Labor Mobility and the Growth of Labor Productivity
Kun DONG\textsuperscript{1,a}, Yu MEN\textsuperscript{2,b,*}, and Ru-Ling FAN\textsuperscript{3,c}

\textsuperscript{1}2\textsuperscript{nd} on Linggong Road, Ganjingzi District, Da Lian, Liao Ning Province in China
\textsuperscript{2}2\textsuperscript{nd} on Linggong Road, Ganjingzi District, Da Lian, Liao Ning Province in China
\textsuperscript{3}2\textsuperscript{nd} on Linggong Road, Ganjingzi District, Da Lian, Liao Ning Province in China

\textsuperscript{a}dongkun@dlut.edu.cn, \textsuperscript{b}menyu15@mail.dlut.edu.cn, \textsuperscript{c}fanruling@mail.dlut.edu.cn

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Abstract. The mobility of production factors is one of the important factors influencing the growth of labor productivity, and the relationship between them can be explained by the Structural-Bonus Hypothesis. In other words, when factors of production move from a sector with a low productivity to a sector with a high productivity or from a sector with slow growth in productivity to a sector with fast growth in productivity, it will promote the increasing of productivity. In this paper, we use the shift-share method to study the impact of labor mobility among the three industries on the growth of labor productivity. It is found that labor mobility has a positive effect on the growth of productivity, that is, the Structural-Bonus Hypothesis exists, but it does not always exist. Labor mobility sometimes inhibits the growth of productivity. The growth of labor productivity in China largely depends on industry internal effect, such as the progress of technology, the promotion of laborers' quality and so on. Therefore, the more reasonable distribution of factors of production among the three industries is, the more conducive it is to the growth of labor productivity.

Introduction

With the reform and opening up and its accession to the WTO in China, home market is to be broadly opened to other countries, at the same time the globalization of production is deepening. The economy in China has achieved an unprecedented development. Structural change and economic growth are interdependent, and "the Structural-Bonus Hypothesis" is the theory to explain how structural changes affect the economic growth, and it studied the re-allocation of labor resources. In recent years, with the growth of population and the development of economy in China, its demand for labor is increasing. In 1981, Chinese total employment was 437.25 million and it increased to 774.51 million by 2015 with an increase of more than 300 million people. Labor as the basic elements of production, its inter-industry mobility will affect the labor productivity of all industries, and have a direct impact on Chinese economic development further.

In 1981, the primary industry dominated in China, which absorbed 68.1\% of the labor force. By 2015, the share of the primary industry labor force fell to 28.3\%. With the reform and opening up in China, the market integrated quickly and comprehensively into the global economic system, product exports continue to create a new record. The labor force absorbed by the secondary industry is increasing, but the growth of the secondary industry labor force is relatively slow. In the1981-2015 period, the share of the second industry labor force is from 18.3\% to 29.3\%, with an increase of 11\%. With the development of the tertiary industry, the share of the tertiary industry labor force is also increasing. In 1981, it’s 13.6\%, by 2015 it’s 42.4\%, with an increase of 28.8\%. Before 1994, the share of the tertiary industry's labor force was less than that of the secondary industry. After 1994, some of the labor force began to move from the secondary industry to the tertiary industry. On the whole, the total labor force of the three industries in China is increasing. The labor force flows from the first industry to the second and the third industry. Labor flows from the primary industry more to the tertiary industry. It shows that China began to change from agriculture to the manufacturing industry, service industry as the pillar industry.

The basic idea of the Structural-Bonus Hypothesis can be traced back to the classical Dual Sector model. As the productivity of the different sectors of the national economy has a different level, the overall productivity level can be increased when the labor force flows from the low productive sectors.
to the high productivity sectors. Structural-Bonus do not always have a positive effect, there will be negative effects. When the share of labor in a sector with a high productivity is reduced or the share of labor in a sector with a lower level of productivity increases, Structural-Bonus will have a negative effect. Domestic and foreign scholars have done a lot of research on "the Structural-Bonus Hypothesis". Timmer and Szirmai (2000) [1] conducted empirical analysis of 13 manufacturing industries in India, Korea, Indonesia and Taiwan, and found the Structural-Bonus Hypothesis only existed in India in 1963-1993. Lv Tie (2002)[2] conducted an empirical analysis of the "the Structural-Bonus Hypothesis" of China's manufacturing industry from 1980 to 1997, and found that labor mobility among industries had little effect on the growth of labor productivity. Singh (2004) [3] studied the manufacturing industry in Korea from 1970 to 2000, and found that the structural bonus effect was only significant between 1970 and 1980, and did not work much in the subsequent period. Li Xiaoping and Chen Yong (2007) [4] studied the impact of labor mobility among Chinese provincial industry from 1998 to 2004 on the growth of labor productivity by the shift-share method. It was found that the Structural-Bonus Hypothesis of labor mobility is not significant. The vast majority of Chinese industrial productivity growth is due to the internal growth effect. Gan Chunhui and Zheng Ruogu (2009) [5] conducted a test for "the Structural-Bonus Hypothesis" in China from 1978 to 2007 for three stages. The results show that the labor mobility among industries has obvious "Structural-Bonus" effect, especially in the secondary industry, and shows the characteristics of the stage. Su Zhendong (2012) [6] used the structural shift-share method to analyze the labor mobility in Chinese three industries and industrial industries. The results show that there are stages of "the Structural-Bonus Hypothesis" in the process of structure changes from three industrial. Wu Shouping (2013) [7] tested "the Structural-Bonus Hypothesis" among industries from 1985 to 2009 in China, and it showed that labor mobility had a greater impact on productivity, but still relied mainly on internal effects to promote productivity growth.

This paper takes the labor mobility among the three industries in China as the object, and uses the shift-share method to study the impact of labor mobility on labor productivity in China from 1981 to 2015. Then, the same research was carried out in 31 provinces in China from 2001 to 2015, and the impact of the labor productivity and the internal effect on the labor productivity were analyzed.

The Shift-share Method

The shift-share method provides a convenient tool to study how different labor productivity and the reallocation of labor force between industries affect economic growth, which analyzes the Structural-Bonus Hypothesis and structural negative hypothesis. This method was proposed by Fabricant and it was first used by Maddison (1952) to study the growth of labor productivity. It separates the effect of labor force reallocation from the growth of labor productivity. It divides the growth of labor productivity into the resource reallocation effect and the sector's productivity growth, and then divides the resource reallocation effect into static reconfiguration effect and dynamic reconfiguration effect.

Let LP represent the labor productivity. fy and by denote the final year and the base year respectively. Sj represents the proportion of the employment of the industry j. Using the method proposed by Dimmer and Airmail (2000), we divided the growth of labor productivity into three parts:

\[ \text{Growth (LP) } = \frac{LP_{fy} - LP_{by}}{LP_{by}} \]

\[ = \sum_{j=1}^{I} \left( LP_{j, fy} - LP_{j, by} \right) S_j \cdot by + \sum_{j=1}^{II} \left( LP_{j, fy} - LP_{j, by} \right) (S_j - S_{j, by}) + \sum_{j=1}^{III} \left( LP_{j, fy} - LP_{j, by} \right) S_j \cdot by \]

\[ \frac{LP_{by}}{LP_{by}} \]
In the above formula (1), Part I is the static flow effect of the labor force. It measures the weight sum of the labor productivity in the absence of structural changes. If industries with high labor productivity can attract more labor resources, their output will increase. In other words, the labor force flows from the low labor productivity industry to the high labor productivity industry, which increases labor productivity. We call it the Structural-Bonus Hypothesis, and the symbol of below formula (2) is positive.

$$\sum_{j=1}^{n} LP_{j, by}(S_{j, by} - S_{j, by}) > 0$$  

(2)

Part II is the dynamic flow effect of the labor force. It measures the impact of the growth of overall productivity when the labor force moves to industries with higher labor productivity growth. If the labor productivity and labor share of an industry increase at the same time, the total productivity will increase, and the symbol of the formula is positive, that is, the labor force from the slow growth of labor productivity flows to industries where labor productivity growth is fast and will increase the level of labor productivity. However, if the industry with high labor productivity growth can’t sustain their share of labor, that is, the share of labor in industries with high productivity growth reduces or the share of labor in industries with low productivity growth increases, the sign of the formula will be negative, which we call Structural negative hypothesis.

$$\sum_{j=1}^{n} (LP_{j, by} - LP_{j, by})(S_{j, by} - S_{j, by}) < 0$$  

(3)

Part III is the internal growth effect of the industry. It measures the growth of labor productivity in the absence of labor mobility and under the fact that each sector maintains a constant share of labor. The internal growth effect is determined by the progress of the technology within the industry, the improvement of the quality of the workers and the deepening of the capital and so on.

According to the Structural-Bonus Hypothesis, the labor force flows between the three industries to promote the growth of labor productivity, need have two prerequisites:

1. The labor mobility must exist among the three industries and lead to a relative change in the share of labor;
2. There is a difference in the level of labor productivity or growth rate among the three industries.

**Empirical Analysis**

**National Analysis**

This paper begins with staged study of the changes in national labor productivity from 1981 to 2015. The nominal GDP in accordance with the GDP deflator index reduced to 1978 constant GDP. Data are used to adjust the GDP data, based on 1978 years. Indicators are from the China Statistical Statistics Bureau database, "New China 60 years of statistical compilation" and the provincial statistical yearbook.

Table 1 reports the growth rate of labor productivity as well as its decomposition results in China during 1981-2015. In 1981-1985, it can be seen that the growth of labor productivity was very obvious, with an increase of 38.26%. It indicates that with the reform and opening up in China due to the expansion of the market opening, China changed from the planned economy to the economy that the original planned economy and market economy coexist. The deepening of capital can achieve the division of labor and technological progress so as to improve the ability of the laborers. Then it makes the allocation of labor resources more effective through the rational flow of labor. Thus it will promote the growth of labor productivity. From 1986 to 1990, the growth of labor productivity was very slow, only 6.52%, which is the slowest of all years.

<table>
<thead>
<tr>
<th>period</th>
<th>static effects (%)</th>
<th>contribution rate (%)</th>
<th>dynamic effect (%)</th>
<th>contribution rate (%)</th>
<th>Internal effect (%)</th>
<th>contribution rate (%)</th>
<th>The growth rate of labor productivity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981-1985</td>
<td>9.00</td>
<td>23.52</td>
<td>2.30</td>
<td>6.02</td>
<td>26.96</td>
<td>70.46</td>
<td>38.26</td>
</tr>
<tr>
<td>1986-1990</td>
<td>0.98</td>
<td>15.04</td>
<td>0.12</td>
<td>1.82</td>
<td>5.42</td>
<td>83.14</td>
<td>6.52</td>
</tr>
<tr>
<td>1991-1995</td>
<td>10.86</td>
<td>19.06</td>
<td>2.42</td>
<td>4.24</td>
<td>43.69</td>
<td>76.70</td>
<td>56.96</td>
</tr>
<tr>
<td>1996-2000</td>
<td>-0.26</td>
<td>-0.81</td>
<td>0.26</td>
<td>0.82</td>
<td>31.61</td>
<td>99.99</td>
<td>31.61</td>
</tr>
<tr>
<td>2001-2005</td>
<td>7.06</td>
<td>16.18</td>
<td>2.25</td>
<td>5.16</td>
<td>34.33</td>
<td>78.66</td>
<td>43.64</td>
</tr>
<tr>
<td>2006-2010</td>
<td>8.26</td>
<td>16.73</td>
<td>2.48</td>
<td>5.03</td>
<td>38.62</td>
<td>78.24</td>
<td>49.36</td>
</tr>
<tr>
<td>2011-2015</td>
<td>6.22</td>
<td>19.74</td>
<td>1.18</td>
<td>3.75</td>
<td>24.13</td>
<td>76.51</td>
<td>31.54</td>
</tr>
</tbody>
</table>

The possible explanation is that in the 1980s, in spite of Chinese reform and opening up, there comes a few problems with the development of some years. The industrial structure is irrational, and the technology is relatively backward, and the quality of workers is not very high, which seriously affects Chinese economic growth. From 1991 to 1995, the labor productivity increased rapidly, and the reason was that in the late 1980s, China adopted a lot of measures for the slow growth of the economy. In 1992, Deng Xiaoping’s southern tour speech prompted China to deepen and promote economic reform. The economy has experienced a high-speed growth overheating. From 1996 to 2000, labor productivity growth fell, perhaps because the economy was facing the impact of the Asian financial crisis in 1997, and bearing the pressure of insufficient demand, which has had an impact on the labor productivity to a certain extent. After entering the 21st century, with Chinese accession to the WTO, commodity began to export to foreign countries, the degree of capital deepened, the quality of workers has been improved, and the growth of labor productivity has been rapid. In general, during the period of 1981-2010, the growth rate of labor productivity in China generally fluctuated upward, which indicated that with the opening of the Chinese market, the factor market was gradually improved, the optimal allocation of resources was more reasonable, and the liquidity the labor force in the industry Between has been strengthened. Finally, the overall efficiency of the labor force is improved. In 2011-2015, the growth rate of the labor productivity in China showed a downward trend. With the aging of Chinese population and the increase of the domestic factors’ cost, China is in the industrial structure transformation phase nowadays. So the speed of economic growth slowed down, which led to the decline of the growth rate of the labor productivity.

From the data of the partial effects, the contribution rate of internal effects to the labor productivity exceeds 70% at each stage, indicating that the increase in labor productivity in China is largely due to the growth of Industry's own labor productivity. During 1996-2000, the internal effect was almost equal to the growth of labor productivity. The contribution rate of static effect to labor productivity was the largest in 1981-1985, which was 23.52%. It was even negative in 1996-2000. Throughout the dynamic effect on the contribution of labor productivity growth, the largest contribution rate was 6.02% in 1981-1985. At all stages, the contribution of dynamic effects is much smaller than the static effect. Therefore, we can say that the impact of the labor force from the slow growth of labor productivity to the fast growth of labor productivity is negligible and we can even ignore the contribution rate of dynamic effects. The static and dynamic effects show that the impact of labor mobility on labor productivity is small and does not always lead to an increase in labor productivity. Sometimes it may even hinder the growth of labor productivity. It can be seen that the growth of labor productivity in China is largely determined by the internal factors, such as the improvement of the quality of laborers, the improvement of labor skills, the accumulation of knowledge, the introduction of new technologies, the introduction of new technologies in the industry and the inflow of capital and so on.

In 1981-2015, most of the dynamic and internal effects were positive, which indicates that the labor force generally flowed from a low labor productivity industry to a high labor productivity industry. When the labor force flowed from the slow growth of labor productivity industry to the rapid growth
of labor productivity industry, it will make the allocation of labor resources more reasonable, and there comes the Structural-Bonus Hypothesis. What’s more, it will promote the growth of labor productivity effectively. In 1996-2000, the static effect was negative, which indicates that Chinese labor force flowed from the higher labor productivity of the industry to the lower labor productivity of the industry. The labor effect of the labor force indirectly confirms that the labor force in China flows from the first industry to the secondary industry and the tertiary industry as a whole. Thus, we can conclude that an industry can promote its economic growth by two ways, one is through the overall improvement within the industry, and the other is through the mobility of labor among other industries.

From the view of the change trend of each effect data, there are similar trends in the effects of static effects, dynamic effects, internal effects and labor productivity, and there are fluctuating changes. In 1986-1995 and 1996-2000 were the troughs of volatility changes. In 1991-1995, the static effects, dynamic effects, internal effects, and labor productivity growth were the highest.

**The Analysis of Province**

In this paper, we conducted a staged study on the 31 provinces, cities and autonomous regions in China in 2001-2010, in order to make the data more accurate, we used the data in the year 2000 as the base year, the nominal GDP converted to real GDP. It should be noted that there is a lack of the number of “the employed persons in three industries” in Heilongjiang Province Statistical Yearbook from 2011 to 2015. Therefore, the staged study in 2011-2015 aimed at 30 provinces, cities and autonomous regions except Heilongjiang province.

![Figure 1. The Growth of Labor Productivity in Chinese Provinces during 2001-2005.](image)

![Figure 4 The Growth of Labor Productivity in Chinese Provinces during 2006-2010.](image)

![Figure 5. The Growth of Labor Productivity in Chinese Provinces during 2011-2015.](image)

Figures 3, 4 and 5 depict the changes in labor productivity in Chinese provinces in 2001-2015. From the figures, we can see that the labor productivity in the provinces has increased significantly, but there are large differences in the growth of the provinces. From the contribution rate of internal
effects, there are 30 provinces with a contribution rate greater than 50%. In 2001-2005, 31 provinces in 2006-2010 and 28 provinces in 2011-2015, and we conclude that the growth of labor productivity depends largely on the internal effects.

In 2001-2005, the provinces with faster growth were: Inner Mongolia, Chongqing, Gansu, Jiangsu, Guizhou and Shanxi. The relatively slower provinces were Guangxi, Hainan, Shanghai, Xinjiang and Beijing. In 2006-2010, the provinces with rapid growth were: Guizhou, Chongqing, Shaanxi, Inner Mongolia and Jilin. While the labor productivity growth in Guangdong, Tibet, Beijing, Xinjiang and Zhejiang provinces was relatively slow. In 2011-2015, the provinces with faster growth are: Shaanxi, Hubei, Hunan, Chongqing and Yunnan. The relatively slow provinces are Beijing, Xinjiang, Hainan, Guangxi and Shanghai. It can be seen that, in terms of labor productivity growth, the western region is the most slow. The reason may be that the economic development of the western region is relatively backward, the industrial structure is relatively poor relative to other areas, the quality of workers is relatively low, capital, technology can not effectively promote the rapid economic development.

Figure 6. The Contribution Rate of Internal Effects in Chinese Provinces during 2001-2005[%].

Figure 7. The Contribution Rate of Internal Effects in Chinese Provinces during 2006-2010[%].

Figure 8. The Contribution Rate of Internal Effects in Chinese Provinces during 2011-2015[%].

From the contribution rate of internal effects (Fig.6 and Fig.7 and Fig.8), in 2001-2005, the provinces with large contribution rates are: Gansu, Inner Mongolia, Liaoning, Hubei and Tianjin. The provinces are: Anhui, Shandong, Guizhou, Qinghai, Tibet. In 2006-2010, the provinces with greater contribution rate are: Ningxia, Beijing, Heilongjiang, Hubei, Shanghai. The lower contribution rates are: Shaanxi, Henan, Guangxi, Guizhou, Yunnan and so on. In 2011-2015, the provinces with large contribution rates were Shaanxi, Shanghai, Tianjin, Beijing and Liaoning, and the provinces with low contribution rate were Hainan, Jilin, Guizhou, Tibet and Guangxi. The contribution rate of labor mobility is relatively low in provinces with large contribution rates.

As a result, we can see changes in the structure of the labor force between industries. Most of the provinces that contribute more to the growth of labor productivity are in the western region. This also indirectly reflects the fact that the growth in labor productivity is only partially dependent on the flow of labor.
Conclusion

It is critical for the sustained development of the economy to increase the labor productivity. In this paper, we use the shift-share method to study the effect of the labor force on the growth of labor productivity in the three industries. Based on the analysis of the data, we can obtain the following conclusions:

First, after the reform and opening up in China, it has been a remarkable phenomenon of labor mobility among Chinese industries. The labor force mainly flows from the first industry with the low labor productivity to the secondary industry and the tertiary industry with the high labor productivity. It means that China gradually changed from the agricultural power to the industrial power and service industry power.

Secondly, the impact of labor mobility on labor productivity is not always positive, that is, structural dividends do not always exist, and sometimes there will be structural negative hypothesis. The reason may be that, on the one hand, industries with fast productivity growth may not be labor-intensive, and the development of these industries can’t absorb more labor; on the other hand, labor-intensive industries can absorb a lot of labor, but the labor productivity growth of these industries is not fast.

Finally, Chinese labor productivity shows a trend of volatility growth on the whole. It can be seen that the change trend of static effect, dynamic effect and internal effect is the same as that of labor productivity, and all of them show the change of volatility. The growth of labor productivity depends mainly on the improvement of the quality of workers within the industry, technological progress and other factors. Changes in the structure of the labor force between departments have an impact on labor productivity, but not significant. And the effect of static effect on labor productivity is greater than that of dynamic effect, so we can ignore the influence of dynamic effect. To sum up, if we want to accelerate the growth of labor productivity, we need to improve the quality of laborers, strengthen their skills training, increase farmers' access to work in non-agricultural areas, and promote labor productivity by improving labor structure.

References


