

## **An Analysis of the Internal and External Relations of the Shanghai Economy Based on Input-Output Table**

**Lin Sun**

Institute of National Economy  
Shanghai Academy of Social Sciences  
China

### **Abstract**

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*In the past two decades, the internal structure of Shanghai's economy and the relationship between Shanghai's economy and the international and domestic markets have undergone significant changes. This paper examines the change in Shanghai's internal economic structure and the linkages of Shanghai's economy with the rest of China (ROC) and the rest of the world (ROW) based on the input-output tables of 1997, 2002, 2007, 2012, and 2017. The results indicate that Shanghai's economy has become integrated more with the ROW than with ROC before 2008, but after the 2008 financial crisis, the opposite phenomenon has happened. Concerning ROC, Shanghai is more of a supplier than a source of demand. Concerning ROW, however, Shanghai is both a supplier and a source of demand, reflecting a high degree of integration of Shanghai with the world market and the rest of China.*

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**Keywords:** Shanghai Economy, Rest of China (ROC), Rest of World (ROW), Input-Output

### **1. Introduction**

Shanghai is the most economically developed city and is an international economic, financial, trade, shipping, and technological innovation center in mainland China. Shanghai's GDP is growing year by year. Between 1993 and 2021, Shanghai's GDP growth rate averaged more than 9 percent per annum, and the GDP at the constant 2000 price rose from 151.9 billion to 4.32 trillion Yuan, and accounted for about 4% of the country's total, and ranked first among major cities in the country. Shanghai's export volume of goods is increasing year by year. Affected by the pandemic of Covid 19, the growth rate of the national export value of goods in 2020 is negative, while Shanghai has maintained the stability of the export value of goods. In 2021, Shanghai's exports of goods will reach 1.57 trillion yuan, an increase of 14.6% over 2020. At present, Shanghai's industrial structure is an inverted pyramid structure. The traditional pillar industries, such as the textile industry, low-end manufacturing, and labor-intensive industries, have moved to the suburbs, other provinces, or closed. The overall industrial structure of Shanghai has made remarkable progress, and its core competitiveness has been formed and gradually consolidated.

The effects of regional growth can be divided into supply-side and demand-side sources. Some papers analyzed the effect factors of Shanghai's economic growth. Shi (2003) studied the sources of economic growth in Shanghai, and the results show the growth effect brought about by increasing internal demands is the source of economic growth in Shanghai. Li and Zhao (2005) analyzed the relationship between ex-import and the economic development of Shanghai by an empirical method. They demonstrated the ways and importance of directly and indirectly promoting the effects of imports and export on economic growth. Zhang et al. (2013) researched Shanghai's economic development power in the transformation period based on structure decomposition, demonstrated the role of export to ROW and ROC as essential sources. Hang et al. (2015) analyzed the productivity promotion effect and Shanghai's economic transformation and escalation; the results show that technical progress and technological catch-up to promoting productivity are rising, while the growth of manufacturing industries and their productivity is reducing.

By 2020, strategic emerging industries led by frontier technologies such as big data, quantum computing, and new materials are breeding and accumulating new dynamics of economic growth (Yang and Ma, 2021).

The purpose and method of the study are different from those described above. This paper aims to describe the main changes in Shanghai's economic structure and analyze the changes in Shanghai's external economic links in more detail by input-output data. For this purpose, the paper uses the input-output data for 1997, 2002, 2007, 2012, and 2017, capturing both demand and supply side linkages and the relation of the Shanghai economy with ROC and ROW. This paper is an upgraded version of the previous document (Sun, 2016).

## ***2. The Achievements of Shanghai's Economic Structural Adjustment***

With the deepening of reform and opening, the development of the Pudong New Area, and the influence of joining the World Trade Organization, Shanghai's economy has taken off in an all-around way. At the beginning of the 1990s, the Shanghai government took over *Pudong*. It focused on it as the main developing area, at the same time speeding up economic reforms and embracing more openness. Shanghai engaged twice in significantly upgrading its economic structure to adapt to domestic and international economic changes. The first was in the mid-1990s when the Shanghai government selected automobile, information, and communication technology (ICT), general electric equipment, petroleum and chemical, steel, and modern home appliance manufacture as the key industries to be developed. However, towards the end of the 1990s, the Shanghai government realized the importance of service industries. It, therefore, modified the list of critical sectors to be promoted to include business and trade services, financial and insurance services, and the real estate industry. Through high-tech manufacturing and advanced business services, Shanghai aimed to become a significant international metropolis and emerge as the Yangtze River Delta Economic Region leader and the Chinese economy (Wang, 2008). These two waves of upgrading resulted in significant changes in the structure of Shanghai's economy and altered its links with the domestic and the international economy (Leng and Fei, 2006).

Significant progress has been made in the adjustment of Shanghai's economic structure. The initial formation of an industrial design centered on the service economy. Since the mid-to-late 1990s, Shanghai has been strengthening the development of the service economy. The growth rate of the added value of the tertiary industry significantly exceeds that of the primary and secondary sectors and continues to be higher than the GDP growth rate. The service industry has become the economic growth of Shanghai. An important driver of growth. Since the 1990s, the proportion of Shanghai's primary sector has begun to show a downward trend. Compared with 4% in the early 1990s, it has remained at around 0.5% in recent years, and the overall growth trend of the output value of the primary industry has declined significantly; Compared with the primary sector, the overall development of the secondary sector shows a steady growth trend. Affected by the financial crisis in 2008, the growth rate has slowed down in recent years; the growth rate of the tertiary industry is apparent. The average annual growth rate remains around 10% more than the secondary industry.

The modern service industry and emerging industries are developing rapidly, and the modern service industries such as finance and information are increasing. The pace of industrial restructuring is accelerated, and the high-end development trend of the internal structure of the industry is gradually emerging. First, the producer service industry has maintained a relatively high level within the service industry. The second is accelerating the transformation and upgrading of traditional manufacturing industries. The economy of new technologies, new initiatives, new business forms, and new models has become a new highlight of Shanghai's economic development.

In this paper, we do not analyze the industrial structure in the usual sense, but the changes in the internal structure of Shanghai's economy and the changes in the relationship between Shanghai's economy and ROC and ROW based on the input-output table structure and data. In analyzing the economy of a region within a country, except for the internal economic system, it is necessary to consider its links with both the rest of the country and the world market at the same time (Miller and Blair, 2009). These links span trade, factor flows, government transfers, etc. The analysis of this paper focuses on the real economy, so that attention is paid to the export, import of products and services between Shanghai on the one hand and ROC and ROW on the other. Issues of factor flows and transfers between the regional and central governments are left for future studies. Input-output tables provide good information regarding trade linkages and changes over time.

### 3. The Changes in Shanghai's Internal Economic Structure

On the production/supply side, Table 1 shows that between 1997 and 2002, the share of value-added in Shanghai's gross output has increased only slightly from 31.4 to 32.3, indicating that the intermediate input intensity of Shanghai's economy has not changed much during this period. But between 2002 and 2007, the share of value-added in Shanghai's gross output has decreased from 32.3 to 28.2, indicating that the intermediate input intensity of Shanghai's economy has increased by about four percentage points during this period. And between 2007 and 2012, the share of value-added in Shanghai's gross output almost has not changed, but between 2012 and 2017, it backed the level of 2002. That indicated the intermediate input intensity of Shanghai's economy was stable for 20 years.

However, there have been notable changes in the composition of the value-added itself (see Table 1), with the share of 'fixed capital depreciation' increasing from 12.1 percent in 1997 to 14.7 percent in 2002, decreasing to 13.4 percent in 2007, 12.2 percent in 2012 and 11.3 percent in 2017, showed a continuing downward trend. The 'employee compensation' share showed steady growth from 1997 to 2007 (34.4 percent in 1997, 35.0 percent in 2002, and 36.6 percent in 2007), but showed a significant increase to 41.6 percent in 2012 and 44.4 percent in 2017. Therefore, capital accumulation rather than employment expansion played a more important role in Shanghai's recent growth from 1997 to 2007. Still, employment expansion rather than capital accumulation played a more important role in Shanghai's recent development in 2012 and 2017. Also, more of the surplus is now captured by the government in the form of taxes, leading to an increase in the share of 'net taxes' in the value-added from 21.1 percent in 1997 to 24.6 percent in 2002 but decreased in 2007 (15.2 percent) and once again increased to 19.9 percent in 2012 and 17.4 percent in 2017. The increases in the shares in value-added of depreciation, labor, and taxes have taken place at the expense of the percentage of capital, as reflected in the marked decline in the share of 'operation surplus' in the value-added from 32.4 percent in 1997 to 25.7 percent in 2002, but increased in 2007 (34.8 percent) and once again decreased to 26.3 percent in 2012 and 26.9 percent in 2017.

**Table1: The Composition of Input, Added Value, and Consumption**

	1997	2002	2007	2012	2017
Total Input	100.0	100.0	100.0	100.0	100.0
Intermediate Input	68.6	67.7	71.8	71.7	67.4
Total Added Value	31.4	32.3	28.2	28.3	32.6
Total Added Value	100.0	100.0	100.0	100.0	100.0
Fixed Capital Depreciation	12.1	14.7	13.4	12.2	11.3
Employee Compensation	34.4	35.0	36.6	41.6	44.4
Net Production Tax	21.1	24.6	15.2	19.9	17.4
Operation surplus	32.4	25.7	34.8	26.3	26.9
Total Consumption	100.0	100.0	100.0	100.0	100.0
Intermediate Consumption	68.1	70.0	72.9	72.7	68.1
Household Consumption	10.5	11.7	10.4	12.4	13.9
Government Consumption	2.7	3.4	3.7	4.0	4.9
Gross Fixed Capital Formation (GFCf)	18.7	14.9	13.0	10.9	13.1

Data source: Calculated by 1997, 2002, 2007, 2012, and 2017 Shanghai Input-Output Table

On the disposal/demand side, Table 1 shows that the shares of 'intermediate consumption,' 'household consumption,' and 'government consumption' in Shanghai's output have changed respectively from 68.1, 10.5, and 2.7 percent in 1997 to 70.0, 11.7 and 3.4 percent in 2002, 72.9, 10.4 and 3.7 percent in 2007, 72.7, 12.4 and 4.0 percent in 2012, and 68.1, 13.9 and 4.9 percent in 2017. The share of 'gross fixed capital formation (GFCf),' on the other hand, has decreased from 18.7 percent in 1997 to 14.9 percent in 2002, 13.0 percent in 2007, 10.9 percent in 2012, and backed to 13.1 percent in 2017.

However, GFCf and ‘intermediate consumption’ together account for more than 80 percent of absorption of Shanghai’s output from 1997 to 2017, leaving only less than 20 percent for ‘household’ and ‘government consumption.’ This indicates that most of Shanghai’s production is geared toward producing intermediate and capital goods rather than consumption goods.

#### 4. Shanghai’s economic relationships with ROC and ROW

The Changes in Shanghai’s economic structure were associated with changes in Shanghai’s external financial relationships, with changes in the relative importance of Shanghai’s market, ROC, and ROW as sources of demand and supply for Shanghai. First, there has been a significant shrinkage of the role of Shanghai’s domestic market as a destination of Shanghai’s output from 1997 to 2012. The Shanghai domestic market's share of Shanghai’s output absorbed decreased from 73.1 percent in 1997 to 61.7 percent in 2002, 50.0 percent in 2007, 34.5 percent in 2012, and 38.3 percent in 2017 (Table 2). Analogous shares of ROC increased from 14.3 in 1997 to 19.3 in 2002, to 24.1 percent in 2007, to 43.7 percent in 2012, and 47.4 percent in 2017; ROW rose from 12.6 percent in 1997 to 19.0 percent in 2002, to 25.9 percent in 2007, and decreased to 21.8 percent in 2012 and 14.3 percent in 2017. In other words, about 40 percent in 2002, 50 percent in 2007, 65 percent in 2012, and 61.7 percent in 2017 of Shanghai’s output is now marketed outside of Shanghai, of which the world market absorbed half by 2007 but significantly exceeded by the rest of China in 2012, and especially in 2017. During this period, the change in the world market is the leading cause of this phenomenon. The U.S. Sub-Prime Financial Crisis triggered by the global financial turmoil slowed down Shanghai’s economic growth significantly from 2008.

Second, related shifts have occurred on the demand side too. The share of Shanghai’s demand met by Shanghai’s output declined from 72.6 percent in 1997 to 63.8 percent in 2002, to 50.7 percent in 2007, 34.9 percent in 2012, and backed a little to 38.6 percent in 2017 (Table 2). Interestingly, the share of ROC in meeting Shanghai’s demand has declined from 19.2 percent in 1997 to 12.3 percent in 2002 but has significantly increased to 20.4 percent in 2007, 37.2 percent in 2012, and 33.4 percent in 2017. Also, there has been a significant increase from 8.2 percent in 1997 to 23.9 percent in 2002 and 28.9 percent in 2007, in the role of the foreign market in meeting Shanghai’s demand, and has declined only slightly to 27.9 percent in 2012, and 28.0 percent in 2017. The international market's supply to Shanghai is stable.

**Table 2: The Relation of Shanghai Economy with ROC and ROW**

	1997	2002	2007	2012	2017
Destination of Output	100.0	100.0	100.0	100.0	100.0
to Shanghai market	73.1	61.7	50.0	34.5	38.3
to ROC market	14.3	19.3	24.1	43.7	47.4
to ROW market	12.6	19.0	25.9	21.8	14.3
Sources of Demand	100.0	100.0	100.0	100.0	100.0
From Shanghai Supply	72.6	63.8	50.7	34.9	38.6
From ROC Supply	19.2	12.3	20.4	37.2	33.4
From ROW Supply	8.2	23.9	28.9	27.9	28.0

Data source: Calculated by 1997, 2002, 2007, 2012, and 2017 Shanghai Input-Output Table

Thus, while ROC absorbs relatively more (in 2017 compared to in 1997) of Shanghai’s output, Shanghai itself is absorbing relatively more from the international market and somewhat less from ROC (in 2017 compared to in 1997) but more from ROC and less from the global market. This paper highlights the total amount level of the relation between Shanghai, ROC, and the world market, not discussing industries’ status in detail. In other words, ROC is more a market for the sale of Shanghai products than its supply source. For the latter, Shanghai was more dependent on the world market from 1997 to 2007 but more dependent on the rest of China after the 2008 financial crisis.

At the same time, the relative importance of Shanghai’s economic links with the rest of China (ROC) and the rest of the world (ROW) changed (see Table 3 and Table 4).

Shanghai's domestic trade (Transfer from or to ROC) to its output increased from 31.2 percent in 2002 to 44.3 percent in 2007 and more than 80 percent in 2012 and 2017. The transfer rate from ROC to its output rose more than the rate of transfer from ROC to its output. Shanghai's domestic trade (Transfer from or to ROC) to its added value increased from 06.7 percent in 2002 to 157.2 percent in 2007 and more than 240 percent in 2012 and 2017. The transfer rate from ROC to its added value increased more than the rate of transfer from ROC to its added value.

The ratio of Shanghai's international trade (Export or import from or to ROW) to its output increased from 20.9 percent in 1997 to 54.4 percent in 2007 and decreased to 49.3 percent in 2012 and 42.1 percent in 2017. The export rate to ROW to its output decreased significantly, but the rate of import from ROW to its output kept steady after 2007. The ratio of Shanghai's international trade (Export or import from or to ROW) to its added value increased from 66.4 percent in 1997 to 193.1 percent in 2007 and decreased to 174.0 percent in 2012 and 129.1 percent in 2017. The export rate to ROW to its added value significantly reduced than the rate of import from ROW to its added value after 2007.

**Table 3: The Domestic Trade with Total Output and Added Value**

	1997	2002	2007	2012	2017
Domestic Trade/Total Output	33.6	31.2	44.3	80.4	80.5
Transfer to ROC/Total Output	14.3	19.3	24.1	43.7	47.4
Transfer From ROC/Total Output	19.4	11.9	20.2	36.7	33.1
Domestic Trade/Added Value	107.1	96.7	157.2	283.7	247.1
Transfer to ROC/Added Value	45.5	59.8	85.6	154.3	145.5
Transfer From ROC/Added Value	61.6	36.9	71.6	129.4	101.6

Data source: Calculated by 1997, 2002, 2007, 2012, and 2017 Shanghai Input-Output Table

**Table 4: The International Trade with Total Output and Added Value**

	1997	2002	2007	2012	2017
International Trade/Total Output	20.9	42.1	54.4	49.3	42.1
Export to ROW/Total Output	12.6	19.0	25.9	21.8	14.3
Import From ROW/Total Output	8.3	23.1	28.5	27.5	27.7
International Trade/Added Value	66.4	130.4	193.1	174.0	129.1
Exporter to ROW/Added Value	40.1	58.8	92.1	77.0	44.0
Import From ROW/Added Value	26.3	71.6	101.1	97.0	85.1

Data source: Calculated by 1997, 2002, 2007, 2012, and 2017 Shanghai Input-Output Table

### 5. Conclusions

In the past two decades, the internal structure of Shanghai's economy and the relationship between Shanghai's economy and the international and domestic markets have undergone significant changes. This paper examines the changes that have taken place from 1997 to 2017 in Shanghai's economic structure and its linkages with ROC and ROW.

A comparative analysis of the data from Shanghai input-output tables of 1997, 2002, 2007, 2012, and 2017 shows that Shanghai's economy has become more integrated with the ROW than ROC. Still, after the 2008 financial crisis, the opposite phenomenon has happened. Secondly, Shanghai's economy is now firmly connected with ROC and ROW through supply and demand linkages, whereas its connection with ROC runs more supply linkages than demand linkages. Thirdly, concerning ROC, Shanghai is more of a supplier than a source of demand. Concerning ROW, however, Shanghai is both a supplier and a source of demand, reflecting Shanghai's high degree of integration with the world market (globalization) before the 2008 financial crisis. Fourthly, Shanghai has become a workshop for the entire world, absorbing capital goods and intermediate inputs and exporting finished manufacturing products. An accompanying feature of this process has been the greater reliance of the Shanghai economy on capital accumulation and less on labor absorption for its expansion.

The increased importance of intermediate input in the process also reflects the decline of the share of value-added in gross output. To what extent the latter deterioration is also a manifestation of a reduction in the efficiency of utilization of capital and labor is an important question that demands further investigation. Because of the two-way integration with the world market and the rest of China especially backed by the large-scale domestic demand from the rest of China that it caters to, Shanghai can withstand adjustments in the fluctuations of the global economy.

As a general issue, the further development of Shanghai's economy will encounter new challenges. Since the reform and opening, Shanghai's previous industrial restructuring has been carried out under the government's leadership. In the future, Shanghai's industrial restructuring will face the challenge of strengthening the driving force of the market and giving play to the decisive role of the market in the allocation of industrial resources. While Shanghai's industrial restructuring has made remarkable achievements, it faces problems such as a lack of overall development momentum in the secondary industry, increased pressure from excess capacity, a low level of the service industry, and a low proportion of emerging industries. The degree of integration between producer services and manufacturing in Shanghai is poor. Shanghai will face the problems of excessive expansion of processing and manufacturing and lagging of producer services, and the adjustment and upgrading of the industrial structure will face more significant competitive pressure and challenges. In addition, Shanghai also faces a series of problems such as a high degree of external dependence on industrial, technological innovation, a lack of critical technologies, a relatively slow pace of industrial restructuring and upgrading, slow development of high-end service industries, limited scope of coverage, and a low degree of internationalization. The problems mentioned above and challenges faced by Shanghai's economy will further reshape the internal structure of Shanghai's economy and the relationship between Shanghai's economy and ROC and ROW from both sides of supply and demand.

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