Analysis on the sources of value added of American crop exports and employment

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ABSTRACT

This paper uses the WIOD database combined with the global value chain decomposition to measure the value added of the crop industry and other industries included in the US crop exports. Use the employment coefficient to further analyze the impact of US crop exports on the employment of its own industry and other industries and the impact of exports from other industries on employment in the crop industry. We found: (1) The value-added of the service industry included in the export of the US crop industry is higher than that of the manufacturing industry and the primary industry. (2) Among the exports of other industries, the crop industry included in the manufacturing export has the most value-added and continues to increase, while the value added of the service industry and the primary industry is low. (3) The number of employed people in the industry driven by the export of the US crop industry is increasing. Among the other industries, the service industry has the largest number of employed people driven by the export of the crop industry.

Introduction

The United States is a world economic power, a strong agricultural country, and the world’s largest agricultural exporter. Before the Sino-US trade friction, China was the largest importer of US agricultural products. However, affected by Sino-US trade, US agricultural exports were suppressed to a certain extent. The US New Farming Act, which came into effect on February 7, 2014, continues the tradition of promoting agricultural export projects. One of the main responsibilities of the US Department of Agriculture’s (Foreign Agricultural Service, FAS) is to increase the competitive position of US agriculture on a global scale. With the further deepening of international production segmentation, the division of labor in global trade is becoming more and more detailed. Foreign product recognition is the method of splitting a company’s whole global market as one or even more sections or sub-markets, which are homogenous in all major aspects. Geographical location, such as countries or regions, cultural features, macroeconomic variables, smart devices, demography, consumer tastes, and life-styles are all instances of generic global categorization bases. Agricultural products, as one of the few trade surplus industries in the US foreign trade, have attracted more and more attention from scholars. In this context, this paper calculates the value added of the industry included in the export by decomposing the sources of increased exports from the US industry. Combined with the labor employment coefficient to calculate the employment number driven by the export of crop industry, portray the export path of the US crop industry. Self-employed individuals are much less likely to be influenced by labor force restrictions than employees that have a defined company. The usage of the self-employed as a reference is also allowed, with each row reporting the coefficients on the supplied economic cycle signal, an interception, and a parabolic tendency in a linear regression squares analysis of that page’s predictor variables upon on marker (Nie et al. 2021).

Research on the decomposition of global value chains has become increasingly perfect since Koopman et al. (2014). Wang et al. (2013) decomposed the export into four parts: domestic value added, foreign added value, export return and double counting (Wang et al. 2013). Dai Xiang (2016) refers to the export value-added decomposition method and decomposes the export from the perspective of the
source of added value (Xiang 2016). The difficulty of double accounting in export revenues, the computation of global valuation free of every duplicate accounting, and the breakdown of export revenues at the organizational level are all handled by Segmentation of Value-Added Systems. With the development of global value chain theory, the research on employment issues associated with it has also increased. The most classic study of the American problem is Feenstra et al. (2019) (David et al. 2013). Global value chains (GVCs) refer to international production sharing, a phenomenon where production is broken into activities and tasks carried out in different countries. They can be thought of a large-scale extension of division of labor dating back to Adam Smith’s time (Zhang et al. 2021). By constructing a monopolistic competition model, it analyzes the impact of the US labor market on imported Chinese products. Pierce and Schott (2016) measure the impact of imported China on employment in the United States by making a DID (Differences in Differences) in tariffs (Pierce and Schott 2016). Such studies include Acemoglu et al. (2016), Handley and Limão (2017), Amiti et al. (2017).

Feenstra and Sasahara (2018) found through the calculation of the input-output table of 1995–2011 that the employment in the manufacturing sector caused by US exports increased by about 2 million and the resource industry increased by about 500,000. The service industry has increased by about 4.1 million, of which about one-third of employment is due to the export of intermediate goods (Fan et al. 2019). If the United States implements a trade protection policy, the intermediate products exported by the US service industry will be affected, and employment will drop significantly. Chinese scholar also use the input-output table and the labor employment coefficient of the SEA (Socio Economic Accounts) account to calculate the impact of US exports on employment by decomposing exports (Lin et al. 2018). They found that Sino-US trade not only affects the employment of both countries in the bilateral trade, but also promotes employment in other countries in the value chain.

At present, most of the literature studies American agricultural issues from the perspective of agricultural policies. These documents lack the source of value-added for US agricultural exports, and there is no specific literature on export employment analysis for the US crop industry. Although US agricultural exports account for a small share of US GDP, agricultural status should be valued as a basis for industrial development. Therefore, this paper analyzes the employment of the United States in combination with the value-added export decomposition and US crop exports.

Shipping costs have dropped dramatically, and advances in technological tools, as well as business and investment deregulation, have made it easier to split the manufacturing process over multiple nations. As a reason, the global value chain has become increasingly important. The value-added inferential statistics breaks down the global value chains (GVC) of exporters and gives clarification in such instances. It breaks down China’s gross imports into the elements that make up total GDP in the nation’s income, particularly valuation export industries (Abdel-Basset et al. 2018). From the perspective of global value chain decomposition, this paper uses Dai Xiang (2016) to decompose the sources of export value added, and uses the World Input-Output Database (WIOD) database to analyze the sources of export value added by the US crop industry (Xiang 2016), as well as the added value of the crop industry included in the export of other industries. Input-Output in the World For the years 2000–2014, there are charts and underlying information for 43 nations, as well as a models for the rest of the globe. The Internationally Accepted Industry Taxonomy version 4 is used to classify data for 56 industries. And in conjunction with the Socio-Economic Accounts (SEA), the employment of the US crop industry exports is accounted for. Industry-level statistics on labor, such as the number of employees and academic achievement, company marketing, gross output, and added value at constant current pricing, are included in the socio-economic statistics. The classification of industries is the same as that of the world interface statistics. The system is intended to help sociologists, program architects, and public policymakers better consider the implications of different areas of political expenditures on the personal standard of living, comparative social standing of individuals and groups, and social and community fellow human (Billah et al. 2021). Compared with the previous literature, the improvement of this paper mainly includes: (1) Decomposing the source of export value added to the industry level, and subdividing the source of export value of the US crop industry into three aspects: primary industry, manufacturing industry and service industry. (2) Calculating the added value of the crop industry included in the export of other industries, and measure the value added of the crop industry implicitly in the primary industry, manufacturing and service exports through the analysis of the source value of export value added; (3) Calculating the employment driven by the export of the US crop industry, combined with the decomposition of export value added and the employment coefficient to calculate the employment of the industry and related industries driven by the export of the US crop industry.
The structure of this paper is as follows: the second part is the theoretical basis and the data source part; the third part is the empirical analysis of the source value decomposition of the crop industry in the United States; the fourth part is the export promotion of the crop industry and the employment of the industry related to the crop industry. Situation analysis; the fifth part is the conclusion part of this article, which has a general summary of the full text; The fifth part is the conclusion part of this paper, which has a general summary of the full text.

### Theoretical framework and data sources

#### Theoretical framework

In the context of global value chains, multi-country and multi-sector input-output tables generally use a non-competitive input-output table (MRIO). Establish a basis to quantify the domestically value-added and occupation created from each piece of export earnings, exporters by industry, and export markets by commodity accordingly, using a non-competitive information model that incorporates China’s processed industry. The multi-country multi-sector input-output model mainly includes two parts of intermediate goods and final product consumption. Multi-Regional Input Output Modeling is an economics technique that tracks economic activities between major economic sectors in multiple nations. By assembling information from the National Footprint and Fragile ecosystems Assessments, MRIO techniques can be expanded from cash transactions to predict capital investments. You can analyze the movement of resources via the supply chain using MRIO-based Footprint information. The following table gives a simple G×N, that is, the input-output model of the G Country N department. The implicit assumptions in the table are: open markets, free flow of resources, and products produced in each country are used for intermediate products and final product consumption in the country and other countries, and there are no other trade costs, as shown in Table 1.

The column on the far right in the table represents the total output in the input-output table, and the second-to-last row represents the total output, which are numerically equal. The $Z_{ij}$ in Table 1 indicates the input value of the products used in the country $s$ sector $i$ for the products produced by the country $r$ department $j$. $Y^g_i$ represents the value of the final product produced by the country $s$ sector $i$ for the final consumption of the country $r$. $X^g_i$ represents the total output value of the country $s$ sector $i$. $A$ is a matrix of input-output coefficients, $GN \times GN$ order matrix. Obviously $A = ZX^{-1}$, where $Z$ represents the entire input-output value matrix, which is a $GN\timesGN$ order matrix, i.e.: $Z = [Z_{ii} \cdots Z_{in}]$, $X$ is the total input matrix, which is a $GN \times 1$ order matrix. From the nature of the input-output table, the total input is equal to the total output. Thus, there are:

$$
\begin{bmatrix}
X^1 \\
X^2 \\
\vdots \\
X^g
\end{bmatrix} = 
\begin{bmatrix}
A_{11} & A_{12} & \cdots & A_{1g} \\
A_{21} & A_{22} & \cdots & A_{2g} \\
\vdots & \vdots & \ddots & \vdots \\
A_{gg} & A_{g2} & \cdots & A_{gg}
\end{bmatrix}
\begin{bmatrix}
X^1 \\
X^2 \\
\vdots \\
X^g
\end{bmatrix}
+ 
\begin{bmatrix}
y^1 \\
y^2 \\
\vdots \\
y^g
\end{bmatrix}
$$

(1)

Where $X^g$ represents the total output of country $g$, and $Y^g$ represents the final demand of country $g$, including the final demand at home and abroad. Both $X^g$ and $Y^g$ belong to the $N\times 1$ matrix. Obviously, the total output value is composed of the intermediate product demand and the final product demand. The variables economy multiplier that assesses the subsequent influence on the population as a consequence of an original increase in output of an economic growth branches.

### Table 1. Input and output table of G Country N department.

|        | Intermediate input |        |        | Final products |        |        |        | Total output |
|--------|-------------------|--------|--------|----------------|--------|--------|--------|--------------|
|        | l                 | g      | l      | g               | l      | g      | l      | g           |
| $t$    | $z_{11}^l$        | $z_{11}^g$ | $z_{1l}^l$ | $z_{1l}^g$ | $y_{11}^l$ | $y_{11}^g$ | $x^l$ |
| $n$    | $z_{1l}^l$        | $z_{1l}^g$ | $z_{ll}^l$ | $z_{ll}^g$ | $y_{1l}^l$ | $y_{1l}^g$ | $x^l$ |
| $g$    | $z_{1g}^l$        | $z_{1g}^g$ | $z_{lg}^l$ | $z_{lg}^g$ | $y_{1g}^l$ | $y_{1g}^g$ | $x^l$ |
| $n$    | $z_{lg}^l$        | $z_{lg}^g$ | $z_{nn}^l$ | $z_{nn}^g$ | $y_{ng}^l$ | $y_{ng}^g$ | $x^l$ |
| Total input | $x^l$ | $x^g$ | $x^l$ | $x^g$ |
| Value-added | $v_{l1}$ | $v_{l1}$ | $v_{g1}$ | $v_{g1}$ |
are shown in the Leontief Inverse Matrix. The current and voltage Leontief technique is often used to estimate the consequences of potential adverse environmental shocks, as well as to evaluate the unforeseen consequences across an organization (Orjuela et al. 2020). According to the Leontief inverse matrix equation, it can be concluded that 2:

\[
\begin{bmatrix}
X^1 \\
X^2 \\
\vdots \\
X^9
\end{bmatrix} = \begin{bmatrix}
I - A^{11} & -A^{12} & \cdots & -A^{1g} \\
-A^{21} & I - A^{22} & \cdots & -A^{2g} \\
\vdots & \vdots & \ddots & \vdots \\
-A^{91} & -A^{92} & \cdots & I - A^{9g}
\end{bmatrix}
\begin{bmatrix}
Y^1 \\
Y^2 \\
\vdots \\
Y^9
\end{bmatrix}
\]  

\[
= \begin{bmatrix}
B^{11} & B^{12} & \cdots & B^{1g} \\
B^{21} & B^{22} & \cdots & B^{2g} \\
\vdots & \vdots & \ddots & \vdots \\
B^{91} & B^{92} & \cdots & B^{9g}
\end{bmatrix}
\begin{bmatrix}
Y^1 \\
Y^2 \\
\vdots \\
Y^9
\end{bmatrix}
\]  

(2)

That is: \( X = BY \), where \( B = (I - A)^{-1} \), the Lyon Cove inverse matrix represents the value of the intermediate product required to increase the input per unit; \( Y = [Y^1 Y^2 \cdots Y^9] \), is the total output matrix, \( GN \times 1 \) matrix. The value-added coefficient matrix \( V = Vax^{-1} \), where \( Va = [Va_1 Va_2 \cdots Va_s] \), is a \( 1 \times GN \) order matrix. An inverse on one end of the Lyon Cove inverse matrix is inherently an inversely on the other end. With reference to Dai Xiang (2016) export value-added source decomposition model, combined with the decomposition of the exporting country's industry level, a country's export value-added source can be decomposed, which is:

\[
TV = \hat{V}BE
\]

\[
= \begin{bmatrix}
0 & \cdots & 0
\end{bmatrix}
\begin{bmatrix}
B^{11} & \cdots & B^{1g} \\
B^{21} & \cdots & B^{2g} \\
\vdots & \ddots & \vdots \\
B^{91} & \cdots & B^{9g}
\end{bmatrix}
\begin{bmatrix}
Y^1 \\
Y^2 \\
\vdots \\
Y^9
\end{bmatrix}
\]

\[
\hat{V} = Va_x X^{-1},
\]

is the diagonalization of the matrix of increasing value coefficients, which is \( GN \times GN \) order matrix. \( V \) is the value of added value per unit of output; \( \hat{E} \) is the diagonalization of the exit matrix, belonging to \( GN \times GN \) order matrix. \( E \) represents the total exit matrix, belongs to the \( GN \times 1 \) order matrix. \( \hat{E} \) represents the diagonalization of the export of the sth country, where \( E \) represents the total export of the s country, belonging to the \( N \times 1 \) matrix. The column vector in (3) represents the value-added of other countries included in the export of a country, as indicated by the value-added of country j included in the export of the ith country. The row vector represents the distribution of the value-added of a country among countries, such as the value added of the ith country in the export of country j. Specific to the industry level, one country’s exports will include the value-added of other industries, which is:

\[
\hat{V}^i B^{is} E^i = \begin{bmatrix}
v^i_1 b^1 s^{is} e^i_1 & \cdots & v^i_{n} b^1 s^{is} e^i_{n} \\
v^i_1 b^2 s^{is} e^i_1 & \cdots & v^i_{n} b^2 s^{is} e^i_{n} \\
\vdots & \ddots & \vdots \\
v^i_{n} b^s s^{is} e^i_{1} & \cdots & v^i_{n} b^s s^{is} e^i_{n}
\end{bmatrix}
\]

(4)

The left side of the formula (4) indicates the pure national value-added part included in the export of the country, and the column on the right side indicates that the department’s export contains the value-added from the department and other departments. The line indicates the export value-added share of a certain department in its own department and other departments. For example, \( v^i_j b^j s^{is} e^i \) represents the value-added of the j department included in the export of the ith sector of the country s, and the value-added of the i department included in the export of the ith department of the country s can be expressed by \( v^i_j b^j s^{is} e^i \). In the export of the s country, the value-added of the ith department driven by other departments can be expressed as the sum of the value-added of the ith department driven by the export of other departments, which can be calculated as:

\[
VA^i_s O = \sum_{j \neq i} v^i_j b^j s^{is} e^i
\]

(5)

\( VA^i_s O \) indicates the sum of the value-added of the ith department in the export of other departments. From the decomposition of export value-added, it is possible to have a clearer map of the sources of value added in a country’s exports, which is done from different perspectives with the decomposition methods of Koopman et al. (2014) and Wang et al. (2013). Decomposition is a method of solving the problem by dividing it down into smaller chunks and tackling every one individually, in either simultaneously or in order. It is carried out in a systematic fashion; the benefit comes from the fact that issue difficulty develops exponentially.
rather than sequentially. Because there is some connection or contact between both the subsection vectors, the issues cannot be handled individually, which is a more intriguing situation. They decompose the export into domestic value added, foreign value added, export return part and double calculation from the perspective of value added decomposition. Regardless of the decomposition method, it shows that the trade between countries is not the traditional meaning of the final product exports. Indirect product export trade is becoming more frequent, and departmental exports often include value added from other departments and other sectors in other countries. Selling items through an intermediate, which then sells them straight to consumers or import distributors, is known as indirect exporting. The simplest approach to discover an intermediate to assist you in personal selling is to search for just one with your own nation. Indirect and direct marketing are the two most popular methods of importing. An exporting middleman, such as an export management firm (EMC) or an exporting trading platform (ETC), fully responsible for locating overseas clients, exporting products, and receiving payment in indirectly selling. The corresponding employment situation is similar to the source of value added in exports. The export products of a certain department of a certain country can not only promote the employment of the department, but also have an impact on the employment of other related departments and other countries. Using the employment coefficient, combined with the export value added decomposition measured by Dai Xiang (2016), it can analyze the employment situation driven by a country’s exports. The specific calculation method is as follows:

\[
\text{Temp} = \tilde{W} \tilde{V} \tilde{B} \tilde{E} = L \tilde{B} \tilde{E}
\]

\[
= \begin{bmatrix}
\tilde{L}^1 & \cdots & 0 \\
\vdots & \ddots & \vdots \\
0 & \cdots & \tilde{L}^9
\end{bmatrix}
\begin{bmatrix}
B^{11} & \cdots & B^{19} \\
\vdots & \ddots & \vdots \\
B^{91} & \cdots & B^{99}
\end{bmatrix}
\begin{bmatrix}
\tilde{E}^1 & \cdots & 0 \\
\vdots & \ddots & \vdots \\
0 & \cdots & \tilde{E}^9
\end{bmatrix}
\]  

(6)

The beneficial distinction between both the mortgage and revalorized cartographic revenue is regarded a highly qualified income by the value-added correlation for the measurement of rental advantages of a construction who is an advantageous life investment recipient or former owner to the corporation or affiliation in which the corresponding person performs his exercise. In the above formula, \(\tilde{W} = (\text{Emp})^{\dagger}(\text{Va})^{-1}\) is the diagonalization of the matrix of the employment added value coefficient, belonging to the GNxGN order matrix, and \(W\) is the number of laborers required for each unit of increasing value, and belongs to the GNx1 order matrix; The economic meaning of \(\tilde{V}\) and \(\tilde{E}\) is the same as before; \(\tilde{L} = (\text{Emp}) X^{-1}\) is the diagonalization of the employment output coefficient matrix, which is the GNxGN order matrix, and \(L\) represents the labor force employed for each unit of output produced. Belongs to the GN x 1 order matrix. \(\tilde{L}^i\) indicates the diagonalization of the employment coefficient matrix of the country of \(s\), which is an Nxn-order diagonal matrix. \(\text{Temp}\) represents the employment matrix of 43 countries and ROW, which is the matrix of the labor force employment after decomposition. The column vector of (6) represents the employment effect of a country’s imports, including the employment effect of the country and other countries. The row vector represents a country’s export employment effect decomposition, including the employment effect driven by domestic exports and the domestic employment effect driven by other countries’ exports. From (6) we can calculate that the national employment value caused by the export of \(s\) country should be:

\[
\tilde{\text{Emp}}^i = \tilde{L}^i B^i \tilde{E}^i = \begin{bmatrix}
\tilde{l}_{i1}^{bs} e_1^i & \cdots & \tilde{l}_{i1}^{bs} e_n^i \\
\vdots & \ddots & \vdots \\
\tilde{l}_{in}^{bs} e_1^i & \cdots & \tilde{l}_{in}^{bs} e_n^i
\end{bmatrix}
\]

(7)

In the formula, \(\tilde{l}_{ji}^{bs} e_j^i\) represents the number of employed persons in the \(i\) department driven by the export of the \(j\)th department of the country \(s\), and \(\tilde{l}_{ji}^{bs} e_j^i\) represents the employment of the \(j\)th department driven by the export of the \(i\)th department of the country \(s\). The column vector in (7) represents the number of employed people driven by the export of a certain department, including employment in the department and employment in other sectors. The row vector indicates the employment of a certain department driven by the export, including the employment of the department driven by the export of the department and the employment of the department driven by the export of other departments. In the \(i\)th department of the country, the employment driven by other departments can be expressed as the sum of the employment of the \(i\)th sector driven by all other sectors, which is expressed as:

\[
\tilde{\text{EMP}}^i_{O} = \sum_{j \neq i}^{n} \tilde{l}_{ji}^{bs} e_j^i
\]

(8)

\(\text{EMP}^i_{O}\) represents the sum of employment driven by other sectors in the employment of the \(i\) sector in
country. As a result, the sources of value-added in the export of a country have been comprehensively decomposed. Combined with the labor employment coefficient, it is possible to calculate the number of employed people driven by the export of the certain industry in and the number of employed people driven by other sectors’ exports.

**Data descriptions**

The main method used in this paper is to use multi-country multi-sector (MRIO) input-output analysis. By decomposing sources of value added in exports, it is possible to distinguish between sources of value added in a country’s trade. The input-output table data used in this paper is derived from the World Input-Output Database (WIOD) organized by the European Commission. The database has been updated in 2016 to calculate the current value of the total input and output value of the major countries in the world (in millions of US dollars), covering 28 countries in the European Union and the United States, Canada, China, Japan, South Korea, China and Taiwan and other 15 major countries and regions, the rest of the country together constitute an economy (ROW). The 2016 edition of WIOD data covers the years from 2000 to 2014. The SEAs include annual time series data on industry revenue, intermediate products, and wealth created for 56 industries from 2000 to 2014, as well as pricing sparking for the aforementioned variables. Volume indexes for the variables given above, at today's pricing, capital stocks are a good investment. Work, capital accumulation recompenses. The main industries covered include 56 industries such as agriculture, forestry, fishery, textile and garment leather, machinery and equipment, electro-optical products, transportation, and legal consulting management. Regarding the accounting of the employment coefficient, this paper uses the Socio-Economic Accounts (SEA) in the WIOD database. The account mainly includes employment figures, capital stock, total output, value added value, etc. at the industry level. The SEA database also has been divided into 56 industries, the classification is consistent with the industry classification of the WIOD database. Regarding the number of employed people in the SEA data, this article uses EMP (Number of persons engaged), that is, the number of people engaged in labor rather than the number of employees (EMPE, Number of employees), EMP can better reflect the employment status of crop industry. Rural labor wages have increased, but its impact on real wages has dropped as the labor-to-land ratio has continued to increase across the probability sampling. Despite the fact that agriculture’s part in the economy overall has been progressively declining during the region’s development plan. For industry classification, this paper refers to the classification of Fan Z et al. (2019) (Feenstra and Sasahara 2018). This paper divides 56 industries of WIOD database into four categories, namely, crop industry (first industry), primary Industry (2–4th industry, i.e. resource industry), manufacturing industry (5–23 industry), and service industry (24–56). The agricultural exports studied in this paper use the first category of the WIOD classification industry, namely: Crop and animal production, hunting and related service activities. For industries other than the crop industry, this article uses the primary industry, manufacturing, and service industries as a general division.

**Analysis of the value-added of US crop exports**

From the perspective of global value chains, US crop industry exports involve value-added trade in other industries. This section first distinguishes the sources of value added of US crop exports, and divides the value added of crop exports into two parts: the export value added within the industry and the value added of exports from other industries. In addition, the value added of other industries included in the crop exports is further divided into three parts: primary industry value added, manufacturing value added and service industry value added; Production value is the amount of production minus the cost of intermediate inputs; it is an indicator of an individual performer’s, industries in the world, or sector of the economy contribution to GDP; production value is the origin of the SNA’s main revenues and is thus passed forward towards the main industry. The overall estimation of net-output of any and all residential industrial activity units calculated by adding together outputs and deducting intermediary use is known as manufacturing added value. Non-core activities, or, in essence, all providers other than ordinary voice conversations and fax transfers, are referred to as ‘service sector value of a property’ in the telecommunication market. This can, conversely, be employed in just about any service sector to advertise their principal business by providing low-cost or even no products. This section will comprehensively analyze the export status of the US crop industry by calculating the value-added of the exports of crop industry in the primary industry, manufacturing, and service industries.

The total export value added of the US crop industry has an increasing trend as a whole, the value added within the certain industry exports and the value added of exports from other industries are increasing;
The export value-added within the certain industrial is higher than the value-added from other industries included in it. Figure 1 shows the total export value added of the US crop industry, the export value added within the industry, and the value added from other industries. As can be seen from the figure, the export value-added of the US crop industry has increased year by year from 2000 to 2008, from 15.88 billion dollars in 2000 to 59.56 billion dollars in 2008, and the increment in 2006–2008 is relatively large, which indicates that the intensity of US foreign trade and crop exports have increased. The export value-added of US crop industry drastically reduced between 2008 and 2009, reduced to 45.29 billion dollars in 2009, combined with the economic background of the subprime mortgage crisis in 2008, US crop exports were suppressed to a certain extent, and exports were reduced; In 2009–2014, the value added of exports began to increase, and the export of crops industry strengthened. However, in 2013, there was a certain degree of reduction. In general, the value added of US crop exports increased, as well as the foreign trade.

As can be seen from the above figure, the trend of the value added within the certain industry and the value added from other industries in the US crop exports is basically consistent with the trend of the increase in value-added by total exports. Both have a certain reduction in the period of 2008–2009 and 2012–2013. After 2002, the value added within the industry was significantly larger than that of other industries included. In 2000–2002, the added value of the two was basically equal. The value-added within the certain industry in the export is slightly lower than that of other industries. However, after 2003, the value-added of pure domestic exports is obviously faster than the increase of other industries. During the period 2003–2007, the gap between the two was not very large. In 2003, the export value-added within the industry and the value-added from other industries were 11.08 billion dollars and 9.04 billion dollars, respectively, which differed by about 2 billion dollars. In 2007, the added value of the two increased to 22.98 billion dollars and 18.71 billion dollars respectively. The difference between the two is about 4 billion dollars, which is not too large; After 2007, the domestic value-added in exports increased rapidly, and the value-added of other industries included decreased. The gap between the two began to increase. After 2007, the domestic value-added in exports increased rapidly, and the value-added of other industries decreased. The gap between the two began to increase. By 2014, the value-added of the two was 42.04 billion dollars and 27.02 billion dollars, respectively, which differed by about 15 billion dollars. From the results, the value-added of the sector in the US crop export trade is increasing, and the value-added of other industries is relatively low, and this trend is gradually increasing. The gap between the value-
added of the crop industry in the export and the value-added of other industries is widening.

Among the US export value-added, the proportion within the sector is increasing year by year. The proportion of service industry in the total value added of the export industry is declining; The proportion of the manufacturing industry is rising as a whole; And the proportion of the added value of the primary industry is not large; The value added of the primary industry has not changed much. Among the added value of total exports, the value-added within the sector is the main factor, followed by the value-added of the service industry. The proportion of the manufacturing industry and the primary industry account for the least (Figures 2 and 3).

In the above picture, the proportion within the certain industry is obviously rising. In 2000–2014, except for 2000 and 2002, which accounted for 49.59% and 49.20% respectively, the export value added of industries in other years accounted for more than 50%, and the highest year was 2013, reaching 62.73%. In addition to the relatively high value-added of the certain industry, among the proportion of value-added from other industries, the service industry accounts for the highest proportion, but overall it also has a downward trend. Among them, in 2000, the value-added of service industry included in the export of crop industry accounted for 32.91%, and the proportion in 2014 fell to 21.36%; the value-added of service industry reached the highest point of 34.98% in 2002, reaching the lowest point of 18.98% in 2011, and the service industry accounted for a small change in the 2008–2009 sub-prime mortgage crisis. The proportion of service industry has not changed much during the 2008–2009 subprime mortgage crisis. The proportion of manufacturing added value in the export of crops industry has not changed much between 2000 and 2014, and there is an overall upward trend. In 2000, the added value of manufacturing industry accounted for 12.07% of the value added of crop industry exports. In 2004, it dropped to 10.78%. In 2004–2008, the proportion of manufacturing value-added increased. In 2008, it reached 15.86%, which was the year with the highest proportion of manufacturing value-added between 2000 and 2014. It declined in 2008–2010 and began to rise after 2010. Overall, the share of manufacturing in the export value added of the crop industry is increasing year by year. And the proportion of value added in the primary industry has not changed much. The manufacturing proportion of the US crop industry exports has risen, and the value-added of service properties has declined. This shows that the relationship between the US crop export industry and the manufacturing industry has become closer, while the relative relationship with the service industry has declined.

Among the value-added of agricultural in exports of other industries, manufacturing is the mainstay, followed by service industry and primary industry. The value-added of agriculture included in manufacturing exports is much higher than the sum of agricultural value-added contained in exports of services and primary industries; Agricultural value-added in
manufacturing, services and primary industry exports is increasing. The chart below shows the changes in the value added of the crop industry included in US manufacturing, services and primary industry exports.

As can be seen from the figure, the value added of the crop industry in manufacturing exports is relatively high. In 2000, the value added of the crop industry in the US manufacturing exports was 3.9 billion dollars, and the value added in 2008 was 12.38 billion dollars. The increase is relatively large; In 2008–2009, affected by the subprime mortgage crisis, the value added of the crop industry in manufacturing exports declined, and began to rise rapidly after 2009. In 2014, 23.94 billion dollars were reached, the highest value-added year between 2000 and 2014, and the value added of the crop industry in manufacturing exports increased. The value added of the crop industry in the export trade of services is also rising, from 277.14 million dollars in 2000 to 1.27 billion dollars in 2014, and its development trend is consistent with the value added in manufacturing exports. There was a certain decline in 2008–2009 and a higher value-added in 2014. Among other industries, the export value of crops included in the primary industry exports is the lowest, reaching the maximum of the value-added in 2014, which is 149.14 million dollars. This proportion reaches lower levels in other years, mainly because the primary industry contains fewer industries, only the 2–4 industry in the WIOD database; And the primary industry is focused more on the resource development, and the demand for other industries is relatively small. On the whole, the crop industry is more closely linked to the manufacturing industry, and the crop industry value added included in manufacturing exports has the highest proportion.

The analysis of the US Employment driven by crop exports

The export of American agricultural products can not only promote the employment of the industry, but also promote other related industries, and the export of other industries can also drive the export of American agricultural products. This chapter is mainly for the calculation of the role of US agricultural exports in the employment of its own industry, the primary industry, the manufacturing industry and the service industry. It also calculates the employment effects of primary industry, manufacturing and service exports on the US crop industry, and comprehensively analyzes the employment effects of US crop exports.

The employment number of people driven by the exports of US crop industry is growing. Employment in the crop industry driven by exports from other industries and employment in other industries driven by exports from the crop industry are also increasing. The number of jobs driven by the export of crop industries is much
higher than that driven by the export of other industries. The employment of other industries driven by export of crop industries is higher than that of export of crop industries driven by other industries. Figure 4 shows the trend of US crop exports driving employment in the industry and employment in other industries, as well as employment trends in the crop industry driven by exports from other industries.

As is clear from the chart, the number of jobs created by U.S. crop exports rose from 180.90 thousand in 2000 to 215.85 thousand in 2014, and peaked at 250.63 thousand in 2011. Between 2008 and 2009, the number of U.S. jobs created by crop exports fell from 239.77 thousand to 224.71 thousand, or 15 thousand, a relatively modest decline. In 2012–13, the number of U.S. jobs created by crop exports fell from 233.82 thousand to 201.18 thousand, the drop was 32.6 thousand. Combined with Figure 1, the export value added of the U.S. crop industry decreased more in 2008–2009 than in 2012–2013, indicating that the U.S. crop industry was affected by other factors besides export in 2012–2013, resulting in a decline in the employment of the U.S. crop industry. The employment of other industries driven by the export of crop industry was slightly higher than that of the crop industry driven by export in other industries in 2005, and the other years were higher than the latter. The difference between the two reached a maximum in 2008; Among them, the export of crop industry led the employment of other industries to 167.80 thousand, while the export of other industries led the employment of the crop industry to 95.32 thousand, the difference between the two was 72.48 thousand, and after 2008, the gap between the two began to shrink. The employment of other industries driven by the export of crop industry has changed by a large margin, from 100.50 thousand in 2000 to 167.80 thousand in 2008, and 149.72 thousand in 2014. The changes in the employment of the crop industry driven by other industries have been relatively flat, from 97.04 thousand in 2000 to 130.18 thousand in 2014. From these changes, it can be concluded that the employment of the crop industry and related industries driven by the export of crops in the United States is greatly affected by export trade, and the number of employed people changes with the increase in the value added of export trade. The change of the employment of the crop industry driven by other industries is relatively slow, and the number of employed people is also affected by export trade, but the impact is relatively small.

Among the employment in other industries driven by the export of crop industry, the service industry is the mainstay, and the employment ratio of manufacturing employment and primary industry is relatively low. The proportion of employment in the service industry driven by the exports of crop industry is lower than the employment of other industries, the proportion of employment in the primary industry is rising, and the proportion of employment in manufacturing is also falling. The number of employed people in the primary

Figure 4. Employment driven by the crop industry exports and other industry exports drive employment in the crop industry (Unit: thousand). Data source: author calculation.
Industry, manufacturing, and service industries are increasing, among which the employment of the primary industry is increasing rapidly, and the growth rate of employment in the manufacturing and service industries is relatively slow. Table 2 shows the proportion of primary industry, manufacturing, service employment and their respective share of total employment in other industries driven by the export of the US crop industry.

In the above table, the employment of the primary industry driven by the export of the US crop industry increased from 16.49 thousand in 2000 to 35.03 thousand in 2014. The number of employed people in the primary industry declined slightly between 2008 and 2009, and began to rise between 2010 and 2012, and reached a high of 39.15 thousand in 2012. The proportion of the employed people in the primary industry driven by the export of US crop industry among the total number has gradually increased, from 16.41% in 2000 to 23.39% in 2014. It can be seen that the impact of US crop industry exports on employment in the primary industry has become greater. For the manufacturing employment driven by the export of the US crop industry, the number increased from 18.37 thousand in 2000 to 23.07 thousand in 2014, but the corresponding proportion fell from 18.28% in 2000 to 15.10% in 2014. The impact of the US crop export industry on manufacturing employment is getting smaller. Similarly, the employment of the service industry driven by the export of the crop industry increased from 65.65 thousand in 2000 to 92.09 thousand in 2014, and the corresponding proportion dropped from 65.32% to 61.51%. As a whole, the proportion of employment in the service industry and the manufacturing industry driven by the export of US crop industry has declined. The main reason is the increasing number of employment in the primary industry driven by the export of US crop industry, which has led to a relative decline in the number of employment-driven manufacturing and service industries, therefore, the impact is relatively declining. Compared with the total employment in other industries driven by the export of US crop industry, the employment of primary industry, manufacturing industry and service industry driven by it reached the maximum in 2010. The trend of change of the three is consistent with the trend of the export of other industries in the export analysis analyzed in Figure 4.

Among the employment in the crop industry driven by exports from other industries, manufacturing exports led the largest number of employed people, accounting for the highest ratio of exports of other industries to the employment of crops, followed by services. The proportion of employment driven by the primary industry is the lowest, while the proportion of employment driven by manufacturing exports is rising, and the proportion of employment driven by exports of primary industries and services industries is declining (Figure 5).

The above figure shows the proportion of employment in the crop industry driven by the US primary industry, manufacturing industry, and service industry exports among the total number of employed people driven by the export of other industries. It can be clearly seen from the figure that the proportion of employment in the crop industry driven by the export of the manufacturing industry is the highest and is rising, from 92.28% in 2000 to 94.42% in 2014. The employment of the industry driven by other industries is basically composed of manufacturing exports. The proportion of employment in the crop industry

Table 2. Employment of other industries driven by export of crop industry (unit: thousand) and the ratio of total employment in other industries (unit: %).

| Year | Export Drives Employment in Primary Industries | Export Drives Employment in Manufacturing | Export Drives Employment in Service | Export Drives Employment in Other Industries |
|------|-----------------------------------------------|-----------------------------------------|----------------------------------|---------------------------------------------|
|      | Employment | Proportion  | Employment | Proportion  | Employment | Proportion  | Employment | Proportion  |
| 2000 | 16.49      | 16.41      | 18.37      | 18.28      | 65.65      | 65.32      | 100.50     |
| 2001 | 15.05      | 15.58      | 17.08      | 17.68      | 64.47      | 66.74      | 96.61      |
| 2002 | 14.77      | 15.42      | 16.41      | 17.13      | 64.62      | 67.45      | 95.79      |
| 2003 | 16.54      | 17.02      | 17.50      | 18.01      | 63.13      | 64.96      | 97.17      |
| 2004 | 15.87      | 18.04      | 15.39      | 17.49      | 56.70      | 64.47      | 87.95      |
| 2005 | 15.41      | 18.31      | 14.75      | 17.54      | 53.96      | 64.15      | 84.12      |
| 2006 | 21.19      | 21.62      | 16.12      | 16.45      | 60.71      | 61.93      | 98.03      |
| 2007 | 28.46      | 21.61      | 22.70      | 17.24      | 80.53      | 61.15      | 131.69     |
| 2008 | 36.78      | 21.92      | 30.37      | 18.10      | 100.66     | 59.99      | 167.80     |
| 2009 | 34.22      | 22.61      | 25.75      | 17.01      | 91.38      | 60.37      | 151.35     |
| 2010 | 34.28      | 23.42      | 23.07      | 15.76      | 89.02      | 60.82      | 146.37     |
| 2011 | 35.25      | 23.19      | 24.77      | 16.29      | 91.99      | 60.51      | 152.02     |
| 2012 | 39.15      | 23.32      | 25.98      | 15.48      | 102.77     | 61.21      | 167.91     |
| 2013 | 32.46      | 23.42      | 20.86      | 15.06      | 85.26      | 61.52      | 138.58     |
| 2014 | 35.03      | 23.39      | 22.60      | 15.10      | 92.09      | 61.51      | 149.72     |

Data source: Author calculation.
driven by export from the primary industry is declining which accounts for about 1% in the period from 2000 to 2006. After 2006, the proportion is less than 1%, and it is still declining obviously. The proportion of employment in the crop industry driven by export of services has also led to a decline in the total employment of the industry. In 2000, it accounted for about 6.65%, and in 2014 it fell to 4.99%, including in 2006. The lowest ratio is 4.77%, which also has a relatively obvious downward trend.

In the employment of crop industries driven by other industries, the number of employed people driven by primary industry and service industry is very small, and the proportion is very low. The main reason is that the primary industry is a resource-based unprocessed industry whose main role is to provide basic resources for the manufacturing industry, and the primary industry has low demand for intermediate products. In combination with Figure 3, the value-added of the crop industry included in the primary industry exports is also relatively low, so the primary industry exports are not effective in promoting employment in the industry. The value-added of the service industry exports among the crop industry exports are relatively lower than that of the manufacturing industry, and the employment promotion effect of the industry is lower than that of the manufacturing industry. And the service industry exports are mostly added to the manufacturing industry. Theoretically speaking, the value added of the manufacturing industry exports included in the service industry should be higher than the value added of the crop industry.

**Concluding remarks**

The international production division decides the production development more and more specialized. Under the background of global value chain, each industry is not independent of other industries development, international trade is more and more specialized. In this paper, under the perspective of global value chain decomposition, reference Dai Xiang decomposition method (2016) of the added value of exports source, source of crops industry added value of exports to the United States are decomposed, and accounting by decomposing the U.S. crops industry exports contain amount of added value of primary industry, manufacturing, services, to further distinguish the added value of American crops industry exports ingredients;

The research finds that: (1) in the U.S. crop industry, the value added of the export industry is the highest, followed by the value added of the service industry, the manufacturing industry and the primary industry. In the United States, the value added of the agricultural industry accounts for a rising share of the value added of the industry, the value added of the manufacturing industry also slowly rises, and the value added of the service industry accounts for a declining share. (2) among the three categories of exports, the added value of the crop industry included by the export of

![Figure 5. The proportion of employment of crop industry driven by other industries (unit: %). Data source: author calculation.](image-url)
manufacturing industry is the highest and still rising, followed by the export of service industry, and the export of primary industry contains the lowest added value. (3) the export of the U.S. crop industry leads to the increase of employment in its own industry, and the employment of other industries is also rising, among which the service industry leads to the largest number of employment, followed by the manufacturing industry and the primary industry. The number of jobs in crop industries driven by exports in other industries is rising, which is smaller than the number of jobs in other industries driven by exports in crop industries. (4) among the exports of other industries, the number of employment in the crop industry driven by the export of manufacturing industry is the largest, accounting for more than 92% of the total employment in the crop industry driven by the export of other industries, while the number of employment in the crop industry driven by the export of service industry and primary industry is relatively small, accounting for less than 8%.

From the above conclusions, it can be concluded that the export of American crop industry is closely related to the development of globalization. The export of the U.S. crop industry is closely related to the export of the manufacturing industry, and the manufacturing export has a great impact on the employment of the crop industry. Therefore, while promoting the development of agriculture, the US government should consider increasing investment in the manufacturing sector, and encourage export trade in industries closely related to the crop industry, rather than blindly suppressing trade with China by raising tariffs.

Notes
1. The superscript refers to the country, the subscript refers to the industry, the same below.
2. The Leontief’s inverse matrix exists if and only if the matrix A is reversible.
3. means matrix transpose.
4. Dai (Xiang) (2016) export decomposition part implies some repeated calculation values. The repeated calculation values after decomposition are relatively small and can be ignored, which does not affect the problem analysis.
5. (4) uses the equation: \( \hat{W} \hat{V} = (\text{Emp}) (\hat{V}a)^{-1} + \hat{V}a(X^{-1}) = \hat{L} \).
6. The employment data in the SEA account of the European Commission organization study lacks the corresponding ROW employment data. This paper does some data processing, but does not affect the analysis results.
7. In the general industry classification, the first industry is classified as a primary industry, and the text separates the first industry separately for the analysis of the crop industry.
8. In general, it is affected by changes in the employment coefficient, which may be influenced by changes in labor productivity, production structure, or other factors.

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