

Research on the Relationship between Industrial Structure Evolution and Industry Income Gap in Hong Kong

Yi Jin

School of Economics, Jinan University, Guangzhou, China

Email: christinajy@163.com

How to cite this paper: Jin, Y. (2018) Research on the Relationship between Industrial Structure Evolution and Industry Income Gap in Hong Kong. *Modern Economy*, 9, 682-698.
<https://doi.org/10.4236/me.2018.94044>

Received: March 21, 2018

Accepted: April 21, 2018

Published: April 24, 2018

Copyright © 2018 by author and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

The widening industry income gap in Hong Kong has seriously hindered the balanced development of industry and sustained and healthy economic growth. Therefore, it is of great significance to explore the influence mechanism of industrial structure evolution on industry income gap and the relationship between them. This paper takes Hong Kong's industrial structure evolution and industry income gap as the research object, and comprehensively uses statistical data and census data to analyze in detail the causal relationship between industrial structure evolution and industry income gap. Starting with the evolution of Hong Kong's industrial structure, this paper follows the idea that the industrial structure determines the employment structure and thus affects the change of the industry income gap. Then we use agent variables which describe the nature of industrial structure evolution and industry income gap to conduct causality analysis and regression analysis to find the dynamic and quantitative relationship between them.

Keywords

Industrial Structure Evolution, Industry Income Gap, Hong Kong, Relationship Research

1. Introduction

Since its opening in 1841, Hong Kong has completed the transition from the "traditional economy" to the "industrial economy" to the "service economy". Since the reunification, although Hong Kong has suffered a series of external shocks such as the Asian financial crisis, SARS and the US subprime mortgage crisis, which have hit its economic growth to a certain extent, the actual economic growth has remained at a relatively high level. And it has gradually

formed a trade logistics industry, financial services, professional and producer support services and tourism as the pillar industries of the economic structure. In twenty-first century, Hong Kong's economy was once in a downturn, but it soon started a new turn to the "knowledge-based economy". In order to promote the diversification of the local industrial structure, the Hong Kong SAR Government has identified six industries which have obvious advantages in Hong Kong and have potential for further development. At the present stage, the economic development of Hong Kong has shown a good situation in general and is the freest economy in the world. As a developed economy, Hong Kong has long been in the top 10 in the global competitiveness index released by the world economic forum. In the latest 2017-2018 ranking, Hong Kong ranks sixth above Japan [1].

With the rapid economic growth, the income gap of Hong Kong has been expanding. It has formed a coexistence of rapid economic growth and widening income gap. The gap between the rich and the poor in Hong Kong has not changed much since the reunification. Its Gini coefficient has always been a high level in developed countries or regions and has remained above 0.5 for a long time, and the distribution of income has not improved with the economic growth. Although the minimum wage policy has raised the income of low paid workers, the situation of in-service poverty in Hong Kong is still very serious, and the income distribution gap between industries is widening. There is a problem of the coordination and interaction mechanism between economic development and social stability. In the context of service-oriented industrial structure in Hong Kong, this study chooses to start with the evolution of industrial structure in Hong Kong, following the idea that industrial structure determines the employment structure and then affects the change of industry income gap. This paper attempts to study the relationship between the evolution of Hong Kong's industrial structure and industry income gap.

This paper is organized as follows. Firstly, this paper reviews the relevant research literature. Then this paper clarifies the relationship between industrial structure evolution and employment structure and the change of industry income gap caused by employment structure. Furthermore, we empirically analyze the relationship between industrial structure evolution and industry income gap in Hong Kong. Finally, the conclusion of this paper is drawn.

The main contribution of this paper is to discuss in detail the relationship between industrial structure evolution and industry income gap in Hong Kong, and to provide a new way of thinking for the study of industry income gap. It also proves that there is a progressive mechanism and causality between industrial structure evolution and industry income gap in Hong Kong, which provides a visual angle for Hong Kong to study how to narrow the industry income gap. Due to the limitations of individual academic level and data acquisition, this paper has the following shortcoming. There is no systematic theoretical model for the transmission mechanism of industrial structure and employment structure and industry income gap in Hong Kong, which is not convincing enough, which

is expected to continue to research and improve in the future. This is expected to improve in future research.

2. Literature Review

2.1. Research on Industrial Structure Evolution in Hong Kong

With the development of Hong Kong's economy and society, the research on the evolution of industrial structure in Hong Kong is gradually deepened, and the main studies are as follows.

Liu Guofen (2006) points out that the evolution of Hong Kong's industrial structure is divided into four stages: 1) Before 1950s, Hong Kong is in a period of economic recovery and dominant re-export trade; 2) From the 1950s to the 1970s, it is the period of industrialization in Hong Kong; 3) From the 1970s to the 1980s, it is the period of industrial diversification and service industry growth in Hong Kong; 4) Since 1980s, the manufacturing industry of Hong Kong has moved northward and its industrial structure has been highly light. At this time, the proportion of manufacturing industry has decreased, and the proportion of service industry has increased substantially. Hong Kong has a distinct characteristic of service economy. Liu Guofen further points out that Hong Kong has four characteristics related to the industrial structure from the point of view of the actual economic situation. First, the industrial structure has not developed towards diversification, and become more service-oriented. Second, the growth of the service industry is mainly driven by non-productive service industry. Third, CEPA's zero tariff policy and "free travel" policy have little effect on stimulating industrial investment. Fourth, the problem of structural unemployment in Hong Kong is serious [2].

Feng Bangyan (2015) sums up the economic development and the industrial structure evolution in Hong Kong into three stages: 1) The period from 1951 to 1980 is the period of Hong Kong's economic industrialization; 2) From 1980 to 1997, Hong Kong's economic structure is service-oriented; 3) From 1997 to now, Hong Kong is in the stage of becoming a global financial center and improving the strategic position of the three major centers, namely, the international financial center, the international trade center and the shipping center [3].

Guo Jiang and Jing Yan (2016) point out that after the transformation of Hong Kong into a service-oriented economy, the tertiary industry has continued to expand, while the fact that the secondary industry dominated by manufacturing has continued to shrink. And by comparing the industrial structure of Singapore, it is revealed that the unbalance of the industrial structure caused by the low proportion of Hong Kong's manufacturing industry is an important reason for its weak economic growth [4].

2.2. Research on the Relationship between Industrial Structure Evolution and Industry Income Gap in Hong Kong

In the study of the relationship between industrial structure evolution and in-

come gap in Hong Kong, some scholars have done a positive study.

Zhang Yingwu (2007) calculates the degree of industrial deviation and concludes that industries that are related to the future development of Hong Kong are all negative industrial structure deviation, such as import and export trade, finance and insurance, professional services and communication industry, as a result, the ability of these industries to absorb employment is very limited. He points out that the economic growth promoted by the export-oriented high value-added and efficient service industry in Hong Kong does not drive regional consumption and does not benefit lower class workers [5].

Chen Guanghan and Zhang Yingwu (2009) put forward that the influence of economic transformation through the employment market on personal income distribution is an important factor for the deterioration of income inequality in Hong Kong. On the one hand, the economic transformation results in the transfer of employment from the manufacturing industry with relatively low Gini coefficient to the service industry, especially the specialized service industry, where the Gini coefficient is relatively high. On the other hand, the economic transformation leads to the higher level of education for the employed, and the more dispersed income of the highly educated group leads to the increase of income inequality [6]. Gan Hongming (2012) notes that “de-industrialization” expands the income gap in Hong Kong in three ways: Firstly, Hong Kong’s “de-industrialization” has caused massive structural unemployment and depressed the wage level of the middle and lower level labor force. Secondly, due to the failure to promote the upgrading of manufacturing industry, the channel for upgrading human capital has been blocked, which has led a large number of workers to switch to the service industry with low skill requirements, such as transportation, retail, household service industry etc. As a result, wage growth cannot keep up with the pace of economic development. Finally, the development of high value-added service industry makes a small number of people obtain huge returns on wealth investment, accelerate the speed of wealth concentration, and expand the degree of inequality in income distribution [7]. Guan Hongling (2014) points out that the industrial structure transformation leads to the widening of the income gap between industries in Hong Kong, and the income gap is expanding not only between industries, but also within the industry. It is pointed out that the small income gap in the industry is the construction industry [8].

2.3. Brief Summary

According to the foregoing, we know that some literatures have attached importance to the research of the evolution of Hong Kong’s industrial structure and have done some research and analysis on the relationship between industrial structure evolution and industry income gap in Hong Kong. However, relevant literatures fail to explain the transmission mechanism of the effect of industrial structure evolution on the industrial income gap in Hong Kong, and there is no

empirical analysis of the causal and quantitative relationship between the two. This paper studies these problems in the later text.

3. Causal relationship between Industrial Structure Evolution and Industry Income Gap in Hong Kong

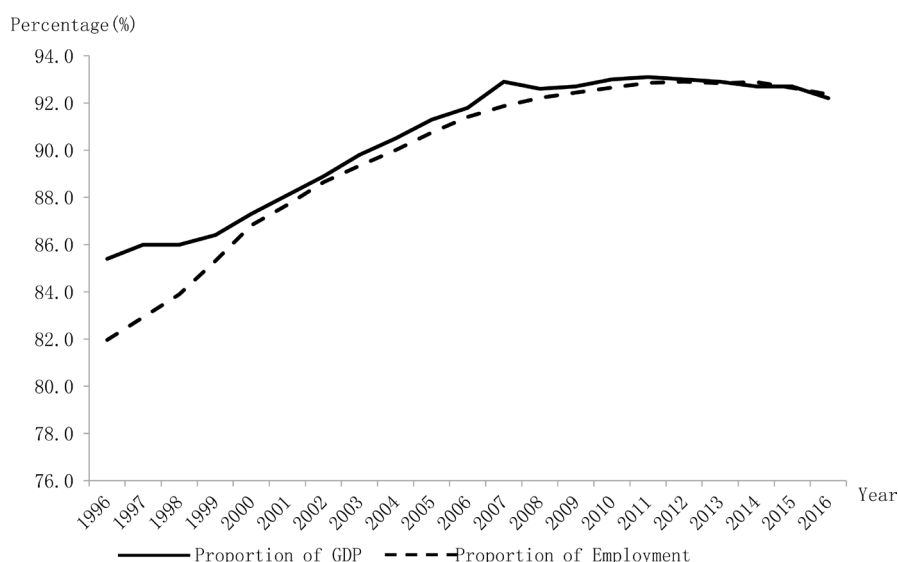
3.1. Research Ideas

In the previous literature review, some scholars have analyzed the reasons for the widening of the income gap in Hong Kong from the perspective of industrial structure. The research ideas of this paper are as follows: there is a progressive mechanism between the evolution of industrial structure and the change of employment structure and the change of industry income gap. On the one hand, as the carrier of employment, the industrial sector determines the employment structure to a large extent. Therefore, the evolution of the industrial structure in Hong Kong will inevitably lead to corresponding changes in the employment structure, so that there is a reasonable employment structure corresponding to it [9]. On the other hand, due to the difference of wage levels among different industrial sectors, the employment structure greatly determines the income situation of the employment population and its family among the various industrial sectors. And the change or stability of the employment structure will directly affect the change of industry income gap in Hong Kong.

3.2. The Relationship between Industrial Structure Evolution and Employment Structure in Hong Kong

The evolution of industrial structure in Hong Kong shows two remarkable characteristics: one is the service-oriented industrial structure, the other is the specialization of the service industry. Accordingly, the employment structure of Hong Kong is also showing the characteristics of service-oriented and specialization.

According to **Figure 1**, from 1996 to 2016, the proportion of service added value to GDP in Hong Kong has always been higher than 85 percent. Compared with other non-service industries, the service industry occupies an absolute advantage. Accordingly, the proportion of employment in Hong Kong's service industry is much higher than that of other non-service sectors. Especially since this century, the two curves describing the proportion of the added value of the service industry to the GDP and the proportion of the employment of the service industry to the total employment have gradually tended to coincide. In 2016, the added value of service industry in Hong Kong accounted for 92.2 percent of GDP. In 2016, the added value of service industry in Hong Kong accounts for 92.2 percent of GDP, and the proportion of service employment to total employment is about 92.4 percent, which is slightly greater than the proportion of service industry added value to GDP. Consequently, Hong Kong is a service economy. The industrial structure tends to be service-oriented, which determines that Hong Kong's labor force is mainly concentrated in the service sector.



Data source: Hong Kong Annual Digest of Statistics.

Figure 1. 1996-2006 service industry GDP ratio (basic price calculation) and employment occupation ratio in Hong Kong (%).

We further examine the development of specialization within the service industry. According to the Hong Kong Standard Industrial Classification version 2.0, we have classified the service industry (excluding ownership of premises) into three categories: productive service industry (including information and communications, financing and insurance, real estate, professional and business services), circulation service industry (including import/export, wholesale and retail trades, transportation, storage, postal and courier services) and living service industry (including accommodation and food services, society and personal services) [10] [11] [12].

According to the availability of data, as can be seen from **Table 1**, from 2000 to 2016, the three types of service industry in Hong Kong presents a noticeable regular change in two aspects of the proportion of GDP and the proportion of employment. Firstly, the proportion of the added value of the productive service industry to GDP and the employment proportion of the productive service industry are increasing, but the former is slightly higher than the latter. Secondly, the proportion of the value added to GDP in the circulation service industry and the living service industry is less than the proportion of their respective employment in the total employment. On the one hand, from 2000 to 2016, the proportion of value added in the circulation service industry to GDP has gone through a process of first rising and then decreasing, and it has decreased by 1.2 percentage points in total. The proportion of employment in the circulation service industry is declining in general, from 40.8% in 2000 to 35.1% in 2016, and a total reduction of 5.7 percentage points. On the other hand, the proportion of living service industry added value to GDP has basically not changed, but its share of employment tends to increase, from 22% in 2000 to 28% in 2016, a total increase of 6 percentage points. Thirdly, with the evolution of industrial structure,

Table 1. 2000-2016 three types of service industry GDP ratio (basic price calculation) and employment occupation ratio in Hong Kong (%).

Year	Productive service industry		Circulation service industry		Living service industry	
	Proportion of GDP	Proportion of employment	Proportion of GDP	Proportion of employment	Proportion of GDP	Proportion of employment
2000	25.3	24.1	29.2	40.8	21.9	22.0
2001	24.4	24.5	29.6	40.2	22.8	23.0
2002	24.5	24.7	30.6	40.3	22.7	23.6
2003	25.4	24.8	31.4	40.6	22.4	23.9
2004	25.2	25.1	33.5	40.5	22.1	24.4
2005	26.0	25.4	34.5	40.5	20.7	24.9
2006	28.7	25.9	32.8	40.1	19.9	25.4
2007	32.5	26.5	31.1	39.7	19.3	25.7
2008	30.4	26.9	30.7	39.4	20.5	26.0
2009	30.2	27.2	29.7	38.6	21.3	26.6
2010	30.3	27.6	31.7	38.3	20.2	26.8
2011	30.7	28.3	32.2	37.5	20.0	27.0
2012	30.9	28.7	31.4	37.0	20.4	27.2
2013	30.9	29.0	31.0	36.6	20.6	27.3
2014	31.1	29.0	30.3	36.2	20.8	27.7
2015	32.0	29.2	29.2	35.5	20.9	27.9
2016	32.2	29.3	28.0	35.1	21.4	28.0

Data source: Census and Statistics Department (The Government of the Hong Kong Special Administrative Region).

the employment population in Hong Kong is flowing out of the circulation service industry, part of which flows to the living service industry, and the other part flows to the productive service industry. From the change of proportion, from 2000 to 2016, the proportion of the employment of the living service industry to total employment has increased by 6 percentage points, while the proportion of the employment of the productive service industry to total employment has increased by 5.2 percentage points, indicating that the former flow is slightly larger than the latter one.

3.3. Employment Structure Leads to the Change of Industry Income Gap in Hong Kong

First of all, we inspect the income gap between industries in Hong Kong. As shown in **Table 2**, the overall income of the productive service industry is the highest, and median monthly wages of its sub sectors from 2010 to 2016 are all more than HK \$18,000. The income of the circulation service industry is at the middle level, while the income level of the living service industry is generally

Table 2. Median monthly wages divided by industry in Hong Kong (HK\$).

	Industry/Year	2010	2016	2010-2016	
				Average	Added value
Productive service industry	Information and communications	15,000	20,700	18,043	5700
	Financing and insurance	19,100	26,000	22,900	6900
	Real estate	15,500	20,700	18,143	5200
	Professional, scientific and technical activities	16,300	21,500	19,086	5200
Circulation service industry	Import and export trade	13,000	17,100	15,371	4100
	Wholesale	10,400	13,800	12,186	3400
	Retail trades	9,000	12,400	10,857	3400
	Land transportation	12,500	17,500	15,014	5000
Living service industry	Other transportation, storage, postal and courier services	12,400	16,800	14,643	4400
	Food services	8000	11,800	9971	3800
	Accommodation and other food services	11,300	14,400	12,914	3100
	Property management, security and cleaning services	7000	11,200	9471	4200
	Administrative and support services	11,600	15,800	13,757	4200
	Travel agents, booking services and related activities	9600	13,800	11,900	4200
Manufacturing	Miscellaneous activities	7400	11,500	9,686	4100
Construction		11,200	15,600	13,400	4400
		13,700	21,200	17,443	7500

Data source: Hong Kong Annual Digest of Statistics.

low. In each of the sub sectors, the median monthly wage of the financing and insurance is the highest, reaching HK \$26,000 in 2016, while the median monthly wage of property management, security and cleaning services is the lowest, with only HK \$11,200 in 2016. It can be seen that the former is 2.3 times more than the latter. From the perspective of added value in income, in addition to construction, the added value of the median monthly wage in productive service industry is the largest. In productive service industry, from 2010 to 2016, the added value of the median monthly wage is HK \$5200 (real estate and professional, scientific and technical activities), and the highest added value of the median monthly wage is in the financing and insurance, and it has reached HK \$6900. The added value of the median monthly wage in the living service industry is generally low and added value of food services and accommodation and other food services is HK \$3800 and HK \$3100. The added value of the median monthly wage in the circulation service industry is in the middle. In addition to

land transportation, added value in several other sub sectors is between HK \$3400 and HK \$4400. Thus, in the service industry, the income gap between the productive service industry and the living service industry and the circulation service industry is expanding.

We further examine the income gap between different types of occupation in Hong Kong. Referring to the practice of Guan Hongling (2014), according to the skill and monthly income level, this paper divides the employed population of Hong Kong into upper, middle and lower classes. The classification is shown in the following **Table 3** [8].

We then study the income gap between different occupations and classes in Hong Kong, as shown in **Table 4**.

1) The income gap between different occupations is obvious. In all occupations, in 2016, the largest median monthly income is the managers and administrators, which is HK \$43,000. The second is professionals, and the median monthly income is HK \$36,000. The lowest income is elementary occupations with a median monthly income of only HK \$7000. It is worth noting that elementary occupations account for the largest proportion of employment, reaching 20.9%.

From the change of income, although the income of all occupations is increasing, the difference is significant. From 1996 to 2016, the largest increase in the median monthly income is the managers and administrators, with an increase of 115%. The second is the craft and related workers, which the median monthly income increases by 76%. The smallest increase in the median monthly income is the elementary occupations, with an increase of only 27%. The growth of other occupations is more than 50%.

2) The structure of the three classes of employment personnel in Hong Kong has changed from “spindle shaped” to “dumbbell shaped”. In 1996, the proportion of employed persons in the upper, middle and lower classes is 29.2%, 37.6%

Table 3. Class by occupation in Hong Kong.

Occupation	Class division	Level of skill	Monthly income level
Managers and administrators	Upper-level employment staff	High	Higher than average income
Professionals			
Associate professionals			
Clerical support workers	Middle-level employment staff	Middle	Close to average income
Craft and related workers			
Plant and machine operators and assemblers			
Service and sales workers	Lower-level employment staff	Low	Lower than average income
Elementary occupations			
Skilled agricultural and fishery workers; and occupations not classifiable			

Table 4. Median monthly income (HK\$) and proportion of employment (%) by occupation in Hong Kong.

Year	1996		2001		2006		2011		2016	
Occupation	Median monthly Income	Proportion of employment	Median monthly Income	Proportion of employment	Median monthly Income	Proportion of employment	Median monthly Income	Proportion of employment	Median monthly Income	Proportion of employment
Managers and administrators	20,000	12.1	26,000	10.7	26,000	10.8	36,250	10.1	43,000	10.1
Professionals	24,000	5.0	30,000	5.5	25,000	6.1	32,160	6.5	36,000	7.0
Associate professionals	14,000	12.1	16,000	15.3	15,000	16.1	18,000	19.6	21,250	20.5
Clerical support workers	9000	16.8	10,000	16.3	9500	16.9	10,000	15.6	14,000	14.1
Craft and related workers	8500	12.3	10,000	9.9	10,000	8.5	10,500	7.4	15,000	5.6
Plant and machine operators and assemblers	8500	8.5	10,000	7.3	9500	6.2	10,000	5.0	13,000	4.3
Service and sales workers	8500	13.8	9110	15.0	8500	16.4	9000	16.2	12,000	17.2
Elementary occupations	5500	18.6	5300	19.5	4900	18.8	5000	19.5	7000	20.9
Skilled agricultural and fishery workers; and occupations not classifiable	7000	0.8	7000	0.3	6500	0.3	7200	0.1	11,000	0.1
Upper-level employment staff		29.2		31.7		33.0		36.2		37.6
Middle-level employment staff		37.6		33.5		31.6		28.0		24.0
Lower-level employment staff		33.2		34.8		35.4		35.8		38.4

Data source: 2006 Population By-census—Thematic Report: Household Income Distribution in Hong Kong. 2016 Population By-census—Thematic Report: Household Income Distribution in Hong Kong.

and 33.2% respectively. However, by the year of 2016, the proportion of employees in the upper, middle and lower classes has become 37.6%, 24.0% and 38.4% respectively. Among them, from 1996 to 2016, the upper-level employment staff has increased by 8.4 percentage points, and the lower-level employment staff has increased by 5.2 percentage points, while the middle-level employment staff has decreased by 13.6 percentage points, and the reduction rate is very large.

According to the available data, we look at the Gini coefficient in Hong Kong in 2016 according to the industry classification. According to **Table 5**, in 2016, the Gini coefficient of Hong Kong's financing and insurance and real estate, professional and business services (calculated by the monthly major occupational income) ranks first and second in all industries. The Gini coefficient of the

Table 5. 2016 Gini coefficient by industry in Hong Kong (calculated by the monthly major occupational income).

Industry/Year	2016
Manufacturing	0.437
Construction	0.374
Import/export, wholesale and retail trades	0.471
Transportation, storage, postal and courier services	0.365
Accommodation and food services	0.361
Information and communications	0.407
Financing and insurance	0.516
Real estate, professional and business services	0.497
Public administration, education, human health care and social work activities	0.451
Miscellaneous society and personal services	0.373
Others	0.488
Total	0.495

Notes: 1) Figures in this table are compiled based on the industry classification modeled on the Hong Kong Standard Industrial Classification Version 2.0. 2) Figures exclude unpaid family workers. 3) “Others” include “Agriculture and fishing”; “Mining and quarrying”; “Electricity and gas supply”; “Water supply, sewerage, waste management and remediation activities” and industrial activities inadequately described or unclassifiable. Data source: 2006 Population By-census—Thematic Report: Household Income Distribution in Hong Kong.

financing and insurance is 0.516, and the Gini coefficient of the real estate, professional and business services is 0.497. The increasing proportion of financing and insurance and real estate, professional and business services of total output value of service industry indicate that there is an increase in specialization within the service industry, which will result in a widening of the income gap in the industry.

In summary, it is not difficult to find that the polarization trend of the industry income gap in Hong Kong is increasing. It is particularly noteworthy that the differences in human capital between industries lead to differences in wage levels in industries. The high skilled labor force is concentrated in the high-income productive service industry, and the opportunity for the low skilled labor to flow upwards has been reduced due to the “threshold effect”, which has led to a continuous reduction in the proportion of the middle-level employment staff, and a considerable number of labor forces are “stranded” in the lower levels. Because the income growth of the lower-level employment staff is obviously lagging behind the upper-level employment staff, the income gap in Hong Kong society continues to expand.

4. Empirical Analysis

This paper has already analyzed the evolution of Hong Kong’s industrial structure and employment structure and analyzed the changes of industry income

gap caused by employment structure from the perspective of industry, profession and class. This part attempts to further empirically analyze the relationship between industrial structure evolution and industry income gap in Hong Kong.

4.1. Data

Generally, we use the Theil index and Gini coefficient to measure the industry income gap. Referring to the relevant literature, this paper attempts to establish the following Theil index to measure the industry income gap in Hong Kong.

$$TH = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{\bar{y}} \ln \left(\frac{y_i}{\bar{y}} \right) \quad (1)$$

In model (1), TH is the Theil index to measure the industry income gap. y_i represents the income of the industry i . \bar{y} represents the average income of all industries [13].

Based on the availability of data, this paper selects the average wages of workers in various industries in Hong Kong from 1997 to 2015 to calculate the Theil index (Table 6). Due to the adjustment of industry items in Hong Kong in 2009,

Table 6. 1997-2015 average wages by industry in Hong Kong (HK\$).

Year/Industry	Manufacturing	Wholesale, retail, import and export trade, food and hotel industry	Transport service industry	Financing, insurance, real estate and business services	Personal service industry
1997	9,361	11,468	12,708	10,927	6672
1998	9691	11,783	13,595	11,247	7158
1999	9689	11,802	13,471	11,671	6978
2000	9748	11,960	12,932	11,442	7107
2001	10,112	12,047	13,171	11,280	6638
2002	9654	11,745	13,300	10,586	6364
2003	9457	11,580	12,972	10,649	6163
2004	9546	11,388	12,721	9855	6227
2005	8816	11,707	13,193	9831	6061
2006	9698	11,905	12,930	10,253	6167
2007	10,109	11,921	13,154	11,206	6755
2008	10,107	12,036	13,806	10,832	6738
2009	9465	11,439	14,682	10,961	11,536
2010	9415	11,813	14,882	11,438	12,108
2011	10,790	12,883	15,663	12,305	12,925
2012	11,566	13,446	16,283	13,215	14,546
2013	12,439	14,281	16,843	13,677	15,009
2014	12,986	14,708	17,756	14,260	15,889
2015	13,416	15,211	18,832	14,804	17,402

Notes: 1) The industry classification is compiled according to the Hong Kong Standard Industrial Classification Version 1.1. 2) The data from 2009 to 2015 are summarized according to industry classification. 3) Statistical data are quarterly averages. Data source: Census and Statistics Department (The Government of the Hong Kong Special Administrative Region).

this paper combines the different industry categories in different periods and calculates the Theil index of industry income in different years. In this paper, the proportion of service added value to GDP is used to measure the service-oriented of industrial structure, and it is recorded as TR (**Table 7**). In order to further depict the effect of the change of industrial structure, we measure the internal specialization of service industry by using the proportion of output value of financing, insurance, real estate and business services in the service industry, and record it as TS (**Table 8**).

4.2. Granger Causality Test

The results of the study have passed the ADF unit root test, showing that TH, TR and TS are all first-order single integer sequence, which can be used for causality test and cointegration analysis. Then we deal with the data in the **Tables 6-8** and use the empirical calculation to get the results of **Table 9**. In the second period of lag, under the confidence level of 5%, TR and TS are the Granger causes of

Table 7. 1997-2015 service industry added value and GDP in Hong Kong (Millions HK\$).

Year	Service industry	GDP
1997	1,136,366	1,320,886
1998	1,082,657	1,259,318
1999	1,066,525	1,234,742
2000	1,120,265	1,283,035
2001	1,118,884	1,269,989
2002	1,110,646	1,249,781
2003	1,102,221	1,227,056
2004	1,163,558	1,285,324
2005	1,257,617	1,378,002
2006	1,352,383	1,473,535
2007	1,490,475	1,605,245
2008	1,499,529	1,620,013
2009	1,466,724	1,581,824
2010	1,614,922	1,737,298
2011	1,770,166	1,901,049
2012	1,872,498	2,013,038
2013	1,948,292	2,098,080
2014	2,044,750	2,205,972
2015	2,154,603	2,325,505

Notes: The data from 1997 to 1999 are compiled according to the Hong Kong Standard Industrial Classification Version 1.1. And the data from 2000 to 2015 are compiled according to the Hong Kong Standard Industrial Classification Version 2.0. Data source: Census and Statistics Department (The Government of the Hong Kong Special Administrative Region).

Table 8. 1997-2015 value added in sub industry of service industry based on basic price in Hong Kong (Millions HK\$).

Year/Industry	Import and export trade	Wholesale and retail trades	Accommodation and food services	Transportation, storage, postal and courier services	Financing, insurance, real estate and business services	Community, social and personal services
1997	223,264	51,088	43,297	114,358	327,316	234,979
1998	216,052	41,683	35,528	108,849	288,693	246,865
1999	209,045	41,801	35,682	108,994	270,968	256,603
2000	234,643	42,334	37,843	140,469	282,443	243,423
2001	239,075	42,723	34,449	138,542	265,218	255,543
2002	244,691	39,658	30,949	143,115	260,236	252,581
2003	252,850	36,737	26,505	140,411	266,576	247,694
2004	274,545	46,283	34,128	151,461	281,911	249,018
2005	310,065	49,666	37,494	161,254	312,077	247,942
2006	313,361	53,206	42,701	165,245	374,639	251,211
2007	324,571	54,895	48,830	171,413	469,983	262,395
2008	337,170	62,029	53,600	147,517	443,198	278,100
2009	309,773	60,453	48,789	147,101	429,803	288,109
2010	341,615	71,693	56,418	192,965	472,228	295,257
2011	401,558	91,342	66,421	182,986	519,269	313,585
2012	410,071	101,466	72,044	191,475	551,728	337,678
2013	413,445	110,296	75,413	201,610	572,037	356,326
2014	421,004	110,538	78,725	215,419	607,423	379,588
2015	420,046	107,776	78,134	230,886	662,647	407,467

Data source: Census and Statistics Department (The Government of the Hong Kong Special Administrative Region).

Table 9. The result of granger causality test of industrial structure evolution and industry income gap (lag period: 2).

Null Hypothesis	F-statistic	Prob.	Conclusion
TR does not Granger Cause TH	9.41051	0.0035**	Reject Null Hypothesis
TH does not Granger Cause TR	1.97772	0.1810	Accept Null Hypothesis
TS does not Granger Cause TH	6.10444	0.0148**	Reject Null Hypothesis
TH does not Granger Cause TS	0.35355	0.7093	Accept Null Hypothesis

Notes: **represents that causal relationship exists at the significance level of 0.05.

TH, but TH is not the Granger reason of TR and TS, that is, the service industry structure is the Granger cause of the industry income gap, and the internal specialization of the service industry is the Granger cause of the income gap in the industry. That is to say, the service-oriented of the industrial structure is the Granger cause of industry income gap and the internal specialization of the service industry is also the Granger cause of industry income gap. This indicates that industrial structure evolution has a significant impact on the industry income gap in Hong Kong, which can be analyzed by regression analysis [14].

4.3. Johansen Co-Integration Test

According the result of Granger causality test (Table 9), the service-oriented of the industrial structure and the internal specialization of the service industry are Granger causes of industry income gap. We use the Theil index of the industry income gap (TH) as an explained variable, and we take two indices of the service-oriented of industrial structure (TR) and the internal specialization of service industry (TS) as explanatory variables. Then the time trend item (trend) is added, and the cointegration analysis is carried out to further explore the numerical relationship between industrial structure evolution and industry income gap in Hong Kong. We set up a cointegration regression model (model (2)). That is to say, the proportion of service added value to GDP and the proportion of output value of financing, insurance, real estate and business services in the service industry explain the change of the industry income gap.

$$TH_t = \alpha_t + \beta TR_t + \gamma TS_t + \lambda TREND_t + \mu_t \quad (2)$$

This paper selects average wages by industry, the changes of service industry added value and GDP and the value added in sub industry of service industry from 1997 to 2015 in Hong Kong are used to calculate the industry income gap Theil index, the service-oriented industrial structure index and the service internal specialization index respectively. The cointegration equation results are shown in Table 10.

According to the results of Table 10, the estimated function can be written as follows.

$$\widehat{TH}_t = -0.8774 + 0.9955TR_t + 0.1526TS_t - 0.0057TREND_t \quad (3)$$

z (-10.16) (-1.95)

The whole cointegration equation is significant, and TR and TS have passed z test at the significance level of 10%. The regression results show that the service-oriented

Table 10. Cointegration equation results.

Cointegrating equations						
Equation	Parms	chi²	P > chi²			
_ce1	2	111.2678	0.0000			
Identification: beta is exactly identified						
Johansen normalization restriction imposed						
beta	Coef.	Std. Err.	z	p > |z|	95% Conf.	Interval
_ce1						
th	1	.	.	.	.	.
tr	−0.9954872	0.0979364	−10.16	0.000	−1.187439	−0.8035353
ts	−0.1526207	0.0783512	−1.95	0.051	−0.3061862	0.0009447
_trend	0.0057077	.	.	.	.	.
_cons	0.8774314	.	.	.	.	.

of industrial structure and the internal specialization of service industry are the reasons for the change of industry income gap. TR and TH, as well as TS and TH, are positively related. This indicates that service-oriented development of industrial structure and internal specialization of service industry can lead to the widening of industry income gap in Hong Kong, in line with previous theoretical analysis of expectations.

The empirical results show that industrial structure evolution is the Granger cause of industry income gap, and there is a significant relationship between the two. Industrial structure evolution of Hong Kong has had a profound impact on the income gap in the industry. The increasing proportion of service added value to GDP and output value of financing, insurance, real estate and business services in the service industry will widen the industry income gap in Hong Kong.

5. Conclusion

Aiming at the coexistence of Hong Kong's sustained economic growth and large income gap, this paper systematically analyzes the influence mechanism of industrial structure evolution on the industry income gap in Hong Kong. This paper reveals the transmission mechanism of industrial structure, employment structure and industry income gap in Hong Kong, and empirically verifies the causal relationship between service-oriented of industrial structure, specialization within the service industry and industry income gap in Hong Kong, and the quantitative relationship between them is further discussed by regression analysis. The results show that the industrial structure affects the income gap of the industry by influencing the employment structure. The industrial structure that tends to be service-oriented and the internal specialization of the service industry lead to the transfer of employment from the manufacturing industry with a relatively low Theil index to the service industry, especially financing, insurance, real estate and business services, which are relatively high in the Theil index. As a result, the overall industry income Theil index is rising, and the industry income gap is widening in Hong Kong.

References

- [1] World Economic Forum (2017) The Global Competitiveness Report 2017-2018. <https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018>
- [2] Liu, G.F. (2006) The Evolution and Outlet of Hong Kong's Industrial Structure. *Special Zone Economy*, No. 3, 65-67.
- [3] Feng, B.Y. (2015) The Third Transformation of Industrial Structure in Hong Kong: Constructing a "1 + 3" Industrial System. *Hong Kong and Macao Journal*, No. 4, 38-46 + 95.
- [4] Guo, J. and Zhao, J.Y. (2016) A Study on the Economic Development of Hong Kong from the Perspective of Industrial Structure. *Reform & Opening*, No. 12, 17-18.
- [5] Zhang, Y.W. (2007) Hong Kong' Economy Retrospect and Prospect. *International Economics and Trade Research*, 11, 18-23.
- [6] Chen, G.H. and Zhang, Y.W. (2009) Economic Transformation and Income Distri-

bution in Hong Kong. *Studies on Hong Kong and Macao*, No. 1, 15-27.

- [7] Gan, H.M. (2012) Can Economic Growth Bring Common Prosperity: Research Based on the Distribution of Income in Hong Kong. *Special Zone Economy*, No. 5, 13-15.
- [8] Guan, H.L. (2014) Interpretation of Industrial Structure Transformation and Income Distribution in Hong Kong. *Academic Research*, No. 11, 90-96.
- [9] Zhang, C. (2016) Summary of Study on Relationship between Industrial Structure and Employment Structure. *Journal of Huizhou University (Social Science Edition)*, **36**, 42-46 + 58.
- [10] Browning, H.L. and Singelmann, J. (1975) The Emergence of a Service Society: Demographic and Sociological Aspects of the Sectoral Transformation of the Labor Force in the U.S.A. National Technical Information Service, Springfield, Virginia.
- [11] Singelmann, J. (1978) From Agriculture to Services: The Transformation of Industrial Employment. Sage Publications, Beverly Hills.
- [12] Shang, Y.L., Shen, Y.M. and Qiu, L. (2008) The Primary Study on Industry Definition and Classification of Producer Services in China. *Journal of Capital Normal University (Natural Science Edition)*, No. 3, 87-94.
- [13] Xia, H. (2007) Theil Index and Its Application in the Industry Income Gap in China. *Productivity Research*, No. 7, 10-11.
- [14] Liang, S.H. and Peng, D.Y. (2017) Research into the Mechanism of Industrial Structure's Impact on Industrial Income Gap. *Wuhan University of Technology (Social Science Edition)*, No. 2, 16-23.