Qualitative Changes in China's Foreign Trade in the Era of "New Normal"

Katarína BROCKOVÁ – Martin GREŠŠ* – Lidiia KARPENKO** – Ľudmila LIPKOVÁ**

Abstract

Since the second decade of the 21st century, the Chinese economy has reached a qualitatively higher stage of development. In literature, this development stage is referred to as the "new normal" and is characterized by the balancing of disproportions in the Chinese economy. The present paper deals with the qualitative changes in Chinese foreign trade from the end of the global financial crisis to the present "new normal" era. The main aim of the paper is to examine the qualitative changes in the commodity structure of China's exports and imports during the "new normal" in the second decade of the 21st century. We conclude that during this period, the Chinese economy was transformed into an economy with a high GDP share of innovative secondary and tertiary sectors with a change in the commodity structure of foreign trade in favor of high value-added products. We conclude that China's position in the world economy is changing from a "world factory" to an innovative economy.

Keywords: *China, foreign trade, new normal, old normal growth*

JEL Classification: F01, F14, F19

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Introduction

At the APEC summit in 2014, Chinese president Xi Jinping presented the content of the term "new normal" for China's further socio-economic development (Xinhua, 2014). The development phase of the "new normal" is characterized by

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the leveling of macroeconomic imbalances, lower economic growth rates and economic stabilization (Chinadaily, 2017).

The changes associated with the "new normal" also directly affect Chinese foreign trade. The growth rates of exports and imports are declining, the trade balance surplus is declining, and the territorial and commodity structure is changing. This paper deals with the structural changes in China's foreign trade in the second decade of the 21st century, with a special focus on changes in the commodity structure of exports and imports filling the gap in the literature presented in the Literature review.

The main aim of the paper is to examine the qualitative changes in the commodity structure of China's exports and imports during the "new normal" in the second decade of the 21st century.

1. Theoretical Background

Since 1979, China has been implementing reforms that have transformed the centrally planned economy into a market economy. As a result of introduction of the market mechanism, China has mobilized latent resources and has shown high economic growth rates. The period from 1979 to 2015 is referred to as "old normal growth" characterized by the creation and deepening of macroeconomic imbalances.

External sources – foreign direct investment, foreign loans and foreign trade – played an important role in stimulating the economy. Foreign trade has been the engine of growth for the Chinese economy since the 1990s. With the absolute growth in the volume of exports and imports, the share of foreign trade in gross domestic product (GDP) grew. In particular, the share of exports in GDP increased. In 1990, this share was 5.91% of GDP, in 2010 it reached a maximum level of 26.33% (Macrotrends, 2020).

In the first decade of the 21st century, China's foreign trade was affected by two major events – WTO accession and the global financial crisis. Accession to the WTO led to the liberalization of exports and imports, to an increase in the volume of exports and imports and to an increase in foreign trade surplus. The crisis in 2008 – 2009 led to a decline in both exports and imports. However, China quickly dealt with the problems associated with the crisis and was once again on the trajectory of high foreign trade growth. During this period, the policy of substitution of imports by domestic production also intensified, which was reflected in the commodity structure of imports, with a decrease in imports of finished products. The continuing modernization of industrial production has also affected the commodity structure of exports in favor of higher value-added products.

1.1. "Old Normal Growth" Era

Chinese economic development has undergone fundamental quantitative and qualitative changes since the late 1970s. No country has seen such changes in the history of the world economy. Since the late 1980s, the Chinese economy has developed in the "old normal growth" model. This period has been associated with the creation of imbalances that have manifested themselves in many areas of the Chinese economy and society, such as income imbalances, leading to deepening social imbalances. To ensure a high rate of economic growth, natural resources were used extensively, leading to subsequent devastation of the environment.

"Old normal growth" in the Chinese economy was characterized by high rates of economic growth. From 1979 to 2019, absolute GDP at current prices increased from USD 178.28 billion to USD 13.368 billion, i.e. 75 times (Country-economy, 2020). High growth rates were also recorded in foreign trade turnover, especially in exports. From 1980 to 2018, foreign trade turnover increased 220 times. The volume of exports increased 240 times and the volume of imports 205 times during this period (National Bureau of Statistics of China, 2020). Exports were one of the important factors of economic growth. The foreign trade surplus as a share of GDP has been growing since 1990 from 2.96% to 6.49% in 2008, until it gradually declined to 2.58% in 2018. Foreign trade surpluses were caused by massive support for export industries, but also by "manipulation" with the exchange rate (devaluation), which led to an increase in exports (Navarro and Roach, 2012).

Following China's accession to the World Trade Organization (WTO), there have been positive quantitative and qualitative changes in its foreign trade as a result of the liberalization of exports and imports. After overcoming the financial crisis at the end of the first decade of the 21st century, Chinese economy has reached a higher level of economic development no longer benefiting from the "old normal growth" model based on extensive resources, in particular labor growth and export growth.

In 40 years, China has achieved an average growth rate of 9.5% enabling it to transform from a poor country to a country with lower middle income (Yesmin, 2019).

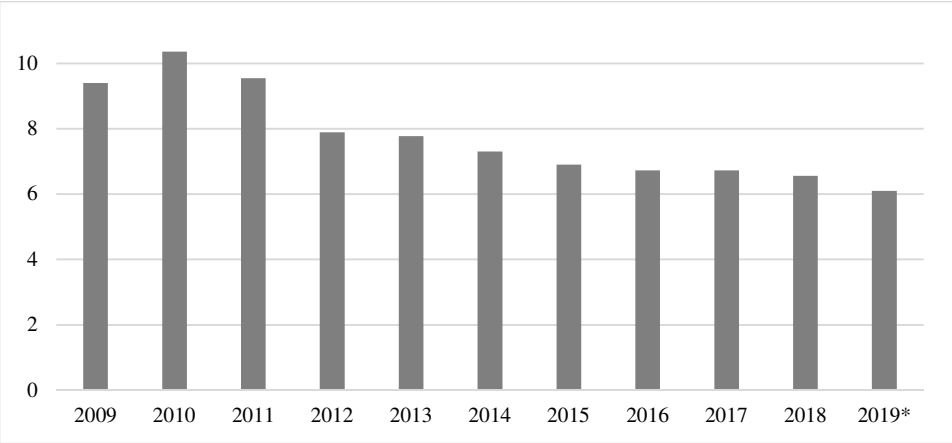
1.2. Characteristics of The Development Era "New Normal"

The term "new normal" is becoming more common in the economic literature. The "new normality" is considered to be the new conditions of existence that have formed under the influence of many evolutionary factors and are fundamentally changing the quality of further development and its results, in our

case the Chinese economy. As part of the 13th Five-year plan 2016 – 2020, it is planned to build a "new normal" together with building a prosperous society (National Development and Reform Commission, 2016).

Figure 1

Economic Growth Rates, Annual, %



Source: World Bank (2019); *Elegant (2020).

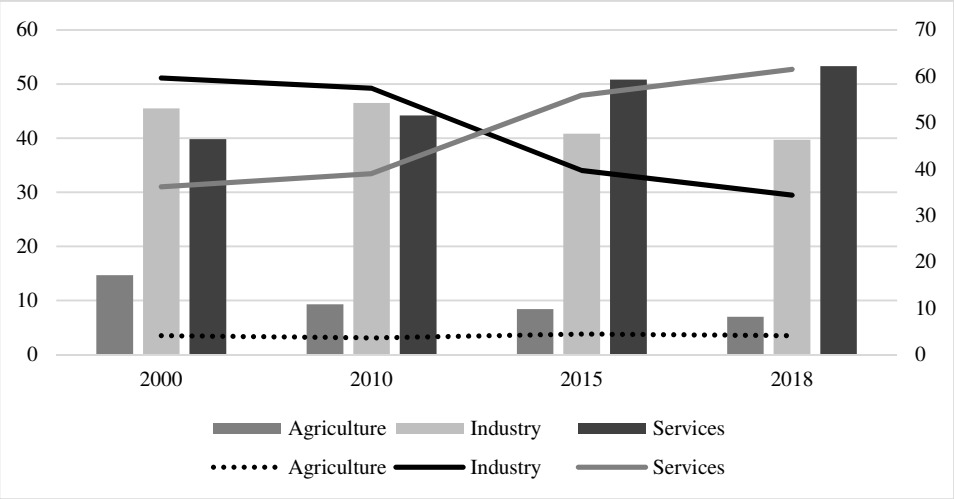
New economic policy objectives have been set – such as reducing the rate of economic growth to 6.0 – 6.5% (Figure 1), reducing income inequality, increasing domestic demand and living standards, reducing the economy's dependence on exports, developing innovative production, modernizing the economic system and overall stabilization of the economy.

Exports ceases to be the engine of growth, but domestic demand increases. The structure of GDP is changing in favor of services, which in 2018 contributed 61.5% to GDP growth, industry contributed 34.4%, and agriculture only 4.1% despite the differences between these sectors in GDP structure as presented in Figure 2.

As already mentioned, the development era "new normal" leads to the elimination of imbalances in the Chinese economy. Chinese foreign trade is also experiencing a high level of imbalance. In addition to its comparative advantages, China uses a wide range of pro-export policy instruments to support exports, including currency manipulation (Silver, 2019). Chinese active pro-export policy leads to restrictive measures by some countries during the "new normal" era to reduce Chinese exports. In 2015, the US responded to unequal trade with China by raising import tariffs and restricting imports from China. The US-China trade war is considered part of the "new normal". Uncertainty in the US-China trade relations is considered a risk factor for China's economic growth.

F i g u r e 2

Structure of GDP, Share of Sectors in GDP Growth, %



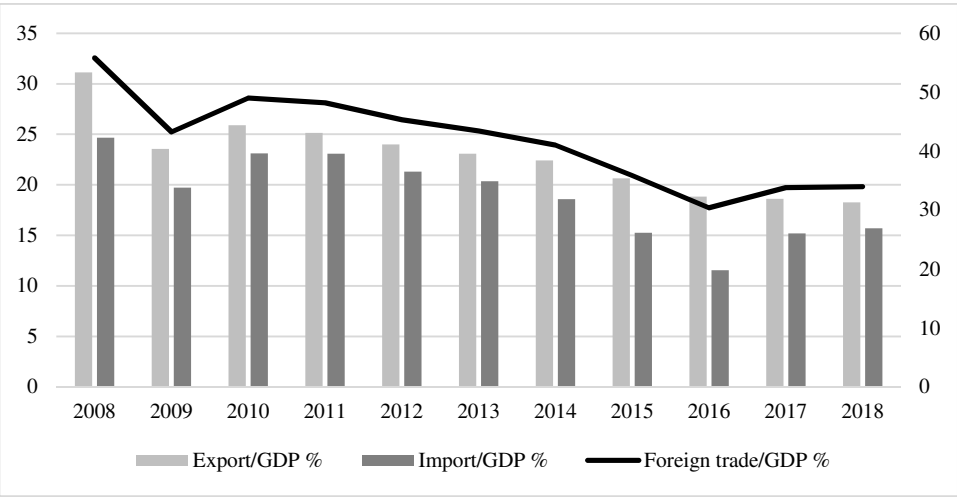
Note: Structure of GDP – left axis, share of sectors in GDP growth – right axis.

Source: National Bureau of Statistics of China (2019).

Since the beginning of the second decade of the 21st century, the share of foreign trade turnover in GDP has been declining together with the growth rate of exports while the growth rate of imports has been increasing (Figure 3).

F i g u r e 3

Share of Foreign Trade in GDP



Note: Exports and imports – left axis, foreign trade turnover – right axis.

Source: National Bureau of Statistics of China (2019).

The maximum share of foreign trade turnover in GDP was reached in 2008 with a share of 55.79%. Because of the trade war with the US, the share of foreign trade turnover in Chinese GDP fell to 30.39% in 2016, and the share of exports fell from 31.14% in 2008 to 18.27% in 2018. The relative share of trade surplus, which peaked in 2008 at 6.49%, decreased by 2018 to 2.58%. The share of imports has also been declining since the crisis year of 2008. Imports reached a minimum share in GDP in 2016 (11.56%), following the mutual introduction of import restrictions with the US.

The gap between the share of exports and imports in Chinese GDP is gradually widening and narrowing. In 2015 and 2016 (Table 1), China witnessed a record drop in exports leading to a reduction in GDP growth.

T a b l e 1

Dynamics of China's Foreign Trade in 2009 – 2018 in Billion USD

Year	Export	Export growth in %	Import	Import growth in %	Foreign turnover (exports + imports)	Foreign turnover growth in %	Foreign trade balance (exports – imports)	Trade balance surplus as % of GDP
2008	1,430.69	–	1,132.56	–	2,563.26	–	298.13	6.49
2009	1,201.61	–14.01	1,005.92	–12.19	2,207.54	–13.9	195.69	3.83
2010	1,577.75	+31.30	1,396.25	+38.90	2,974.00	+34.7	181.51	2.98
2011	1,898.38	+20.32	1,743.48	+24.80	3,641.86	+22.45	154.90	2.05
2012	2,048.71	+7.90	1,818.41	+4.30	3,867.12	+6.18	230.31	2.68
2013	2,209.00	+7.80	1,949.99	+7.23	4,156.99	+7.49	259.02	2.70
2014	2,342.29	+6.00	1,959.24	+0.47	4,301.53	+3.47	383.06	3.82
2015	2,273.47	–2.94	1,679.56	–14.28	3,953.03	–8.11	593.90	5.39
2016	2,097.63	–7.74	1,587.93	–5.46	3,385.56	+14.36	509.71	4.57
2017	2,263.37	+7.90	1,843.79	+16.10	4,107.16	+21.31	419.58	3.45
2018	2,486.70	+9.86	2,135.75	+15.90	4,622.45	+12.54	350.95	2.58

Source: National Bureau of Statistics of China (2019).

In the era of "new normal", the emphasis in the Chinese economy is to increase domestic demand, which is unsaturated, especially the demand for better quality products, but also for foodstuffs. It is also important to shift the commodity structure of imports to the import of consumer goods, which will ensure a higher standard of living for the Chinese population. In this context, higher imports are expected from developing countries, especially in agricultural products and foodstuffs.

2. Literature Review

Even though the term "new normal" proposed by the Chinese president Xi Jinping in 2014 is a relatively new phenomenon, it raised a lot of attention in scientific and expert circles because of the changes in the Chinese economy.

Many authors analyzing the "new normal" come from China or co-author articles with Chinese scientists and experts. Cheo (2017) argues that old growth model of China was based primarily on the capital accumulation, but currently China stands at the crossroads of its development path facing challenges unknown to small economies in the world economy. He notes that in order to further growth of the Chinese economy, China must take much greater risks that favor market-oriented reforms in meeting the challenges of the slowing economy. From the domestic point of view, Wen, Jia-Dong and Li-Yun (2018) empirically studied the demand-side and supply-side factors together with the "new normal" as a dummy variable in industrial structure upgrade at national, regional and provincial level. Their analysis implies three factors such as consumption, investment, technology improvement and labor supply significantly facilitate the industrial upgrade. They propose to adopt innovation-driven strategy and regional economy development strategy to further promote industrial upgrade. Chen and Groenewold (2019) focus on the slowdown of economic growth in Chinese economy from levels around 10% per annum to 6 – 7% as an important aspect of the "new normal". Based on their analysis, they state that the demand and foreign shock are of relatively little importance and make little contribution to explaining the long-run growth decline in Chinese economy and they conclude that the decline is driven mostly by the long-term supply factors. Heng (2018) notes that Chinese economy is, by entering the "new normal", transforming from high-speed growth to high-quality development. He notes that in order to face new demands and challenges, China should not only shift its path of development, but also take further steps in modernizing its economic system. Heng argues that the building of such a modern economic system lies in promoting innovation, strengthening property rights protection and fair competition, as well as enhancing the free flow of economic factors and their efficient allocation. Mozias (2015) conducted the analysis of the peculiarities of the current stage of development of the Chinese economy and structural causes and proposes that China is close to or beyond the breaking point. The slowdown in economic growth is caused by the weakening of basic drivers like domestic consumer demand, investment demand and net exports. There is also exhaustion of labor resources, changes in the sectoral structure of the economy in favor of services, reduced productivity of used factors of production. He notes that China has adopted a development plan to prevent further imbalances and crises and has the potential to eliminate negative processes and continue to develop.

With respect to trade, Zhang (2017) analyzes Chinese trade policy and performance on economic growth and FDI in the era of the "new normal". He outlined three challenges the Chinese economy will face in near future: 1. RMB exchange rate policy and rising labor costs, 2. The efficiency of the Belt and Road Initiative,

and 3. Management of credit risks and financial system stability. Cabrillac et al. (2016) note special role of China in trade slowdown in recent years because of declining income elasticity of imports in the beginning of the 21st century. They note the slowdown of growth in Chinese exports together with slowing import demand caused by more consumption and less by trade-intensive exports and investment. Lemoine and Unal (2017) analyzed the Chinese foreign trade since the financial crisis of 2007/2008 and note that it has continued to grow faster than international trade. However, they propose the drivers behind this growth are different from those prevailing before the crisis. They conclude that that participation in global manufacturing chains is no longer at the core of Chinese foreign trade and instead indigenous industrial capabilities have taken the lead. As Leomine and Unal (2017) note, there is an ongoing change in the geographic pattern of Chinese trade from developed economies in favor of emerging economies. Xu's (2012) analysis shows that the relationship between foreign trade and GDP is the following: for a short period, exports have a rather strong impact on Chinese GDP and the effect is a generally positive, while the effect coming from imports is relatively weak. However, for a long period, exports' impact on Chinese GDP grows weaker and the effect tends to be steady, while the effect coming from imports grows stronger and tends to be steady. Regarding the changes in Chinese trade patterns, Caporale, Sova and Sova (2015) analyzed the period between 1992 and 2012 in order to see whether increasing trade in this period has led to industrial structural adjustments and changes in Chinese trade patterns. Their main findings confirm the significant change in Chinese trading structure associated with the fast growth of foreign trade, in particular a shift from resource- and labor-intensive to capital- and technology-intensive exports. Sun and Heshmati (2010) analyzed international trade and its effects on economic growth in China in the period from 2002 to 2007. They proposed that increasing participation in global trade helped China gain the static and dynamic benefits and stimulate rapid national economic growth. They also note that both international trade volume and structure towards high-tech exports result in positive effects on China's regional productivity. Regarding the foreign trade based on the type of enterprise (state owned or private), Fu (2018) suggests that foreign trade of private enterprises is the main contributor to growth of Chinese import and exports values.

3. Methodology

For the quantitative and qualitative analysis of structural changes in the export and imports of goods, we used the database provided by National Bureau of Statistics of China (2020). For our analysis, we chose three basic years of this century

– 2009, 2015 and 2018. Year 2009 as a year of the global financial crisis in the world economy, year 2015 as a year following the "new normal" statement by the Chinese president Xi Jinping and year 2018 as the last year of this decade with relevant data available. The Standard international trade classification (SITC) (United Nations Statistics Division, 2008) is used in the analysis to clarify the share of processed and finished goods.

The structure of socio-economic phenomena always has one or more degrees of mobility and tends to change over time, both quantitatively and qualitatively. Therefore, it is of great practical importance to study the structure in dynamics, assess structural changes, identify and characterize the main trends in the development of economic processes. Statistical methods of analyses make it possible to conduct a study of socio-economic structures taking into account the place and time, which consists, first of all, in their quantitative measurement, identification of proportions and patterns. Structural analyses include the study of structural breaks, which is carried out on the basis of time series data for an individual object, and structural differences using data on several objects at a fixed point in time. In the statistical study of the structure of the population and its changes, one dwells on the aspects of determining the indicators of the structure: simple (one-dimensional), hierarchical "tree-like", balance and multidimensional structure with overlapping features. Comparative analysis of structures calculates the absolute, relative and rank indicators of changes in structures. Structural analyses in the economy are changes in the relationship between parts and the whole population in time and space. They are determined by calculating the indicators of the dynamics of the relative values of the structure, showing the relationship between parts of the studied population and between them and the entire population. The analysis of structural changes consists of determining individual and generalized indicators of structural changes, which can be represented using a linear and quadratic coefficient of absolute and relative structural changes with variable and constant comparison bases. Linear and quadratic coefficients make it possible to draw conclusions about the intensity of changes in the structure. Individual indicators of structural changes reflect the intensity of changes in each analyzed group. Among individual indicators, there are absolute and relative indicators of structural changes with variable or constant comparison bases. The following are used as generalizing characteristics of structural changes, measured on a scale of relations and allowing to obtain a consolidated estimate of the rate of change in the specific weights of individual parts of the population:

- linear coefficient of absolute structural changes with constant and variable base of comparison;
- linear coefficient of relative structural changes with constant and variable base of comparison.

To avoid mutual cancellation of changes in the specific weight of individual elements in the total population of different signs in the total population, the following are also used as generalizing indicators:

- quadratic coefficient of absolute structural changes with constant and variable comparison base;
- quadratic coefficient of relative structural changes with constant and variable base of comparison.

The quadratic coefficient of structural changes, in contrast to the linear coefficient, is more sensitive to changes in the structure. Based on the experience of domestic and international statistics, in order to determine the choice of directions for structural transformations, we propose using the following indicators to analyze structural changes at different economic levels:

1. Average linear coefficient of absolute and relative differences of structures. The expediency of using this coefficient in the analysis of structural changes, in our opinion, is explained by the possibility of avoiding mutual cancellation of changes in shares of different sign during aggregation by using the modules of deviations in the shares of groups.

2. Mean square coefficient of absolute and relative differences of structures. Used to calculate the rate of structural changes. In our opinion, the use of the quadratic coefficient is preferable, since it responds more clearly to strong fluctuations in structural changes.

We divided our analysis into two steps. In the first step, we assessed China's structural shifts in exports and in the second step the same assessment was done for structural shifts in imports.

We calculated the generalizing absolute indicator of structural change A_d, which is based on the sum of the absolute modules of changes in shares, expressed in percentage points:

$$A_d = \sum_{i=1}^{n} |d_2 - d_1|$$

where

d_1 and d_2 – specific gravity of features in two comparable structures.

We then set the task of determining how strong the changes in structure have occurred compared to the maximum possible value of the sum of modules. For this, in mathematical statistics, the indicator of the degree of intensity of the absolute structural changes is used:

$$KA_d = \frac{A_d}{2} = \frac{\sum_{i=1}^{n} |d_2 - d_1|}{2}$$

Further, we calculated the generalized statistical indicators of structural changes, the average linear and average quadratic coefficients of absolute and relative differences of structures:

$$L_{(d_2-d_1)} = \frac{\sum_{i=1}^{n}|d_2 - d_1|}{n}$$

$$\sigma_{(d_2-d_1)} = \sqrt{\frac{\sum_{i=1}^{n}(d_2 - d_1)^2}{n}}$$

$$L_{\left(\frac{d_2}{d_1}-1\right)} = \frac{\sum_{i=1}^{n}\left|\frac{d_2}{d_1} - 1\right|}{n}$$

$$\sigma_{\left(\frac{d_2}{d_1}-1\right)} = \sqrt{\frac{\sum_{i=1}^{n}\left(\frac{d_2}{d_1} - 1\right)^2}{n}}$$

where

d_1 and d_2 – specific gravity of features in two comparable structures,
$i = 1 \ldots n$ – number of gradations in structures,
$L_{(d_2-d_1)}$ – average linear coefficient of absolute structural shifts,
$\sigma_{(d_2-d_1)}$ – root mean square coefficient of absolute structural shifts,
$L_{\left(\frac{d_2}{d_1}-1\right)}$ – average linear coefficient of relative structural shifts,
$\sigma_{\left(\frac{d_2}{d_1}-1\right)}$ – root mean square coefficient of relative structural shifts.

Moreover, the obtained values of the indicators were interpreted as the absolute and relative values of the discrepancies between the frequencies of the attributes, calculated by the methods of mean linear and standard deviation. Note that in the paper we calculated changes in the structure as a whole, i.e. structural shifts, not the changes in individual shares.

To assess the significance of structural differences in relative terms, it is advisable to use integral indices that take into account the size of the population, the number of selected groups and the different contributions of groups to the total volume of the studied feature. With the help of generalizing indicators of structural changes, not only the differences between two sets (for example, exports and imports) are studied, but also an assessment of the dynamics of changes in the structure is given. In this case, the corresponding indicators should be

interpreted as generalizing indicators of structural changes in dynamics. The integral coefficient of structural differences (K_g), Salai index (I_S), and Ryabtsev index (I_R) have more perfect analytical properties than the linear and root-mean-square coefficients, since they vary between 0 and 1. The closer to 0, the smaller the differences between the features; the closer to 1, the more tangible the differences between the features in the structure. These indicators are the most accurate and convenient tools for solving the research goals. Testing the methodology for calculating structural changes in the sectoral structure of exports and imports for the period 2009–2018 on the basis of these generalized indicators, it is possible to identify trends and make an appropriate economic and statistical interpretation of structural changes in China`s exports and imports. To obtain more accurate conclusions about the similarities or differences between the two structures, more advanced generalizing criteria were used to assess the significance of differences: the integral coefficient of structural differences (K_g), Salai index (I_S), and Ryabtsev index (I_R):

$$K_g = \sqrt{\frac{\sum_{i=1}^{n}(d_2 - d_1)^2}{\sum_{i=1}^{n} d_2^2 + d_1^2}}$$

$$I_S = \sqrt{\frac{\sum_{i=1}^{n} \frac{(d_2 - d_1)^2}{(d_2 + d_1)^2}}{n}}$$

$$I_R = \sqrt{\frac{\sum_{i=1}^{n}(d_2 - d_1)^2}{\sum_{i=1}^{n}(d_2 + d_1)^2}}$$

where:

d_1 and d_2 – specific gradation values of two structures,

$i = 1 \ldots n$ – number of gradations in structures.

The afore mentioned coefficient and indices have upper and lower limits of values between 0 and 1 and were used in the study of assessing the significance of quantitative differences in the export/import structure for three periods. The closer the value is to 1, the greater the level of differences. The advantage of the Ryabtsev index compared to the Salai index is that it is more “rigid” and does not depend on the number of gradations of the aggregate, while at the same time showing the ratio of the actual measure of the difference between the components of the two structures with their maximum possible values. The denominator of the Ryabtsev integral coefficient of structural differences means the maximum possible difference between the components of the two structures. Thus,

the meaning of the Ryabtsev coefficient reduces to the ratio of the actual measure of the divergence of the values of the components of the two structures to their maximum possible value. The greatest preference from the point of view of economic interpretation is the Ryabtsev index, which has a scale of values and does not overestimate structural changes, like the Salai index.

The advantage of Ryabtsev's integral coefficient of structural differences is also that it does not depend on the number of gradations of the structure of the totality. For the interpretation of the results, the scale of assessment of the measure of materiality of structural differences was proposed by V. M. Ryabtsev (Table 2).

T a b l e 2

Scale for Assessing the Significance of Structural Differences by Ryabtsev's Criterion

Range of criteria	Characteristic measures of structural differences
0.000 – 0.030	Identical structures
0.031 – 0.070	Extremely low level of differences
0.071 – 0.150	Low level of differences
0.151 – 0.300	Significant level of differences
0.301 – 0.500	Significant differences
0.501 – 0.700	Very significant level of differences
0.701 – 0.900	Opposite type of structures
0.901 – 1.000	The exact opposite type of structures

Source: Karelina (2010).

4. Results and Discussion

The commodity structure of both exports and imports shows significant differences by product groups for 2009 – 2018. Mobility and transformation of the commodity structure of exports and imports necessitate the structural analysis and an accurate assessment of structural changes. Table in Appendix A presents the initial information regarding the values of both exports and imports based on the SITC (2008) classification as well as the shares of individual sections of the SITC (2008) classification in the commodity structure of Chinese exports and imports.

4.1. Assessment of Structural Shifts in Chinese Exports

Tables in Appendix B present the calculations of the values of the linear and root-mean-square coefficients of structural changes in the export of Chinese goods in 2009, 2015 and 2018. We calculate the generalizing absolute indicator of structural change as proposed in Methodology:

$$A_{d(2018/2009)} = 2.99$$

$$A_{d(2018/2015)} = 4.87$$

In 2018, compared to 2009, the absolute change in the structure of exports amounted to 2.99 percentage points, and in 2018, as compared to 2015, this indicator amounted to 4.87 percentage points, i.e. there has been an increase in export structure over the past three observed years by almost 2-times. Regarding total results in tables in Appendix B, we use indicator of the degree of intensity of the absolute structural changes KA_d:

$$KA_{d(2018/2009)} = \frac{2.99}{2} = 1.495$$

$$KA_{d(2018/2015)} = \frac{4.87}{2} = 2.435$$

Calculations show that changes in Chinese export structure over the course of 9 years by 1.495 percentage points and over 3 years by 2.435 percentage points are recognized as visible and reasonable (from 1 to 2 – the low level of differences; from 2 to 10 are considered significant in the group; more than 10 – large structural changes).

As a result of the calculations, the following coefficients characterizing the structural shift in Chinese exports were obtained:

2018 compared to 2009:

a) average linear coefficient of absolute structural shifts, percentage points:

$$L_{(d_2-d_1)} = \frac{2.99}{12} = 0.25$$

b) root mean square coefficient of absolute structural shifts, percentage points:

$$\sigma_{(d_2-d_1)} = \sqrt{\frac{2.13}{12}} = 0.42$$

c) average linear coefficient of relative structural shifts:

$$L_{\left(\frac{d_2}{d_1}-1\right)} = \frac{1.24}{12} = 0.103 \text{ or } 10.3\%$$

d) root mean square coefficient of relative structural shifts:

$$\sigma_{\left(\frac{d_2}{d_1}-1\right)} = \sqrt{\frac{0.99}{12}} = 0.29$$

2018 compared to 2015:

a) average linear coefficient of absolute structural shifts, percentage points:

$$L_{(d_2-d_1)} = \frac{4.87}{12} = 0.41$$

b) root mean square coefficient of absolute structural shifts, percentage points:

$$\sigma_{(d_2-d_1)} = \sqrt{\frac{4.36}{12}} = 0.60$$

c) average linear coefficient of relative structural shifts:

$$L_{\left(\frac{d_2}{d_1}-1\right)} = \frac{3.72}{12} = 0.31 \text{ or } 31.0\%$$

d) root mean square coefficient of relative structural shifts:

$$\sigma_{\left(\frac{d_2}{d_1}-1\right)} = \sqrt{\frac{3.37}{12}} = 0.53$$

Economic and statistical interpretation of the obtained calculations: although the obtained coefficients characterize the discrepancies of the structures, there is a problem of their full interpretation in terms of assessing the significance of the quantitative differences between the two structures due to the fact that they do not have a clear upper limit of values and do not have criteria for identifying the measure. At the same time, the linear coefficient of relative structural shifts indicates that, when the structure of exports changed in 2018 compared to 2009, 10% shift occurred – a change in the role of product groups in the total sum. Similarly, in 2018 compared to 2015 – 31%. The conclusion is drawn about the growth of structural changes after the crisis of 2015 and a positive trend.

To obtain more accurate conclusions about the similarities or differences between the two structures, we use the integral coefficient of structural differences (K_g), Salai index (I_S), and Ryabtsev index (I_R) with interim calculations in tables in Appendix C. The results of the calculations were integral indicators indicating a significant level of structural differences that occurred in China's exports in 2018 compared to 2009, i.e. for 9 years. We also note very significant structural changes for 3 years, in 2018 compared to 2015. A pronounced upward trend in export product groups over the past three years has been observed.

2018 compared to 2009:

$K_g = 0.079;$ $I_S = 1.166;$ $I_R = 0.380$

2018 compared to 2015:

$K_g = 0.027;$ $I_S = 0.171;$ $I_R = 0.593$

Confirmation of this conclusion should take into account the value of the Ryabtsev index. On a scale for assessing the significance of structural differences according to the Ryabtsev criteria (Table 2), the study shows:

• In 2018, compared to 2009, the Ryabtsev index was 0.380, thus significant differences between structures were observed (according to the Ryabtsev model, the range 0.301 – 0.500 corresponds to the significant level of differences)

• In 2018, compared to 2015, the Ryabtsev index was 0.593, so very significant level of differences were observed (range 0.501 – 0.700).

4.2. Assessment of Structural Shifts in Chinese Imports

Tables in Appendix D present the calculations of the values of the linear and root-mean-square coefficients of structural shifts in imports of Chinese goods in 2009, 2015, 2018. For a more accurate assessment of structural changes in imports, we calculate the generalizing absolute indicator of structural change as proposed in Methodology:

$$A_{d(2018/2009)} = 15.01$$

$$A_{d(2018/2015)} = 9.86$$

In 2018, compared to 2009, the absolute change in the structure of imports amounted 15.01 percentage points, and in 2018, as compared to 2015, this indicator decreased by 1.5 times and amounted 9.86 percentage points. The generalized absolute indicators of the import structure are significantly higher than the export indicators. This was especially reflected in 2018 compared to 2009 (for imports 15.01; for exports 2.99). That is, the structural range of imports exceeds exports by 5 times. Similarly, in 2018 compared to 2015 (for imports 9.86; for exports 4.87), the structural range of imports exceeds exports by 2 times. Regarding total results in tables in Appendix D, we use indicator of the degree of intensity of the absolute structural changes KA_d:

$$KA_{d(2018/2009)} = \frac{15.01}{2} = 7.505$$

$$KA_{d(2018/2015)} = \frac{9.86}{2} = 4.93$$

Calculations showed that changes in Chinese import structure over the course of 9 years by 7.505 percentage points and over 3 years by 4.93 percentage points are considered significant (from 2 to 10 are considered significant in the group; more than 10 – large structural changes).

As a result of the calculations, the following coefficients characterizing the structural shift in Chinese imports were obtained:

2018 compared to 2009:

a) average linear coefficient of absolute structural shifts, percentage points:

$$L_{(d_2-d_1)} = \frac{15.01}{12} = 1.25$$

b) root mean square coefficient of absolute structural shifts, percentage points:

$$\sigma_{(d_2-d_1)} = \sqrt{\frac{25.21}{12}} = 1.45$$

c) average linear coefficient of relative structural shifts:

$$L_{\left(\frac{d_2}{d_1}-1\right)} = \frac{3.68}{12} = 0.307 \text{ or } 30.7\%$$

d) root mean square coefficient of relative structural shifts:

$$\sigma_{\left(\frac{d_2}{d_1}-1\right)} = \sqrt{\frac{97.83}{12}} = 2.855$$

2018 compared to 2015:

a) average linear coefficient of absolute structural shifts, percentage points:

$$L_{(d_2-d_1)} = \frac{9.86}{12} = 0.82$$

b) root mean square coefficient of absolute structural shifts, percentage points:

$$\sigma_{(d_2-d_1)} = \sqrt{\frac{18.13}{12}} = 1.23$$

c) average linear coefficient of relative structural shifts:

$$L_{\left(\frac{d_2}{d_1}-1\right)} = \frac{1.51}{12} = 0.126 \text{ or } 12.6\%$$

d) root mean square coefficient of relative structural shifts:

$$\sigma_{\left(\frac{d_2}{d_1}-1\right)} = \sqrt{\frac{0.35}{12}} = 0.171$$

Economic and statistical interpretation of the calculations: the obtained coefficients indicate high structural changes in imports over 9 years (30.7%); moderate changes over three years (12.6%).

To obtain more accurate conclusions about the similarities or differences between the two structures, we use the integral coefficient of structural differences (K_g), Salai index (I_S), and Ryabtsev index (I_R) with interim calculations shown in tables in Appendix E. The results of the calculations were the integral indicators, indicating the complete opposite of the structures that occurred in China's imports in 2018 compared to 2009, i.e. for 9 years ($I_R = 4.039$).

This change is pronounced for product group number 6 (Animal and Vegetable Oils, Fats and Wax). We can also note significant levels of differences in the structure of import product groups for 3 years, in 2018 compared to 2015.

2018 compared to 2009:

$$K_g = 0.019; \qquad I_S = 0.110; \qquad I_R = 4.039$$

2018 compared to 2015:

$$K_g = 0.067; \qquad I_S = 0.086; \qquad I_R = 0.296$$

Confirmation of this conclusion should take into account the value of the Ryabtsev index. According to the Ryabtsev criterion, the results show the complete quantitative opposite of import structures over the observed years on a scale for assessing the significance of differences in structures, which indicates the constant development of trade relations. The exact opposite of structures over 9 years, and a significant level of differences over 3 years have been identified. On a scale for assessing the significance of structural differences according to the Ryabtsev criteria, the results show:

- In 2018, compared to 2009, the Ryabtsev index was 4.039, thus the exact opposite of the structures is observed;
- In 2018, compared to 2015, the Ryabtsev index was 0.296, thus a significant level of differences is observed.

Based on our analysis, we identified a change in the commodity structure of exports and imports in favor of products with higher added value and also a change in structural differences during the observed period which is in accordance with Caporale, Sova and Sova (2015) and their findings for previous period of 1992 – 2012 and Sun and Heshmati's (2010) analysis of 2002 – 2007.

Conclusion

The core of the present paper is the analysis of the commodity structure of Chinese exports and imports in the second decade of the 21st century, in the era of "new normal".

In the first decade of the 21st century, Chinese foreign trade, economic growth rate and export and import structure were affected by two historically significant events. On the one hand a positive one – accession to the WTO, on the other hand a negative one – the global financial crisis. While the WTO accession led to a significant increase in both Chinese exports and imports, the global financial crisis led to a decline in both exports and imports. Both of these events were accompanied by a gradual change in the structure of the Chinese economy, which is reflected in the change in the structure of GDP. The change in the structure of GDP is permanent and continues in the second decade of the 21st century, with a decline in the primary sector and a decline in the secondary sector but at the same time with secondary sector's qualitative changes aimed at high-tech production in favor of the tertiary sector.

The conducted analysis made it possible to define changes in the dynamics of China's foreign trade. It also allowed to define changes caused by the US-China trade war, as well as China's policy, defined by its President Xi Jinping in 2014 and subsequently translated into the 13th Five-year plan for economic and social development of China.

There are several conclusions drawn from the performed analysis. The Chinese economy is changing under the influence of both internal and external conditions. China's economic policy is changing, with an emphasis on balancing the imbalances that have arisen. The pace of economic growth is declining, the balance of the foreign trade surplus is decreasing, and domestic demand is increasing. In the second decade of the 21st century, China is transforming into an economy with a high share of the innovative secondary and tertiary sectors in GDP. Foreign trade shows uneven growth in the analyzed period, which is caused by the consequences of the financial crisis in 2008 and by the consequences of the trade war with the US. A positive consequence of economic development but also of the trade war with the US is a change in the commodity structure of exports and imports in favor of products with higher added value. China's position in the world economy is gradually changing, from a "world factory" to an innovation-based economy changing the commodity structure of exports in favor of higher value-added products. The transformation of the Chinese economy to the level of high-quality development will be China's new contribution to the development of the world economy.

Limits to the research are mostly reflected in the period of analysis which covers only the decade of "new normal" declaration (i.e. the second decade of the 21st century). Since the analyzed period only includes one decade, we suggest further research in the area of Chinese "new normal" to include longer time periods in order to reflect the changes in macroeconomic indicators of Chinese economy as well as to include the potential impacts of coronavirus pandemics on these indicators.

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Appendices

Appendix A

Values and Shares of Chinese Exports and Imports, 2009 – 2018, SITC

	Value of exports			**Share of exports**		
	Million USD			%		
	2009	2015	2018	2009	2015	2018
1.	63 111.79	103 927.11	134 992.83	2.63	2.29	2.71
2.	32 627.78	58 154.36	65 471.19	1.36	1.28	1.32
3.	1 640.95	3 309.29	3 713.24	0.07	0.07	0.07
4.	8 153.08	13 917.14	18 021.01	0.34	0.31	0.36
5.	20 373.73	27 901.51	46 722.22	0.85	0.61	0.94
6.	316.25	644.82	1 065.18	0.01	0.01	0.02
7.	1 138 483.47	2 169 541.11	2 351 688.68	47.37	47.71	47.29
8.	62 017.02	129 579.57	167 465.65	2.58	2.85	3.37
9.	184 815.98	391 017.71	404 659.17	7.69	8.60	8.14
10.	590 274.47	1 059 118.22	1 207 787.54	24.56	23.29	24.29
11.	299 746.87	587 444.66	565 605.76	12.47	12.92	11.37
12.	1 629.13	2 380.94	6 170.56	0.07	0.05	0.12
Total	**2 403 190.52**	**4 546 936.44**	**4 973 363.03**	**100.00**	**100.00**	**100.00**
	Value of imports			**Share of imports**		
	Million USD			%		
	2009	2015	2018	2009	2015	2018
1.	289 804.19	472 057.17	701 744.10	14.40	14.05	16.43
2.	14 827.19	50 500.98	64 800.88	0.74	1.50	1.52
3.	1 953.65	5 774.42	7 664.96	0.10	0.17	0.18
4.	141 346.69	209 709.88	272 143.65	7.03	6.24	6.37
5.	124 037.60	198 589.03	349 356.17	6.17	5.91	8.18
6.	7 639.07	7 482.85	7 778.44	0.38	0.22	0.18
7.	716 119.00	1 207 507.33	1 433 989.78	35.60	35.95	33.57
8.	112 090.04	171 265.82	223 636.11	5.57	5.10	5.24
9.	107 739.09	133 011.03	151 350.69	5.36	3.96	3.54
10.	407 796.84	682 418.06	839 656.46	20.27	20.32	19.66
11.	85 186.07	134 692.50	143 739.67	4.23	4.01	3.37
12.	3 306.97	86 119.92	75 606.86	0.16	2.56	1.77
Total	**2 011 846.40**	**3 359 128.99**	**4 271 467.77**	**100.00**	**100.00**	**100.00**

Source: National Bureau of Statistics of China (2019).

A p p e n d i x B

Calculations of Linear and Root-Mean-Square Deviation Coefficients of Structural Changes in Chinese Exports in 2009 and 2018

Commodity group	Export commodity structure		$d_2 - d_1$	$(d_2 - d_1)^2$	$\frac{d_2}{d_1}$	$\frac{d_2}{d_1} - 1$	$\left(\frac{d_2}{d_1} - 1\right)^2$
	2009 d_1	2018 d_2					
1.	2.63	2.71	0.08	0.01	1.03	0.03	0.00
2.	1.36	1.32	0.04	0.00	0.97	0.03	0.00
3.	0.07	0.07	0.00	0.00	1.03	0.03	0.00
4.	0.34	0.36	0.02	0.00	1.06	0.06	0.00
5.	0.85	0.94	0.09	0.01	1.11	0.11	0.01
6.	0.01	0.02	0.01	0.00	1.52	0.52	0.27
7.	47.37	47.29	0.08	0.01	1.00	0.00	0.00
8.	2.58	3.37	0.79	0.62	1.31	0.31	0.09
9.	7.69	8.14	0.45	0.20	1.06	0.06	0.00
10.	24.56	24.29	0.27	0.07	0.99	0.01	0.00
11.	12.47	11.37	1.10	1.21	0.91	0.09	0.01
12.	0.07	0.12	0.05	0.00	1.77	0.77	0.59
Total	**100.00**	**100.00**	**2.99**	**2.13**	**13.75**	**1.24**	**0.99**

Source: National Bureau of Statistics of China (2019).

Calculations of Linear and Root-Mean-Square Deviation Coefficients of Structural Changes in Chinese Exports in 2015 and 2018

Commodity group	Export commodity structure		$d_2 - d_1$	$(d_2 - d_1)^2$	$\frac{d_2}{d_1}$	$\frac{d_2}{d_1} - 1$	$\left(\frac{d_2}{d_1} - 1\right)^2$
	2015 d_1	2018 d_2					
1.	2.29	2.71	0.42	0.18	1.18	0.18	0.03
2.	1.28	1.32	0.04	0.00	1.03	0.03	0.00
3.	0.07	0.07	0	0.00	1.00	0.00	0.00
4.	0.31	0.36	0.05	0.00	1.16	0.16	0.03
5.	0.61	0.94	0.33	0.11	1.54	0.54	0.29
6.	0.01	0.02	0.01	0.00	2.00	1.00	1.00
7.	47.71	47.29	0.42	0.18	0.99	0.01	0.00
8.	2.85	3.37	0.52	0.27	1.18	0.18	0.03
9.	8.60	8.14	0.46	0.21	0.95	0.05	0.00
10.	23.29	24.29	1.00	1.00	1.04	0.04	0.00
11.	12.92	11.37	1.55	2.40	0.88	0.12	0.01
12.	0.05	0.12	0.07	0.00	2.40	1.40	1.96
Total	**100.00**	**100.00**	**4.87**	**4.36**	**15.36**	**3.72**	**3.37**

Source: National Bureau of Statistics of China (2019).

Appendix C

Calculations of Integral Indicators of Structural Differences in the Export of Chinese Goods in 2009, 2018

Commodity group	Export commodity structure		$d_2 + d_1$	$\frac{d_2 - d_1}{d_2 + d_1}$	$\frac{(d_2 - d_1)^2}{(d_2 + d_1)^2}$	$(d_2 + d_1)^2$
	2009 d_1^2	2018 d_2^2				
1.	6.90	7.34	5.34	0.0157	0.0002	28.4746754
2.	1.84	1.74	2.68	–0.0141	0.0002	7.17000204
3.	0.00	0.00	0.14	0.0124	0.0002	0.01912195
4.	0.12	0.13	0.70	0.0297	0.0009	0.48896547
5.	0.72	0.88	1.79	0.0516	0.0027	3.19615159
6.	0.00	0.00	0.03	0.2063	0.0426	0.00109956
7.	2 244.28	2 236.34	94.66	–0.0009	0.0000	8 961.24133
8.	6.66	11.36	5.95	0.1327	0.0176	35.4097817
9.	59.14	66.26	15.83	0.0284	0.0008	250.602903
10.	603.30	590.00	48.85	–0.0056	0.0000	2386.52935
11.	155.57	129.28	23.84	–0.0463	0.0021	568.48253
12.	0.00	0.01	0.19	–5.8729	0.0773	0.0352652
Total	**3 078.54**	**3 043.36**	**–**	**–5.4630**	**0.1446**	**12 241.6512**

Source: National Bureau of Statistics of China (2019).

Calculations of Integral Indicators of Structural Differences in the Export of Chinese Goods in 2015, 2018

Commodity group	Export commodity structure		$d_2 + d_1$	$\frac{d_2 - d_1}{d_2 + d_1}$	$\frac{(d_2 - d_1)^2}{(d_2 + d_1)^2}$	$(d_2 + d_1)^2$
	2015 d_1^2	2018 d_2^2				
1.	5.24	7.34	5.00	0.0840	0.0071	25
2.	1.64	1.74	2.6	0.0154	0.0002	6.76
3.	0.00	0.00	0.14	0.0000	0.0000	0.0196
4.	0.10	0.13	0.67	0.0746	0.0056	0.4489
5.	0.37	0.88	1.55	0.2129	0.0453	2.4025
6.	0.00	0.00	0.03	0.3333	0.1111	0.0009
7.	2 276.24	2 236.34	95.00	–0.0044	0.0000	9025
8.	8.12	11.36	6.22	0.0836	0.0070	38.6884
9.	73.96	66.26	16.74	–0.0275	0.0008	280.2276
10.	542.42	590.00	47.58	0.0210	0.0004	2 263.8564
11.	166.93	129.28	24.29	–0.0638	0.0041	590.0041
12.	0.00	0.01	0.17	0.4118	0.1696	0.0289
Total	**3 075.04**	**3 043.36**	**–**	**1.1409**	**0.3511**	**12 232.4373**

Source: National Bureau of Statistics of China (2019).

Appendix D

Calculations of Linear and Root-Mean-Square Deviation Coefficients of Structural Changes in Chinese Imports in 2009, 2018

Commodity group	Import commodity structure		$d_2 - d_1$	$(d_2 - d_1)^2$	$\frac{d_2}{d_1}$	$\frac{d_2}{d_1} - 1$	$\left(\frac{d_2}{d_1} - 1\right)^2$
	2009 d_1	2018 d_2					
1.	14.40	16.43	2.02	4.10	1.14	0.14	0.02
2.	0.74	1.52	0.78	0.61	2.06	1.06	1.12
3.	0.10	0.18	0.08	0.01	1.85	0.85	0.72
4.	7.03	6.37	0.65	0.42	0.91	0.09	0.01
5.	6.17	8.18	2.01	4.05	1.33	0.33	0.11
6.	0.38	0.18	2.20	4.84	0.48	0.52	0.27
7.	35.60	33.57	2.02	4.08	0.94	0.06	0.00
8.	5.57	5.24	0.34	0.12	0.94	0.06	0.00
9.	5.36	3.54	1.81	3.28	0.66	0.34	0.12
10.	20.27	19.66	0.61	0.37	0.97	0.03	0.00
11.	4.23	3.37	0.87	0.76	0.79	0.21	0.04
12.	0.16	1.77	1.61	2.58	10.77	9.77	95.42
Total	**100.00**	**100.00**	**15.01**	**25.21**	**22.84**	**3.68**	**97.83**

Source: National Bureau of Statistics of China (2019).

Calculations of Linear and Root-Mean-Square Deviation Coefficients of Structural Changes in Chinese Imports in 2015, 2018

Commodity group	Import commodity structure		$d_2 - d_1$	$(d_2 - d_1)^2$	$\frac{d_2}{d_1}$	$\frac{d_2}{d_1} - 1$	$\left(\frac{d_2}{d_1} - 1\right)^2$
	2015 d_1	2018 d_2					
1.	14.05	16.43	2.38	5.64	1.17	0.17	0.03
2.	1.50	1.52	0.01	0.00	1.01	0.01	0.00
3.	0.17	0.18	0.01	0.00	1.04	0.04	0.00
4.	6.24	6.37	0.13	0.02	1.02	0.02	0.00
5.	5.91	8.18	2.27	5.14	1.38	0.38	0.15
6.	0.22	0.18	0.04	0.00	0.82	0.18	0.03
7.	35.95	33.57	2.38	5.66	0.93	0.07	0.00
8.	5.10	5.24	0.14	0.02	1.03	0.03	0.00
9.	3.96	3.54	0.42	0.18	0.89	0.11	0.01
10.	20.32	19.66	0.66	0.44	0.97	0.03	0.00
11.	4.01	3.37	0.64	0.41	0.84	0.16	0.03
12.	2.56	1.77	0.79	0.62	0.69	0.31	0.10
Total	**100.00**	**100.00**	**9.86**	**18.13**	**11.80**	**1.51**	**0.35**

Source: National Bureau of Statistics of China (2019).

A p p e n d i x E

Calculations of Integral Indicators of Structural Differences in the Import of Chinese Goods In 2009, 2018

Commodity group	Import commodity structure		$d_2 + d_1$	$\frac{d_2 - d_1}{d_2 + d_1}$	$\frac{(d_2 - d_1)^2}{(d_2 + d_1)^2}$	$(d_2 + d_1)^2$
	2009 d_1^2	2018 d_2^2				
1.	207.50	269.90	30.8335	0.0656	0.0043	950.7064
2.	0.54	2.30	2.2541	0.3461	0.1198	5.0808
3.	0.01	0.03	0.2766	0.2977	0.0886	0.0765
4.	49.36	40.59	13.3969	–0.0489	0.0024	179.4774
5.	38.01	66.89	14.3442	0.1404	0.0197	205.7559
6.	0.14	0.03	0.5618	–0.3517	15.3346	0.3156
7.	1 267.01	1 127.04	69.1665	–0.0293	0.0009	4 784.0009
8.	31.04	27.41	10.8071	–0.0311	0.0010	116.7930
9.	28.68	12.55	8.8985	–0.2036	0.0414	79.1838
10.	410.86	386.41	39.9271	–0.0153	0.0002	1 594.1740
11.	17.93	11.32	7.5993	–0.1144	0.0131	57.7499
12.	0.03	3.13	1.9344	–0.4493	0.6890	3.7420
Total	**2 051.12**	**1 947.62**		**–0.3937**	**16.3149**	**7 977.0561**

Source: National Bureau of Statistics of China (2019).

Calculations of Integral Indicators of Structural Differences in the Import of Chinese Goods in 2015, 2018

Commodity group	Import commodity structure		$d_2 + d_1$	$\frac{d_2 - d_1}{d_2 + d_1}$	$\frac{(d_2 - d_1)^2}{(d_2 + d_1)^2}$	$(d_2 + d_1)^2$
	2015 d_1^2	2018 d_2^2				
1.	197.49	269.90	30.48	0.0779	0.0061	929.1282
2.	2.26	2.30	3.02	0.0045	0.0000	9.1232
3.	0.03	0.03	0.35	0.0215	0.0005	0.1234
4.	38.97	40.59	12.61	0.0102	0.0001	159.1176
5.	34.95	66.89	14.09	0.1609	0.0259	198.5493
6.	0.05	0.03	0.40	–0.1004	0.0098	0.1639
7.	1 292.19	1 127.04	69.52	–0.0342	0.0012	4 832.8073
8.	25.99	27.41	10.33	0.0133	0.0002	106.7936
9.	15.68	12.55	7.50	–0.0555	0.0031	56.2948
10.	412.71	386.41	39.97	–0.0165	0.0003	1 597.8133
11.	16.08	11.32	7.37	–0.0874	0.0075	54.3885
12.	6.57	3.13	4.33	–0.1831	0.0332	18.7818
Total	**2 042.98**	**1 947.62**	**–**	**–0.1889**	**0.0878**	**7 963.0849**

Source: National Bureau of Statistics of China (2019).