion of China's trade value added to developed countries is higher. Table 4 shows the trade value added obtained by China's exports to developed countries and developing countries. Among them, 82.71% of the total value added of China's exports to developed countries in 2005 and 75.08% in 2011. In contrast, China's trade value added to developing countries accounted for 17.65% of the total value added in 2005 and 27.93% in 2011.

Table 3: Development of added value in China's export trade

| Year | Trade value added (million USD) | Share of global (%) | Ranking |
|------|---------------------------------|---------------------|---------|
| 2005 | 489561.45                       | 5.46                | 4       |
| 2008 | 1027911.33                      | 7.32                | 3       |
| 2010 | 1225603.57                      | 8.79                | 2       |
| 2011 | 1346891.06                      | 9.12                | 2       |

Table 4: Value added of trade in exports to developed and developing countries

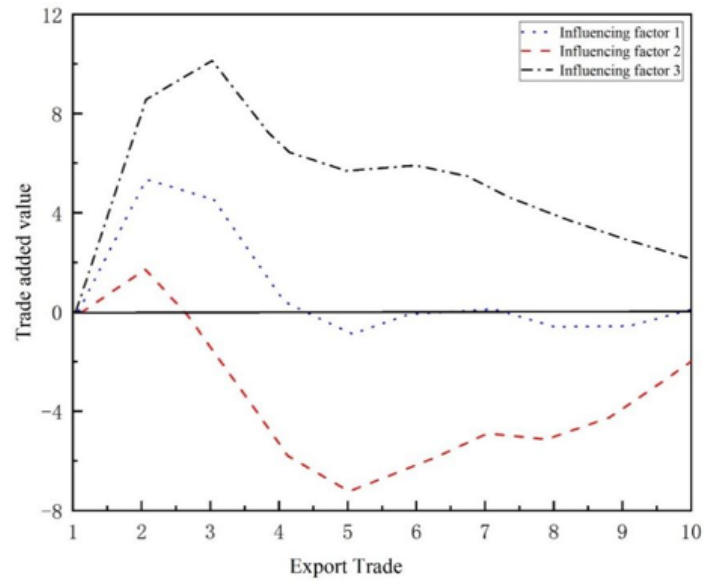
| Year | Developed Countries |            | Developing Countries |            |
|------|---------------------|------------|----------------------|------------|
|      | Trade Value Added   | Proportion | Trade Value Added    | Proportion |
| 2005 | 361354.62           | 82.71%     | 80128.72             | 17.65%     |
| 2008 | 658471.23           | 71.32%     | 224114.57            | 25.54%     |
| 2010 | 693247.36           | 73.62%     | 264137.27            | 26.17%     |
| 2011 | 846197.72           | 75.08%     | 331854.67            | 27.93%     |

#### 4.2. Optimization of International Trade Value-Added Measurement Based on Kernel Density Estimation Method

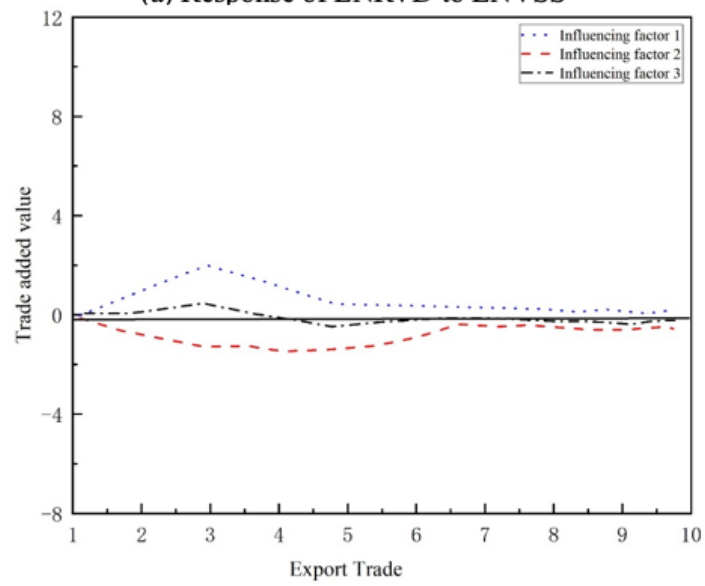
Optimization of international trade value-added measurement based on kernel density estimation algorithm in the digital context, studying its distribution characteristics from the data itself, can avoid the problems of existing model structure assumptions and parameter estimation. In many practical cases, the study variables are often not defined over the entire real number domain, but there are bounded intervals with one or two boundaries. In this chapter, a method based on kernel differential homogeneous estimation is proposed for the kernel density estimation algorithm, which has the problem of boundary estimation bias when kernel density estimation is performed for bounded random variables. The degree of influence of each influencing factor on the export trade addition rate is further verified. The analysis of the influence of each influencing factor on the export trade addition rate is shown in Figure 2.

From the figure, the following conclusions can be drawn:

1. The export trade addition rate responds more strongly to shocks to the degree of vertical specialization in the international division of labor. For a positive shock to the VSS, the RVD is positively affected from period 2 and gradually weakens from period 4. It indicates that in the short run, the increase in the degree of vertical specialization causes a relatively large positive impact on the export trade addition rate, but this effect gradually weakens and contributes to the overall increase in the export trade addition rate.
2. The response of the export trade addition rate to shocks to medium and high-level labor inputs is relatively smooth. For a positive shock to the HHM, the RVD is positively affected from period 2 and reaches a peak in period 3, after which the effect gradually decreases. It indicates that the increase in middle and higher level labor input leads to an increase in export trade addition rate, but the impact is smaller.
3. In the short run, the export trade addition rate has a large impact on its own changes, but this impact weakens significantly over time, dropping to 67.7% in period 2. From period 3 onward, it is stable at 63% to 67%. Second, the degree of vertical specialization is the main factor affecting the export trade addition rate. From period 3, its impact on the export trade addition rate accounts for 37.2% of the level. It indicates that in the long run, nearly 36.2% of the fluctuating changes in the export trade addition rate are influenced by the degree of vertical specialization.



(a) Response of LNRVD to LNVSS



(b) Response of LNRVD to LNHHM

Figure 2: Impact of each influencing factor on export trade addition rate

## 5. Conclusion

Export trade benefits, to a certain extent, depend on the expansion of export size. In this paper, based on the theoretical analysis of the factors affecting the trade value-added rate, a kernel density estimation algorithm model is constructed, and a quantitative empirical analysis of the factors influencing the country's export trade value-added rate is conducted.

The results of the analysis found that the index of vertical specialization degree and the input of middle and senior-level labor is positively correlated with the export trade value-added rate. The gradual increase in the level of participation in the international division of labor and the increase in the level of medium- and high-level labor input lead to an increase in the unit value added obtained from export trade. In the short run, after a positive shock from the degree of vertical specialization, the export trade addition rate will increase to a certain extent in the short run, while the shock effect of the level of medium and high-level labor input is smaller. In the long run, the degree of vertical specialization is the main factor affecting the export trade addition rate, except for the export trade addition rate itself, which is maintained at about 36.2% in the long run.

## 6. Discussion

The analysis of the trends in the value added of export trade and its added rate shows easily that the increase in trade value-added relies to some extent on the expansion of the export trade scale. Therefore, the country should focus on strengthening trade relations with emerging economies on the basis of strengthening cooperative relations with trade partner countries. Promote the strategy of free trade zones and establish strong, unified, and mutually beneficial partnerships, thus expanding the scale of export trade and increasing trade value added.

Enterprises to strengthen the understanding of the added value of the product, and understand that real market competition is the competition of the inherent quality of the product differences, rather than pure price competition, playing unnecessary price war can only lead to a lose-lose situation. Export trade enterprises face market competition not only from domestic enterprises in the same industry but also from all outstanding enterprises in the world. Therefore, enterprises should focus their attention on improving production efficiency and increasing the added value of product export trade. Industry associations should give full play to their own joint advantages and industrial appeal, so that more small enterprises to participate in the industrial division of labor, in a certain field to do fine and specialized, different divisions of enterprises cooperate closely with each other to make the cake bigger, giving full play to the external economies of scale. At the same time, cultivate a number of excellent leading enterprises to large-scale, integrated direction.

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