**DEVELOPMENT OF MANAGEMENT
AND ENTREPRENEURSHIP METHODS
ON TRANSPORT, № 2 (71), 2020**

**РОЗВИТОК МЕТОДІВ
УПРАВЛІННЯ ТА ГОСПОДАРЮВАННЯ
НА ТРАНСПОРТІ, № 2 (71), 2020**

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ИССЛЕДОВАНИЕ ЗАНЯТОСТИ НАСЕЛЕНИЯ В КИТАЕ: ПЕРЕОЦЕНКА ЗАНЯТОСТИ НАСЕЛЕНИЯ ПОСЛЕ РЕФОРМЫ И ОТКРЫТОСТИ

Аннотация. На основе стандарта занятости МОТ и данных переписи населения по полу и возрасту, в соответствии со структурой занятости пола в городских и сельских районах и изменяющимся законом, в настоящем документе рассчитывается модель занятости населения и общая занятость мужчин и женщин в городских и сельских районах Китая с 1978 по 2020 год. Результаты показывают, что общая занятость в Китае с 1978 по 2010 год увеличилась с 464 миллионов до 757 миллионов человек. С развитием урбанизации численность занятых в городах быстро росла с 85 миллионов до 349 миллионов человек. Численность рабочей силы в сельской местности выросла с 380 млн. до 508 млн. в 1995 году, а затем постепенно до 408 млн. в 2010 году. Разрыв между городской и сельской занятостью впоследствии сократился с 295 млн. в 1978 году до 59 млн. человек. С постепенным сокращением численности трудоспособного населения и изменением структуры занятости общая численность занятых в Китае достигла пика в 765 миллионов в 2014 году, а затем постепенно сократится до 756 миллионов в 2020 году. С углублением урбанизации занятость городского населения увеличится с 349 миллионов в 2010 году до 402 миллионов человек, а численность сельского населения сократится с 408 миллионов до 354 миллионов человек.

Ключевые слова: занятость населения; модель занятости; демографические прогнозы.

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ДОСЛІДЖЕННЯ ЗАЙНЯТОСТІ НАСЕЛЕННЯ В КИТАЇ: ПЕРЕОЦІНКА ЗАЙНЯТОСТІ НАСЕЛЕННЯ ПІСЛЯ РЕФОРМИ І ВІДКРИТОСТІ

Анотація. На основі стандарту зайнятості МОП і даних перепису населення за статтю та віком, відповідно до структури зайнятості статі в міських і сільських районах і постійно змінюваних законом, в цьому документі розраховується модель зайнятості населення та загальна зайнятість чоловіків і жінок в міських і сільських районах Китаю з 1978 по 2020 рік. Результати показують, що загальна зайнятість в Китаї з 1978 по 2010 рік збільшилася з 464 мільйонів до 757 мільйонів осіб. З розвитком урбанізації чисельність зайнятих в містах швидко росла з 85 мільйонів до 349 мільйонів осіб. Чисельність робочої сили в сільській місцевості зросла з 380 млн. До 508 млн. В 1995 році, а потім поступово до 408 млн. В 2010 році. Розрив між міською та сільською зайнятістю згодом скоротився з 295 млн. У 1978 році до 59 млн. чоловік. З поступовим скороченням чисельності працездатного населення і зміною структури зайнятості загальна чисельність зайнятих в Китаї досягла піку 765 мільйонів на 2014 році, а потім поступово скоротиться до 756 мільйонів у 2020 році. З поглибленням урбанізації зайнятість міського населення збільшиться з 349 мільйонів у 2010 році до 402 мільйонів осіб, а чисельність сільського населення скоротиться з 408 мільйонів до 354 мільйонів чоловік.

Ключові слова: зайнятість населення; модель зайнятості; демографічні прогнози.

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A STUDY ON THE EMPLOYMENT POPULATION IN CHINA
---And re-estimation of the employment population since reform and opening up

Abstract: Based on the ILO employment standard and the census data of gender and age, according to the employment pattern of gender in urban and rural areas and its changing law, this paper calculates the population employment model and total employment of gender in urban and rural areas in China from 1978 to 2020. The results show that China's total employment from 1978 to 2010 had increased from 464 million to 757 million. With advance of urbanization, the urban employment population has been growing rapidly from 85 million to 349 million. The rural workforce will climb from 380 million to 508 million in 1995, and then gradually to 408 million in 2010. The gap between urban and rural employment has subsequently narrowed from 295 million in 1978 to 59 million. With the gradual decline of the working-age population and the change in employment pattern, China's total employment population will reach a peak of 765 million in 2014, and then gradually decrease to 756 million in 2020. With the deepening of urbanization, the urban employment population will increase from 349 million in 2010 to 402 million, and the rural employment population will also decrease from 408 million to 354 million.

Keywords : employment population; employment model; population projections.

I. Problem statement. As the International Labor Organization remarks it, employment is a means for one to survive, integrate into society, realize himself and bring hope to future generations, which is not only the core of one's lives, but also one of the key factors to maintain economic, social and political stability. With the rapid development of China, employment has increasingly become an important driving force for its economic growth. Accurate measurement of total amount employment and its changing trend are the prerequisites to grasp the employment situation in china, which also plays a particularly important role in the formulation of economic development policies. But it is not certain that total amount employ-ment in China's urban and rural areas. Because China still lacks a unified and coherent employment statistics system which is in line with the international standards, it brings a lot of inconvenience to the direct or indirect study of urban and rural employment. To begin with, the data of urban and rural employment population, published by different channels, are lack of consistency, with inconsistency to some extent. Second, there is a lack of necessary analysis on the statistical caliber, scope of application of urban and rural employment data. Although some scholars use different methods to estimate the total real employment population, the results are quite different mainly for the following two reasons: one is the difference

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in the use of employment statistics caliber; the other is that the selected statistical methods are inappropriate. Given the shortcomings of the existing research, this paper first unifies the caliber of employment statistics, and utilizes a new method to re-estimate the total amount employment and employment rate since the reform and opening up. With reliable estimation methods, this paper may analyze the trends and predict the total amount of employment and employment in the future.

The innovation of this paper is as follows: In accordance with the employment standards of the International Labor Organization, based on the data of population census and sampling survey, this paper estimates the size of the employed population by gender in urban and rural areas in China. Among them, the estimated results before 1990 is of great important reference for adjusting the errors in China's employment statistics in history. The prediction results of total amount employment divided by ur-ban-rural and gender in the future have certain reference value for the solution of employment problems in China.

II. Definition & Statistical Coverage of Employment. As things stand, to define employment is the basic premise of effective statistics. According to the International Labor Organization (ILO) standard, employment refers to persons who, within a week prior to the point of investigation, have been engaged in production, operation and service activities for a period of not less than one hour for the purpose of obtaining wages, in kind remuneration or operating income, and who have a «definite date of recall» for temporary suspension or suspension of work, including those who have not worked during the survey week due to study leave or other reasons, but have a work unit or work place, and all kinds of temporary shutdowns or shutdowns caused by equipment failure or maintenance, shortage of raw materials, lack of power, power failure, weather disasters or other disasters. From definition of the employed population, the employed population is the part of the labor force that is truly involved in social productive activities. In the definition of employment concept, many previous studies have had the trouble of concept confusion, which leads to a lot of data abuse. In effect, they are three groups that are linked and fundamentally different. The working-age population refers to the population within a certain range of working-age, which includes the population actually participating in social production, the population willing to work but not yet participating in social production, and the population not participating in social production. Labor force refers to the population that enters the labor market, including the population that actually participates in social production, and also covers the population that wants to participate but does not participate in social production. Different from the working-age population, there is no obvious age limit for the workforce population, and the employed population is the part of the labor force that is included in the labor force and truly participates in social production. As the workforce population, there is no clear age limit for the employment population. Against the confusion of concepts in many previous studies, this paper carefully identifies the employment data when using them. The following study will also be conducted in accordance with the ILO's employment standards and statistical standards.

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For the time being, China still lacks a mature employment statistics system in line with international standards. Since the reform and opening up, with the transition from the traditional employment system to the market employment system, the traditional employment statistics method can not reflect the real situation of employment. In 1996, China began to conduct a sample survey of the national labor force, adopting the concept of employment recommended by the ILO. Although employment data in line with international standards can be obtained through this survey, relatively reliable employment data have not been obtained because of the small sampling proportion (less than 1 %) and the difficulty in selecting the time and scope of the survey. But census is another important source of comprehensive and systematic information on employment and unemployment. Although there have been changes in the definition of «employment time horizon» and survey time, the design of questions about work conditions in previous censuses and population sample surveys has generally followed the employment criteria recommended by the ILO. Specifically, the employed population as defined by the 1982 and 1900 censuses is the population engaged in social work and receiving remuneration for work or business income. Whether in the ownership of the whole people, collective ownership of the unit work or engaged in individual labor personnel are employed population. Furthermore, those who do not have a permanent job, they need to have a temporary job at the time of the survey and have been engaged in social work for a total of 16 days or more in the month prior to the standard survey time to be considered as employed. Af-

ter 1995, census and sample surveys defined the employed population as «social workers with no less than one hour of income» and «working» but «on-the-job leave, training and seasonal out-of-work» in the week preceding the standard survey period. In determining whether or not a person is in employment, the criterion is «working hours», and in the week preceding the survey standard time, if the accumulated working or working hours are greater than or equal to one hour and thus receive a certain amount of remuneration, whether it is a fixed work or labor, or temporary work or labor, it is considered to be in a working state. After 1995, the definition of employment was very close to the standard of employment recommended by ILO. Although the previous definition of employment had relaxed the inspection period on the study of temporary work, it had also increased the requirement of the frequency of work, so the definition of employment in 1982 and 1900 was not fundamentally different from the definition after 1995, and the actual statistical scope was not relaxed. Overall, the census and sample population survey data since 1982 are very close to the employment criteria recommended by ILO, and the relevant data are very relevant to the analysis of employment status.

Compared with the traditional «three-in-one» statistical method, the introduction of census data to estimate the employment population is more relevant to actual labor input. First of all, the classification of urban and rural population in this paper is based on the resident population, the migrant workers who live in urban areas all the year round are counted as the urban employment population, which is more appropriate to ref-

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lect the labor input in the economic activities of urban areas. And more, in line with the employment statistics caliber of the census, the employed population of the census includes not only the formal employment population, but also the informal employment population (flexible employment population), which makes up for the deficiency of the «three-in-one» statistics (Yue Ximing, 2005).

III. Combing & Evaluation on Estimation Methods. Given the problems existing in the publication of employment data in the yearbook, many scholars have re-estimated the employment data in China. There are three main types of indirect estimation methods for employment.

1. Economic model method. According to the relationship between the employed population, capital input and economic output, a production function model was constructed to estimate the total population deployment (Jia Shaofeng, Meng Xiangjing, 1996; Li Hongsong, Tian Yixiang, 2000). From theory front, this estimation method is of theoretical significance to estimate the actual employment population size from the perspective of economic growth demand for labor. But the reliability of the estimation results of this method is limited not only by the suitability of the model setting, but also by the reliability of GDP data and capital data. As a matter of fact, there is no less controversy over the reliability of China's GDP and capital data than employment data.

2. Proportional adjustment it is mainly based on benchmark data and adjustment coefficients to obtain more accurate employment population data. Based on the total population (working age population) of the calendar year, one method selects the ratio of the employed

population to the total population (working age population) of a certain year as the adjustment coefficient, readjusts the employment population data, obtaining the real employment population size (Rechinley, 2002). Another approach, based on the size of employment in the initial and end years, adjusts the employment data for intermediate years with the average annual growth rate as the adjustment coefficient (Li He et al., 1999). As for the former approach, it often assumes that the proportion of the employed population and the total population (working-age population) remains constant for a long time, which to some extent reduces the effectiveness of the adjustment results. And for the latter method, the reliability of its adjustment results faces two challenges: one is the accuracy of employment data in the base year, and the other is whether the assumption of linear growth in employment scale holds.

3. Classification adjustment method it divides the employed population into different groups according to certain characteristics, and finally obtains more accurate employment data by accurate data of different employment groups (Zeng Xiangquan, 2006). Due to the need for classification, this method requires a high amount of data, and the actual operation is more difficult.

4. Time series model method it adjusts the employment data of the yearbook via linear fitting or constructing time series model (Tan Yongsheng, 2006). The advantage of the time series model is that the data demand is less and easy to operate; the disadvantage is that it cannot reflect the decision mechanism and lacks the theoretical meaning. Based on the advantages and disadvantages of existing estimation method, this paper

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presents a new estimation method, which based on the working age population of different age and gender, in line with the law of changes in urban and rural population employment model, calculates the middle years and the employment pattern in the future years, so as to finally realize the middle years and estimate of the total employment in the future.

### IV. Estimation Methods & Basic Data

(1) Description of Estimation Methods.

In fact, the basic condition of the employed population hinges on the employment model coupled with the total amount and structure of the working-age population.

This paper mainly calculates and predicts the total urban and rural employment population based on the population employment model and the chang-

ing trend of population age structure. Population employment model is age-specific employment rate to some extent. As employment is closely related to age, the distribution of employment rate in age is relatively stable.

It is not only an important index to measure the employment status and progress, but also an effective tool to estimate the total amount of employment population. Based on the good stability of the urban and rural employment model and the clear law of change, this paper uses the linear interpolation and extrapolation method to estimate the employment model of the urban and rural population in the calendar year 1978-2010, and estimates the total urban and rural employment population in the ca-lendar year in combination with the age-disaggregated population. The specific path-diagram is as follows:
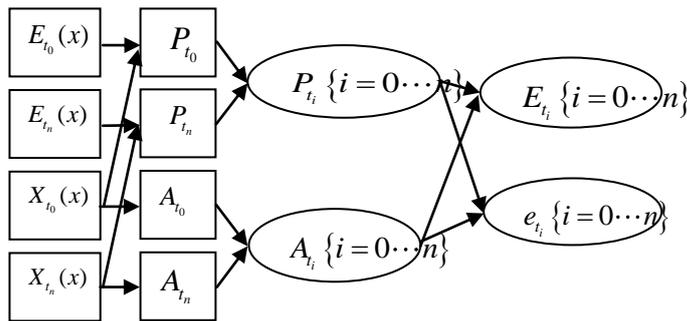
Notes: $E_{t_0}(x)$ is age-specific population in the first year. $E_{t_n}(x)$ is age-specific employed population in the last year. $X_{t_0}(x)$ is age-specific population in the first year. $X_{t_n}(x)$ is age-specific population in the last year. P_{t_0} is employment pattern in the first year. P_{t_n} is employment pattern in the last year. A_{t_0} is age structure of population in the first year. A_{t_n} is age structure of population in the last year. $P_{t_i}\{i = 0\cdots n\}$ is employment pattern in the other years. $A_{t_i}\{i = 0\cdots n\}$ is age structure of population in the other years. $E_{t_i}\{i = 0\cdots n\}$ is age-specific population in the other years. $e_{t_i}\{i = 0\cdots n\}$ is employment rate in the other years.

Fig. 1. Path diagram of the employed population estimation method

Sourse: Own elaboration

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Given the population data and employment patterns for both genders and ages in urban and rural areas, the total amount of employment can be estimated according to Formula (1)

$$E_t = \sum_{x=15}^{+\infty} (L_t^m(x) \times e_t^m(x) + L_t^f(x) \times e_t^f(x)) \tag{1}$$

E_t is the total amount employment in t, $L_t^m(x)$ and $L_t^f(x)$ are the x-year-old population of men and women, and $e_t^m(x)$ and $e_t^f(x)$ are the employment rate of the x-year-old population of men and women.

The population and employment rate by age in 1982, 1990, 1995, 2000, 2005 and 2010 can be obtained by survey data and 1 % population sampling survey. The population and employment rate by age in other years are estimated by using age-period-cohort model. In addition, the author uses population prediction technology to estimate the population and employment population by urban-rural, age and gender in the future.

(2) Data collection & Preprocessing

The data of age-specific population and employment population by gender in urban and rural areas are from previous census data and 1 % population sampling survey data.

Based on the data of the census year, this paper estimated the working-age population of urban and rural gender in 1978-2010 by using the age-period-cohort model, and predicted the age population of urban and rural gender in 2011-2020 by using the population forecasting technology of urban and rural gender. To be specific, based on the data of age population divided by urban and rural gender in 2010, assuming that the life expectancy and death pattern of urban and rural population remain unchan-

ged, and the fertility level and fertility pattern remain unchanged, the urbanization level will gradually increase from 50 % in 2010 to about 60 % in 2020, it predicted the population by urban and rural, gender and age over the years from 2011 to 2020.

From the perspective of the changing trend of the working-age population, China's working-age population aged 15-64 has maintained a rapid growth in the past 30 years. But the growth trend underwent a fundamental shift in 2009, when the total number of people of working age gradually decreased with a slower rate. From the forecast of the working-age population in 1978-2020, the total working-age population in China increase from 550 million in 1978 to 993 million in 2009, and then gradually decrease to 980 million in 2020. However, the urban and rural working-age population shows a completely different trend. Due to the continuous large-scale migration, the total working-age population in urban areas has maintained a rapid growth, while the total working-age population in rural areas has gradually decreased after a period of slow growth. With this «rural decrease and urban inflation», the size of the urban working-age population will surpass that of rural areas after 2008. The total urban working-age population is expected to grow from 113 million in 1978 to 588 million in 2020. The total rural working-age population will increase from 437 million in 1978

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to 571 million in 1995 and then decline to 392 million in 2010.

In terms of the statistical caliber of the employed population in the census and the 1 % sample survey, the employment statistics of 1982 and 1990 were conducted for a total of 16 days or more in the first month of the census standard period. The statistical caliber of 1995 and later is whether the social labor with income of no less than one hour has been engaged in one week before the standard time of general survey. Both of them can better judge the situation of the working population. According to the population of urban and rural working population in the previous census and 1 % sample survey, the age-specific employment rate can be calculated. The age-specific employment rate for other years can be further estimated by linear interpolation and trend extrapolation. In 1982, there was a lack of age-specific employment data for urban and rural areas, which required an indirect estimate of the age-specific employment rate for urban and rural areas. Based on the stability of the employment model and the clear law of change, this paper estimates the age-specific employment rate of the urban and rural in 1982 via calculating the age-specific employment rate trend of the urban and rural from 1990 to 2010, and then utilizes the piece-wise function method to fit and modify, and finally obtained the age-specific employment rate of the urban and rural areas in 1982.

V. Analysis on the Change Trend of China's Population Employment Model

(1) Change Trends in National Population Employment Model

The age-specific employment rate of the Chinese population is «inverted U» with good stability (Fig. 2). First, in terms of the age dimension, the employment rate at the age of 15-24 has gradually increased; the age of 25-40 has remained at a high level; and the age of 40 and older has begun to decline gradually. As time goes on, population employment pattern moves back regularly. Moreover, the age-specific employment rate of the younger and older population varies considerably. Compared with the earlier years, the age-specific employment rate of the younger group decreased significantly, while that of the older group increased significantly. The age-specific employment rate for the middle age (25-40 years) is relatively small. Along with the change of population employment pattern, the average expected employment life of Chinese population has also changed. The average expected number of years of employment in China increased first and then decreased from 1978 to 2010. The average projected employment life in 1978 was 39 years, then gradually increased to 41 years in 1990 and then began to decrease to 36 years in 2010.

From the perspective of gender, the employment pattern of male population is relatively «wide», while that of female population is relatively «narrow». With the exception of the lower age groups, the age-specific employment rate of women in other age groups is significantly lower than that of men, which also determines that the average expected employment life of the female population is significantly lower than that of men. From the changing trend of time dimension, the changing trend of female population employment model is more complicated than that of male.
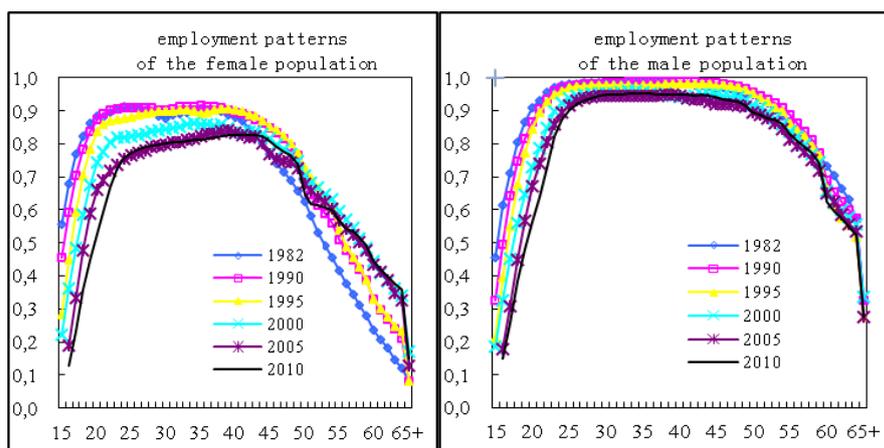
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Fig. 2. Employment patterns of gender-disaggregated population, 1978-2010

Sourse: The data come from census data from 1982 to 2010.

As time goes on, the change in the employment pattern of the male population is mainly reflected in the reduction to the internal. The peak age-specific employment rate has declined slightly, and the age of entering employment has been significantly delayed, with the age of exiting employment slightly earlier. The employment pattern of the female population shows a marked downward and backward trend. The peak age-specific employment rate has declined significantly, and both entry and exit to employment have been significantly delayed. With the passage of time, the average expected employment life of the male population is gradually decreasing, while the average expected employment life of the female population is increasing. The gender gap of the average expected employment life is gradually decreasing.

In general, the employment pattern of the population in the calendar year 1978-2010 is relatively close, the difference is mainly manifested in the low-age labor population and the elderly labor population. The age-specific emp-loyment rate of the young working population has gradually declined as time passes, while the age-specific employment rate of the elderly working population has gradually increased. This estimate is consistent with the objective trend towards higher school attendance, lower labour participation and improved health and labour participation among the elderly.

(2) Change Trend of Employment Pattern of Urban and Rural Population

In terms of urban and rural areas, both male and female, the age-specific employment rate of the rural population is significantly higher than that of the urban population (Fig. 3). On average, the employment pattern of the urban population is relatively «narrow», the age group of 25-50 has a higher employment rate, with a range of 25 years. But the employment pattern of the rural population is relatively «wide», the age group of 20-60 has a higher employment rate, with a range of 40 years. By contrast, the peak employment age of the rural population is 15 years longer than that of the urban population.
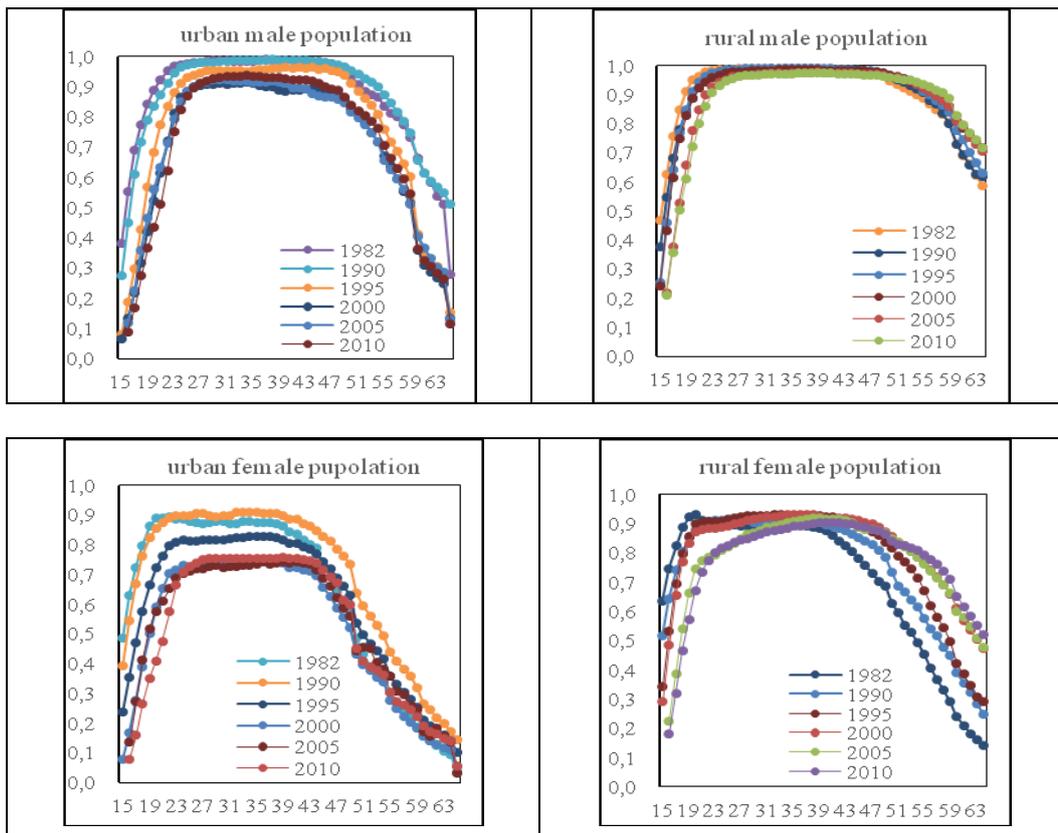
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Fig. 3. Employment Patterns of Urban and Rural Gender Population, 1982-2010

Sourse: The data come from census data from 1982 to 2010.

According to the changing trend of employment model, the change of employment model of urban population shows that the change of employment model is reduced to the inside with time goes by. It not only the peak of employment rate is obviously reduced, but also the age of starting employment is getting late, the age of exiting employment is getting earlier, especially the urban female population. The peak of employment rate is obviously reduced, and the age of starting employment is obviously delayed. But the pattern of employment in rural areas has varied considerably. The change in employment patterns of the rural population is reflected in the backward movement, and the peak employment rate does not decrease significantly. Although the age of entry into employment has been slightly delayed, the age of exit from employment has also been significantly delayed. Especially for the rural female population, where the peak employment rate has been significantly delayed and the age of entry into employment has been longer, and the age of exit from employment has been significantly delayed than before.

Both male and female, the average expectancy of employment years of the rural population is longer than that of the urban population, and the gap bet-

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ween urban and rural areas continues to widen. From 1978 to 2010, the average expectancy of employment years of urban population was 35 years, 36 years, 31 years and 31 years respectively. The average expectancy of employment years of the rural population is 42 years, 42 years, 43 years and 41 years, respectively. The average expectancy of employment years of the rural population is 6 years, 6 years, 12 years and 10 years higher than that of the urban population, respectively, indicating that the working life of the rural population is not only significantly longer than that of the urban population, but also that the urban-rural gap continues to widen. Especially, with the decrease of the average expectancy of employment years of urban female population and the increase of the average expected employment life of rural female population, the gap between urban and rural female population has also widened significantly. According to the data from previous censuses, the average expectancy of employment years of the urban female population is 28 years,31 years,26 years and 26 years respectively, while that of the rural female population is 36 years, 39 years, 41 years and 38 years respectively. Compared with the urban female population, the average expectancy of employment years of the rural female population is 8 years, 8 years, 15 years and 12 years respectively. The average expectancy of employment years of the rural female population is not only significantly longer than that of urban women, but also the gap between urban and rural areas is widening.

In view of this fact, there are two reasons that cannot be ignored. One is that the rural youth often drop out of school earlier and participate in the work, which leads to the high employment rate of the rural young workers. From the point of view of life course, dropping out of school prematurely in youth will seriously affect the accumulation level of human capital and lead to the forced extension of lifelong labor time. Another reason for the expected high number of years of employment in the rural population is the lack of effective old-age security for the elderly in rural areas and the generally poor personal economic conditions, resulting in a higher proportion of rural elderly people's continued participation in social labour, and urban populations are the opposite.

VI. Analysis of the Trend of Employment Population Change in China

(1) Analysis on the Trend of Total Employment Population Change in China.

Figure 4 shows the total number of employed people in China's urban and rural areas from 1978 to 2010 as estimated in this paper, and also provides the employment population data published in China Statistical Yearbook and the traditional «three-in-one» employment statistics. According to the estimated results of this paper, since the reform and opening up, with the vigorous development of the economy, the total amount investment in China has increased from 464 million to 757 million, with an average annual increase of 9,16 million. According to the differences in growth rates, the period 1978-2010 can be roughly divided into three different growth stages, in which the average growth rate was 15 % for the period 1978-1990; 7 % for the period 1991-2005 and 1 % for the period 2005 onwards.
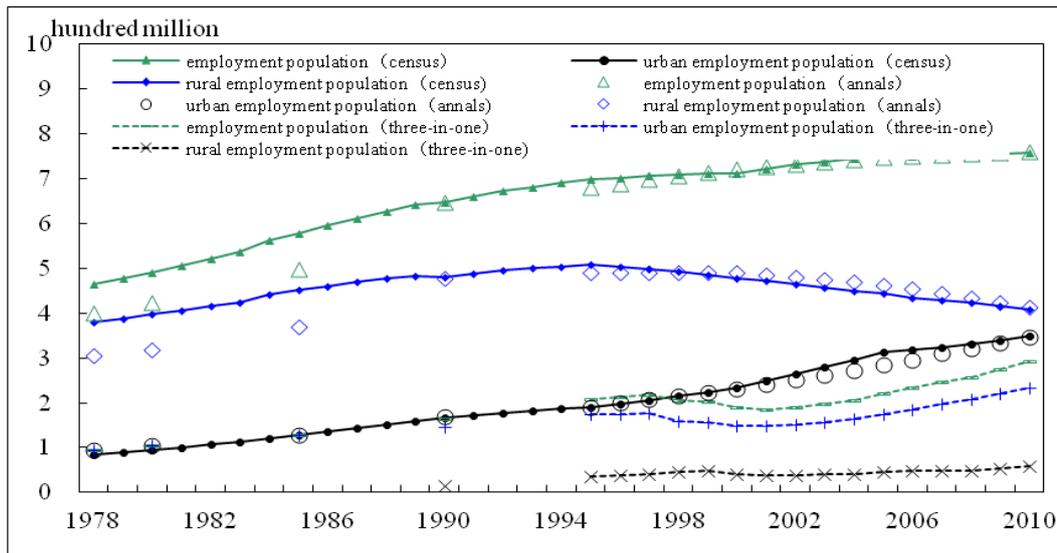
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Fig. 4. Trends of Total Employment Population Change,1978-2010

Sourse: The data come from census data, annals and three-in-one employment statistics data from 1982 to 2010.

Comparing the total amount of yearbook employment, the total amount of traditional «three in one» employment with the estimated results of using census data in this paper, it is found that the total amount of yearbook employment is relatively close to the total amount of census employment, and the total amount of «three in one» employment is obviously low. Due to the traditional «three-in-one» employment statistics range is very narrow, the vast majority of informal employment personnel and agricultural workers are not counted, so the total number of «three-in-one» employment is much lower than the actual employment. Going forward, with the rapid development of informal employment, the gap between the «three-in-one» employment statistics and the actual total amount employment will become more and more large. To the final analysis, the total employment in the yearbook before 1990 is the «three in one»

total employment, and there is a gap between the actual number of employment can not be ignored. It is calculated that an average of 82,69 million employees were left out each year for the period 1978-1989, with the proportion missing as high as 14 %. The total number of yearbook employment after 1990 is closer to that of census employment, but there are still some differences in individual years, mainly reflected in the slightly lower number of yearbook employment in 1995,1996,1997 and 2005. The difference in total employment was 18 million (2,51 %), 12 million (1,72 %), 7 million (1,00 %) and 12 million (1,58 %). From the perspective of the total urban and rural employed population, the annual total employment from 1990 to 2010 and the census total employment change trend is consistent, but there are different degrees of deviation. The main performance in urban areas is that the total employment of the

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yearbook is lower than the total emp-loyment of the census, while the main performance in rural areas is that the total employment of the yearbook is higher than the total employment of the census.

(2)Trends in Total Employment Population Change

There is a big gap between the total urban employment and the total rural employment in China. From 1978 to 2010, the scale of the rural employment population has always been larger than that of the urban areas, of which the average size of the rural employment population was about 300 million more than that of the urban areas during the period from 1978 to 1995. Specifically, the number of people employed in urban areas and in rural areas was 85 million and 380 million in 1978, respectively, with 295 million more people employed in rural areas than in urban areas. In 1995, the number of people employed in urban areas and in rural areas increased to 190 million and 508 million respectively, with a rural employment popula-tion of 318 million more than in urban areas. In 2000, the employed population in urban areas increased to 234 million, while the employed population in rural areas decreased to 478 million, narro-wing the urban-rural gap to 244 million. In 2010, the urban employment popula-tion continued to grow to 349 million, while the rural employment population continued to decrease to 408 million, and the gap between urban and rural areas further narrowed to 59 million.

As time goes on, the urban and ru-ral employed population shows a very different trend of change. Since the re-form and opening up, with the gradual acce-leration of urbanization, the scale of urban employment population has maintained a relatively rapid growth im-petus. After a period of growth, the rural emp-loyment population began to de-cline in 1995. Following the difference of growth rate, the growth process of urban employment population can be divided into three periods: 1978-1991, 1992-2003 and 2004-2010. From 1978 to 1991, the employment population in cities and towns grew sharply, with an average annual increase of 6,75 million. The growth rate of the urban employ-ment population from 1992 to 2003 was obviously lower than the normal deve-lopment trend, which is consistent with the economic downturn in the 1990s and the historical events of laid-off workers from state-owned enterprises. Since 2004, with the rapid development of China's economy, the growth rate of employment population in cities and towns has accelerated significantly, with an average annual growth rate of 7,13 million.

From the point of view of labor supply, the rapid growth of urban emp-loyment population is partly due to the natural growth of urban population, while the other part is due to the large number of migrant rural migrant wor-kers since the reform and opening up. And the large-scale rural floating popu-lation, especially the young and middle-aged labor force, poured into the urban areas, which not only increased the size of the employment population in the urban areas, but also reduced the size of the employment population in the rural areas.

While the scale of employment population in urban areas has been in-creasing rapidly, the scale of employ-ment population in rural areas has expe-rienced the change of first growth and then rapid decline. From 1978 to 1995,

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the rural employment population maintained a relatively rapid growth, with an average annual growth rate of 7,79 million. After 1995, the rural employment population began to decrease rapidly, with an average annual decrease of 6,68 million. The size of the rural employment population decreased to 408 million in 2010, equivalent to that in 1981.

VII. Urban Population Employment Model and Total Forecast for 2010-2020

Based on gender-specific population data in urban and rural areas for 2010, assuming that the life expectancy and mortality patterns of the urban and rural population, fertility levels and fertility patterns remain the same, and that urbanization has gradually increased from 50 per cent in 2010 to about 60 per cent by 2020, this paper predicts the urban and rural age-specific population in 2011-2020, and adopts trend extrapolation to predict the employment model in the coming years according to the regularity of age-specific employment rate. On this basis, predicts and analyses China's total amount employment for 2011-2020.

(1) Population Employment Model 2010-2020

As the number of years of education continues to increase, the employment rate of the young working-age population will decline significantly from 2010 to 2020. As average life expectancy increases and health improves, the age-specific employment rate for the older workforce will rise slightly. Relatively speaking, the age-specific employment rate of the middle-aged working population has not changed much.

In urban and rural areas, the change of employment model of urban population from 2010 to 2020 is relatively large, which is mainly manifested in the obvious decrease of employment rate of low-age population, the significant increase of middle-aged population and the slight decrease of senior population.

Due to the increase in the number of years of education, the employment rate of the urban low-age population will de-crease significantly, with the employment rate of the 16-year-old population falling from 8,40 % in 2010 to 3,19 % in 2020, a decrease of more than 5 percentage points.

The average employment rate of the middle-aged population (25-45) will rise from 85 % to about 88 %, and the emp-loyment rate of the senior citizens at retirement age will decrease significantly. On average, the employment rate at the age of 50-53 fell by 1 percentage point, while the employment rate at the age of 59-63 fell by 3 percentage points.

The changing trend of the reduction of the employment rate of the elderly population in urban areas is consistent with the objective facts of the higher proportion of formal employment in urban areas.

With the transform of employment rate, especially the obvious decline of the employment rate of the younger population, the average expected employment life of the urban population will decrease from 31,09 years to 30,74 years in 2015 and 30,39 years in 2020, with an average annual decrease of 0,07 years.

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Table 1

Total urban and rural employment population and growth rate,1978-2010

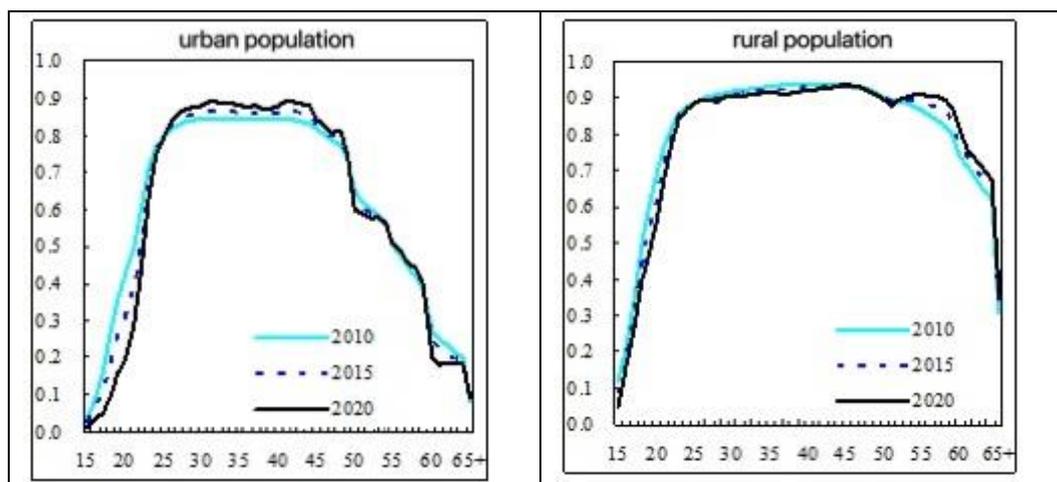| year	Employment Population（million）					Growth Rate（%）				
	Total	Urban		Rural		Total	Urban		Rural	
		Total	Female	Total	Total	Female	Total	Female	Total	Female
1978	464	84	32	380	167					
1979	477	89	35	388	172	2,8	6,08	7,57	2,25	2,74
1980	492	95	37	397	177	3,14	6,14	7,53	2,23	2,65
1981	507	100	40	407	182	3,05	6,15	7,37	2,46	2,86
1982	522	107	43	415	186	2,96	6,06	7,14	2,09	2,37
1983	537	113	46	424	191	2,87	5,64	6,66	2,19	2,46
1984	562	121	50	441	199	4,66	7,89	8,13	4,03	4,28
1985	579	128	53	451	204	3,02	5,53	6,51	2,2	2,48
1986	596	135	56	461	208	2,94	5,63	6,55	2,12	2,39
1987	612	143	60	469	213	2,68	5,65	6,51	1,81	2,01
1988	628	151	64	477	217	2,61	5,6	6,41	1,65	1,84
1989	643	159	68	484	220	2,39	5,46	6,25	1,44	1,63
1990	647	166	72	481	219	0,62	4,47	5,82	-0,55	-0,32
1991	661	172	75	489	224	2,16	3,26	4,11	1,68	1,9
1992	672	177	77	495	227	1,66	2,97	3,74	1,27	1,47
1993	682	182	80	500	230	1,49	2,67	3,39	0,96	1,2
1994	690	186	82	504	232	1,17	2,46	3,13	0,88	1,15
1995	698	190	85	508	235	1,16	2,22	2,82	0,71	1,01
1996	702	198	87	504	232	0,57	4	2,99	-0,83	-0,9
1997	705	206	90	499	230	0,43	4,19	3,21	-0,91	-0,97
1998	708	215	93	493	227	0,43	4,31	3,37	-1,21	-1,28
1999	710	224	96	486	224	0,28	4,35	3,46	-1,41	-1,48
2000	712	234	100	478	220	0,28	4,26	3,4	-1,59	-1,66
2001	722	250	107	472	218	1,4	6,88	7,69	-1,3	-0,89
2002	731	266	115	465	216	1,25	6,28	6,98	-1,44	-1,01
2003	738	281	122	457	213	0,96	5,8	6,45	-1,72	-1,3
2004	745	296	130	449	210	0,95	5,46	6,13	-1,93	-1,48
2005	758	313	138	445	208	1,74	5,68	6,12	-0,77	-0,77
2006	751	317	139	434	203	-0,92	1,32	0,65	-2,52	-2,53
2007	753	324	140	429	200	0,27	2,01	1,13	-1,19	-1,68
2008	754	331	142	423	196	0,13	2,29	1,4	-1,37	-1,85
2009	756	340	145	416	192	0,27	2,53	1,69	-1,67	-2,11
2010	757	349	147	408	187	0,13	2,75	1,96	-1,95	-2,38

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*Fig. 5. Trends in the age-specific employment rate
of the national population for 2010-2020*

From 2010 to 2020, employment pattern change of the rural population mainly shows that the employment rate on the elderly population increases obviously, and the employment rate of the younger and middle-aged population decreases slightly. Compared with the employment rate of the young population in urban areas, the employment rate of the young population in rural areas declined by a smaller margin, with the employment rate of the 16-year-olds falling by 4,7 %, from 19,61 % to 14,91 %. Compared with the urban, rural employment of young people still keep on a high level, it also suggests that the retention of the rural young population in the future will still at a low level, this, to a great extent, is not conducive to the accumulation of human capital level and improve to adulthood and old age pension of employment caused serious negative impact. In fact, the employment rate of the middle-aged population in rural areas from 2010 to 2020 does show a declining trend, among which the employment rate of the 35-40 year-old popu-

lation will drop from 93 % in 2010 to 92 % in 2020, a decrease of one percentage point. Although the decline is small, it suggests that the risk of unemployment may rise. From 2010 to 2020, the employment rate of senior citizens in rural areas increased, especially those aged 52-60. On average, the employment rate for those aged 52-60 rose by three percentage points to 88 %, up from 85 % in 2010. The obvious increase of employment rate of rural elderly population has something to do with the improvement of health status of rural population and the lack of old-age security. With the change of employment rate, the average expected employment life of the rural population will decrease from 41,18 years in 2010 to 41,03 years in 2015 and 40,89 years in 2020, with an average annual decrease of 0,03 years.

(2) Total Employed Population for 2010-2020

1. Total Employment Population and Change Trends 2010-2020.

With the decline of the working-age population and changes in employment

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patterns, 2010-2020 will witness an underlying shift in the total number of working population in China, which will gradually decline after reaching its peak in 2014.

According to the forecast, the total number of employed people in China will increase from 757 million to a peak of 765 million in 2010-2014, and its growth rate will decrease from 0,5 % to 0,12 %. After 2014, the total employed population starts to gradually decrease, which is expected to decrease from 765 million in 2015 to 756 million in 2020. The rate of decline will also increase from 0,02 % to 0,54 %.

From the perspective of gender, the change range of China's male and female employed population from 2010 to 2020 is small, and the total amount of employment remains at a relatively stable level. Between 2010 and 2020, the total male employment population will remain between 422 and 430 million. The total number of women working will also remain between 327 and 337 million. At the same time, the growth rate of the male employed population in the period will drop from 0,57% to 0,42%, while that of women will increase from 0,57% to 0,79%.

2. Total Employed Population in Urban and Rural Areas and its Changing Trend from 2010 to 2020

From 2010 to 2020, the change trend of China's urban and rural employment population is opposite. While the urban employment population is increasing rapidly year by year, the rural employment population is decreasing rapidly year by year. With the deepening of urbanization, China's urban employment population will increase from 349 million to 402 million from 2010 to 2020, with an average annual growth of 5,3 million. Meanwhile, the growth rate of urban employment will gradually decrease from 2,16% to 0,83%, among them, the urban male employment population will increase from 202 million to 242 million, with an average annual growth of 4,06 million. The number of women employed in urban areas will increase from 147 million to 160 million, with an average annual growth of 1,23 million.

From 2010 to 2020, the rural employment population will be reduced from 408 million to 354 million, with an average annual decrease of 5.4 million.

There are two main reasons for the rapid decline in the rural employment population: one is that urbanization has made a large number of rural people turn into urban population, and the other is that the employment rate of rural population has decreased slightly from 2010 to 2020. By comparing the decline of rural employment population with that of urban employment population, 1 million of the decline of rural employment population from 2010 to 2020 is not due to the decrease of urbanization, but the decline of employment in rural areas.

The risk of the decline of the employment rate of rural population especially that of the middle-aged group, will bring a series of problems, which need special attention of the government.

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Table 2

*Total Employed Population and Growth Rate by Gender
in urban and rural areas from 2011 to 2020*

year	Employment Population (million)					Growth Rate (%)				
	Total	Urban		Rural		Total	Urban		Rural	
		Total	Female	Total	female		Total	Female	Total	Female
2010	757	349	147	408	187					
2011	760	357	150	404	186	0,5	2,16	1,85	-0,92	-0,7
2012	763	363	152	400	184	0,34	1,93	1,51	-1,07	-0,85
2013	764	370	154	395	183	0,18	1,7	1,12	-1,19	-0,99
2014	765	376	156	390	181	0,12	1,65	1,03	-1,32	-1,11
2015	765	381	157	384	178	-0,02	1,45	0,84	-1,44	-1,22
2016	765	386	158	378	176	-0,07	1,39	0,78	-1,53	-1,3
2017	763	391	159	372	174	-0,24	1,16	0,54	-1,67	-1,43
2018	760	394	159	366	171	-0,36	0,9	0,09	-1,68	-1,43
2019	760	398	160	362	170	0,02	1,04	0,22	-1,08	-0,82
2020	756	402	160	354	167	-0,54	0,83	0,05	-2,05	-1,58

The total number of women working will also remain between 327 and 337 million. At the same time, the growth rate of the male employed population in the period will drop from 0,57 % to 0,42 %, while that of women will increase from 0,57 % to 0,79 %.

2. Total Employed Population in Urban and Rural Areas and its Changing Trend from 2010 to 2020.

From 2010 to 2020, the change trend of China's urban and rural employment population is opposite. While the urban employment population is increasing rapidly year by year, the rural employment population is decreasing rapidly year by year. With the deepening of urbanization, China's urban employment population will increase from 349 million to 402 million from 2010 to 2020, with an average annual growth of 5,3 million. Meanwhile, the growth rate of urban employment will gradually decrease from 2,16 % to 0,83 %, among

them, the urban male employment population will increase from 202 million to 242 million, with an average annual growth of 4,06 million. The number of women employed in urban areas will increase from 147 million to 160 million, with an average annual growth of 1,23 million.

From 2010 to 2020, the rural employment population will be reduced from 408 million to 354 million, with an average annual decrease of 5,4 million. At the same time, the rate of decline of the rural employment population will gradually increase from 0,92 % to 2,05 %, among which the rural male employment population will decrease from 220 million to 187 million, with an average annual decrease of 3,31 million, and the rural female employment population will decrease from 187 million to 167 million, with an average annual decrease of 2,03 million. There are two main reasons for the rapid decline in the

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rural employment population: one is that urbanization has made a large number of rural people turn into urban population, and the other is that the employment rate of rural population has decreased slightly from 2010 to 2020. By compa-ring the decline of rural employment population with that of urban employment population, 1 million of the decline of rural employment population from 2010 to 2020 is not due to the decrease of urbanization, but the decline of employment in rural areas. The risk of the decline of the employment rate of rural population especially that of the middle-aged group, will bring a series of problems, which need special attention of the government.

VIII. Conclusions

At present, China still lacks a unified and coherent employment statistics system in line with the international system, and the official employment data are not only lack of coherence, but also have differences before and after. Some scholars, therefore, re-estimate the employment data, which provides the basis for accurately measuring the total amount employment and its changing trend in china. But the estimation method and accuracy need to be improved. In view of the problems existing in existing studies, this paper estimates the size of employment population by gender in China's urban and rural areas via the combination of urban and rural population structure, age structure, gender structure and employment structure. Considering the diversity of caliber of employment statistics in China, this paper, based on the concept of employment recommended by International Labor Organization, first defines the concept of employment and unifies the caliber of employment statistics. Then, ac-

cording to the census data of gender-disaggregated age and the employment pattern and its changing pattern of gender population in urban and rural areas, this paper calculates the employment model of urban and rural population in china from 1978 to 2020 and total amount employment.

China's population's employment model is «inverted U»: the age-specific employment rate is gradually rising at 15-24 years of age; the 25-40-year-olds remain at a high level; and the above-40-year-olds begin to gradually decline. As time goes by, population employment pattern moves back regularly, which mainly shows that the employment rate of the young group decreases obviously, while that of the old group increases obviously. In terms of gender, the employment pattern of male population is relatively «wide», while that of female population is relatively «narrow». According to the changing trend, female population employment pattern is more complicated than that of male. With the passing of time, the change of employment pattern of male population is mainly reflected in the inward reduction, while the employment pattern of female population shows obvious downward and backward trends. In urban and rural areas, the employment model of urban population is relatively narrow, while that of rural population is relatively wide. As time goes on, employment pattern change of urban population is shrinking inward, but that of rural population is going backwards.

In terms of the average expected number of years of employment, employment of the national population in 1978-2010 declined from 39 years in 1978 to 36 years in 2010. In urban and rural areas, the average expected emp-

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loyment life of the rural population is longer than that of the urban population, and the gap between urban and rural areas continues to widen over time. From 1978 to 2010, the average expected employment life of the rural population in the previous census years was six years, six years, 12 years and 10 years higher than that of the urban population respectively, of which the urban-rural gap in the average expected employment life of the female population widened more significantly, from about eight years in 1978 to about 12 years in 2010.

With the change of China's total population, structure and employment model, China's employment population experienced a period of rapid growth from 1978 to 2010. Between 1978 and 2010, china's total amount employment grew from 464 million to 757 million, with an average annual growth rate of 9,16 million, showing a slowing trend. In urban and rural areas, with the gradual acceleration of the urbanization process, the size of the urban employment population will continue to grow rapidly from 85 million to 349 million, while the rural employment population will increase from 380 million to 508 million in 1995, and then gradually decrease to 408 million in 2010. Although the rural employment population has been larger than the urban population during the period 1978-2010, the gap is rapidly narrowing. In 1978, the gap between urban and rural areas was 295 million, and by 2010, it had steadily narrowed to 59 million.

As the number of years of education continues to rise for the urban and rural population and the number of healthy lives continues to grow, the employment rate of the younger workforce will continue to decline, while that of the older workforce will rise slightly. In terms of urban and rural areas, the average expected employment life of the urban population will decrease from 31.09 to 30,74 in 2015 and 30,39 in 2020, while the average expected employment life of the rural population will decrease from 41,18 in 2010 to 41,03 in 2015 and 40,89 in 2020. From 2010 to 2020, with the gradual decline of the working-age population and the change of employment model, the total employment population in China reached a peak of 765 million in 2014, and then gradually decreased to 765 million in 2015 and 756 million in 2020. In urban and rural areas, the urban employment population increases rapidly year by year, while the rural employment population decreases rapidly year by year. With the advance of urbanization, China's urban employment population will grow from 349 million to 402 million from 2010-2020, and the rural employment population will decrease from 408 million to 354 million.

Reference

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