Empirical Analysis of Factors Influencing Employment in China—Based on the Analysis of Johansen Co-integration Model and Error Correction Model

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Abstract: Based on the expanded Solow model, this article studied the factors having an influence on the employment in China. With the explanatory variables of gross domestic product, urbanization rate, the level of household consumption, total fixed asset investment, the added value of the tertiary industry, this article did an empirical research with time series analysis model. Through the analysis of Johansen co-integration relationship model and error correction model, this paper tested the influence of these factors in both long run and short run.

Keywords: Employment, Johansen co-integration model, Error correction model

1 Introduction

Macroeconomic policy is designed to achieve four main social purposes that are known as economic growth, full employment, price stability, balance of payments. Among these social purposes, full employment is always given special concern by the government, and there is no exception in China. China is a developing country with a huge population, and in the recent decades, China had shown great ambition in social development and economic growth. Intending to catch up with the speed of economy growth, the process of modernization, industrialization, urbanization is accelerated. Under such circumstance, the problem of unemployment has becoming the primary issue that Chinese government attempt to solve.

The reason of unemployment is complicated, it varies when referred to different societies, counties, and regions so that the treatment differs depend on which country's problem we are dealing with. In general unemployment arises when the supply and demand do not match, the amount of the people who need job is bigger than the market could offer. However it means more in china. It is not amazing we have so much unemployment here because of our large population. The increasing employment pressure in china is mainly caused by three kinds of effect especially in some metropolis such as Beijing and Shanghai. First is the urbanization effect. Millions of people that originally live in rural area rushed into cities to try their fortune. This obviously makes it harder to be employed. Second is the modernization effect. The structure of the economy transformed, so did the kind of workers it needs. Unfortunately most of the unemployed do not get the proper skill or it takes time for them to acquire it. Third is the industrialization effect. Modern industry has generally accomplished automation and new constructed plant trends to use more machine to save labors for the purpose of cost saving. And Manufacture used to absorb a large percentage of workers in labor market has walked its golden age heading to recession. These three effect work together to prevent labor market equilibrium.

Since the unemployment has been given so much concern, a lot of researches were designed to figure out factors that might have an influence on employment. These researches were did from multiple aspect and using different methods. By using time series and econometric models, Liu Qiang find that the relationships between industrial structure and the level of employment. He further explored the causal relationship between the level of employment and the primary secondary and tertiary industries separately with the help of Granger causality test. Yang Hao, Xiao Yun, Chen Lang and Huang qing adopting the views of classic employment theories, proposed factors that may impact employment from six aspects structural factors which are listed as macroeconomic factors, fiscal policy, monetary policy, structural factors, human capital and other random factors. They use multiple regression model to

analyze long-term annual targets and VAR model for analysis of short-term relationships with quarterly data. Consequently, they explained how these factors work on employment both from long-term and short-term viewpoint. You Daming, Yang Xiaohui, Yang Li, Ding Yan tried a new approach to this research. They established a hierarchical mode indicator system, by defining that the sample unit is the first level, the sample area is the second level. By using this hierarchical mode we can clearly observe that same factor may have different impact to employment not only in magnitude but also in direction according to the sample area.

2 The Critical Analysis and Model Construction

2.1 Neoclassical growth model

The Solow–Swan model is an exogenous growth model, an economic model of long-run economic growth set within the framework of neoclassical economics. It attempts to explain long-run economic growth by looking at capital accumulation, labor or population growth, and increases in productivity, commonly referred to as technological progress. Assuming that production function is defined as following:

$$Y_t = A_t f(L_t, K_t) \tag{1}$$

In this function, Y_t represents total output in period t, A_t represents technology progress, K_t represents capital inputs, and L_t represents labor inputs. If taking the derivative of both sides of the function, we can get another equation describing the relationship between output growth, the rate of technological progress, and inputs growth. The new equation is like this:

$$G_y = G_a + \alpha G_l + \beta G_k \tag{2}$$

In the new equation, G_y is for output growth, G_a for technological progress rate, G_l for labor growth, G_k for capital growth parameters α, β, is for output elasticity of labor, capital respectively. According to the model, the change of employment growth is in consistent with that of the economic growth in theory. In another word, faster economic growth will lead to a corresponding increase in employment. Meanwhile, as the equation depicted, the rate of technological progress and capital investment as well as the output elasticity of labor and capital were negatively correlated with employment growth, given that in the labor-saving or capital-intensive patten econony we do not need so many workers. Howerver this is not a bad thing on the other hand, because it can be explained by a more effcent economy.

Another famous thoery about the relationship between gross output and unemployment is Okun's law. It argues that if the real GDP growth is 2% higher than its potential GDP, the unemployment rate could be 1% lower. Although Okun's law is primarily an empirical observation rather than a result derived from theory, it provides the quantitative relation between the two variables sothat we can estimate the other when one changes.

2.2 The econometric model

As the Neoclassical growth model indicated, emplyment rate is affected by GDP growth, labor and capital growth and so on. But only these factors are not enough, we must add new variables in our model to fully explain how the employment changes. So we expanded the solow model, turning it into a new one like this:

$$L = f(Y, U, CU, I, T) = a_0 Y^{b_1} * e^{b_2 u_t} * CU^{b_3} * I^{b_4} * T^{b_5} \tag{3}$$

In this function, L represents the total employment, Y represents GDP, U is short for urbanization, CU is the level of consumption, I is social fixed asset investment, T represents the tertiary industry output value. To use this model we also should take logarithm of equation (3), and we get the final equation like this:

$$\ln L_t = b_0 + b_1 \ln Y_t + b_2 U_t + b_3 \ln CU_t + b_4 \ln I_t + b_5 \ln T_t + \varepsilon_t \tag{4}$$

3 Empirical Analyses

3.1 Data explanation

In this paper, we use total number of employed person in china as the Dependent Variable, GDP, urbanization rate, the level of consumption, the total fixed asset investment and the tertiary industry output as independent variables. Our samples last from 1978 to 2011, all the data we used is got from China Statistical Yearbook.

3.2 Unit root test

The key assumption of time series analysis is that all the sequences are stationary stochastic process. The following process such as parameter estimation and hypothesis testing are all based on this assumption. If this assumption is not obeyed, the F-test and t-test could not work, more seriously it might cause spurious regression, and the conclusion is under the ground. So before the time-series regression analysis, we should first do unit root test with each sequence, and this paper choose ADF (Augment Dickey-Fuller test) method to do this test.

Table 1 Result of ADF test

Variable	Lags	Type	ADF statistics	Critical value (5%)	P	Stationary
lnL	0	c+t	-0.650 690	-3.552 973	0.968 7	not
DlnL	0	c	-4.855 395**	-2.957 110	0.000 4	√
lnY	1	c+t	-2.953 145	-3.557 759	0.160 4	not
DlnY	3	c	-3.722 762**	-2.967 767	0.009 0	√
U	0	c+t	-0.656 289	-3.552 973	0.968 3	not
DU	0	c	-4.673 907**	-2.957 110	0.000 7	√
lnCU	1	c+t	-2.435 238	-3.557 759	0.355 8	not
DlnCU	3	c	-3.118 514*	-2.967 767	0.036 2	√
lnT	4	c+t	-1.531 975	-3.574 244	0.794 6	not
DlnT	0	c	-3.146 948*	-2.967 767	0.034 0	√
lnI	1	c+t	-4.147 630*	-3.557 759	0.013 5	√

Note: D is first difference; c is constant; t is time trend; * significant at 5%; ** significant at 1%.

Test results indicate that, except lnI, all sequences present unit root. It implies that they are non-stationary time series and they are all integrated of order one in fact. Therefore we can apply cointegration test to these integrated of order one series to find out if there exists long-term stable equilibrium relationship.

3.3 Johansen co-integration model error correction model

This paper chooses Johansen method to do cointegration test. We first build VAR model to derive Akaike information, and finally determined the optimal lag order is 3. When deciding the deterministic trend, we choose cointegration equation only intercept. The characteristic roots trace test showed that there are three groups of cointegration, while the maximum value of the test showed that there are two sets of characteristics cointegration. So the result indicates that a stable long-run equilibrium relationship exists in the system consisting of these variables. The standardized Johansen cointegration equation is as following:

$$lnL =0.182\ 993lnY-1.912\ 780U+0.135\ 882lnCU-0.041\ 725lnT \tag{5}$$
$$(0.161\ 45)\quad (0.252\ 66)\quad (0.179\ 27)\quad (0.076\ 11)$$

This equation shows that in the long run the increasing GDP in china slightly stimulates the employment here. The employment rate will add 1.8 percentages in coming with 10 percentage increment in GDP. At

the appearance GDP's stimulating effect is not significant, however considering that china's GDP increases at an average speed of 10 percent each year and its huge population basement, the economic growth promoted the level of employment in recent years indeed. It is not optimistic when turning to the effect of urbanization rate. There is a strong negative correlation between urbanization and employment. With each percent growth in urbanization rate, total employment fell 1.9 percent. It is not surprising to observe such negative relationship and it will last for years in the future. As to the consumption and tertiary industry output, they separately have a slightly positive and negative effect on employment. But these influences could be ignored compared with that of the GDP and urbanization rate.

3.4 Error correction model (ECM MODEL)

To explain how the imbalance in short term adjusts to the long-term equilibrium,we also bulid error correction model. The error correction model is a short-term dynamic model, it's mathematical version is as following:

$$\Delta lnL_t = b_o + \sum_{i=1}^{2} b_{1i}\Delta lnY_{t-i} + \sum_{i=1}^{2} b_{2i}\Delta U_{t-i} + \sum_{i=1}^{2} b_{3i}\Delta lnCU_{t-i} + \sum_{i=1}^{2} b_{4i}\Delta lnYT_{t-i} + b_4 ETM_{t-1} + \varepsilon \quad (6)$$

After excluding not significant influence variables, we got the final ECM regression model like this:

$$DlnLt = 0.040\ 223DlnCUt - 0.034\ 621DlnTt - 1 + 0.947\ 819DlnLt - 1 - 0.017\ 637ETMt - 1 + 0.161\ 248 \quad (7)$$
$$\quad (2.615\ 993) \quad (-2.979\ 983) \quad (14.562\ 59) \quad (-1.128\ 051) \quad (1.142\ 612)$$

$R^2 = 0.897\ 787$, F$= 54.89\ 677$

According the regression, we find that the coefficient of error correction term is below zero, indicating that the co-integration relationship has a reverse regulation on DlnL, that is, when short-term fluctuations deviate from the long-term equilibrium, it will adjust the non-equilibrium state back to a balanced state, yet the intensity of adjustment is too small to realize full employment. The total employment was impacted by its lag phase positively, 1% increment in the previous period of total employment will boost the current employment by 0.95%. As to the other variables, and the amount of consumption has a smaller positive impact while the tertiary industry lag phase has a smaller negative impact.

4 Conclusions

In this paper, our samples are reliable and cover years after China's reform and opening up. By using Johansen co-integration and ECM error correction model, we studied the short and long term equilibrium relationship between employment level, GDP, urbanization rate, consumption, the tertiary industry output. The result shows that in long term, the change of total employment can be explained by the change of the remaining variables. As we see, the GDP's growth made great contribution to the employment, at an average speed of 1.8 percent increment per year. The influence of the rate of urbanization is the largest. Opposite to the GDP, it will cause the reverse change of total employment, each percent of the rate of urbanization arising will cut down 1.9 percent of total employment. That means if the government wants to reduce unemployment, they better found some training institutions to help the unemployed to find a new work. The impact of consumption and tertiary industry output is not significant, for the reason that the tertiary industry took a small part in china's economy and we are experiencing economic structure reforming. The predominance of secondary industry is going to be replaced by the tertiary industry, and now the economy is at a turning point. At this point, labor released by the recession of the secondary industry could not be totally absorbed by the tertiary industry. The transferring process will last for a long period until the economy reforming finished. In short term, the total employment is influenced by its lags most. It's because in short term employment has something to do with economic cycle. The impact of the error correction term indicates that labor market cannot reach equilibrium by itself, to realize full employment the government must act positively.

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