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Research Article

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On macro influencing factors of rural labor force employment in Heilongjiang Province in China based on the state space model

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ABSTRACT

In order to discuss the dynamic changes of rural labor force in Heilongjiang province from 1990 to 2011, the rural employment, rural labor force, regional GDP, rural residents' consumption, rural fixed asset investment and the per capita net incomes of rural residents were selected as research objects, of which the rural employment was regarded as an explanatory variable. The elasticity coefficients of the macro factors were obtained by the establishment of state space model and the following estimations of Kalman filtering. The analytical results suggest that among all factors the rural labor force is the main factor that positively affects the rural employment over the long term, while the rest of the four factors are in the course of fluctuations between positive and negative correlations. In addition, the rural employment was significantly influenced by each macro factor involved in the study before 1998 and then remained stable.

Key words: rural labor force; employment; macro influencing factors; state space model

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INTRODUCTION

The 18th National Congress of the Communist Party of China proposed that the solution to the three farmer-related problems is our top priority. The central of three farmer-related problems is farmer because the full employment of farmers is the key factor to promote the farmer incomes which is directly associated with the survival of farmers, harmony and steadiness of our society. Heilongjiang province is famous for agriculture. Previous studies on the employment of the rural labor force were mainly focused on the state of employment of the regional rural labor force, industrial restructuring， countermeasures under the conditions of effective demand, analysis of employment and microcosmic factors etc..

Relying on the fusion of the first, second and third industries and social division, the chain of agricultural industry was extended and strengthened, which provides guide direction for the transfer of Chinese rural labor force in a new period(Guo, etc. 2010;Li, 2011) . Based on the effective demand and Maslow's hierarchy of needs, increasing expenditure of finance fund, completing the rural social security system, carrying out the financial support agriculture activities, innovating institution and advancing the rural urbanization were proposed via the analysis of resulting in rural labor unemployment and the problems of rural employment protection(Feng, etc. 2010; Xia, 2011). Using the spatial behavior of human being behavioral geography as tool, the analysis of the employment perception behavior, employment decision-making, employment behavior and employment experience behavior in China suggests that employment spatial behavior of rural labor force is actually a unity of perception, decision, behavior and experience(Xu, etc. 2010). Based on the data through investigation on the spot, the basic situation of the regional labor force employment was analyzed, investigating the relationships among individual factors, family factors, human capital factor and the situation of rural labor employment. Meanwhile, the mechanism of these factors to influence the rural labor employment was also explored. The microscopic factors including age, gender,

wage income, education level, agricultural incomes and their satisfaction, skills training and social security were empirically analyzed using Logistic regression model and AHP(Zhang, etc. 2011; Li, etc. 2012; Xue, etc. 2013; Liu, 2012).

Based on the above analysis, the most studies were actually focused on policy advice, mechanisms of action, behavioral analysis and microscopic factors. In contrast few studies were focused on macro factors of rural labor force. In this study, the State space model was used to investigate the macroscopic factors influencing rural labor employment, deeply analyzing the longevity, dynamic and interactivity of the development of the rural labor employment, which provides theories for the sound development of population and economics and offers governmental scientific planning and policy adjustment feasible suggestions. At the same time, this study also showed a realistic significance for the effective development of population urbanization.

INDICATOR SELECTION

The realization of this work supposes the availability of a great number of repetitions of samples responding to the same known theoretical model. In practice, as the theoretical model is unknown, we use the Monte-Carlo method based on the generation of the data by computer according to a fixed theoretical model.

Based on previous research and the particularity of the rural labor force resources, the indicator system applied in this study was composed of 6 components including the number of the rural employment, the number of the rural labor force, GDP, consuming level of rural area, rural fixed assets investment and the per capita annual net income of rural residents. In addition, all the sample data derived from Heilongjiang Statistical Yearbook and Statistical Bulletin of the national economy in Heilongjiang Province. The number of the rural employment (RE) was chosen as the dependent variable and the rural labor force (RL), gross domestic product (GDP), the consumption level of rural residents (HC), rural fixed assets investment (RI) and per capita annual net income of rural residents (PI) were selected as explanatory variables.

In order to eliminate heteroscedasticity existing in time-series, the natural logarithm applies to all indicators studied in this research, namely rural employment for LNRE, rural labor force for LNRL, regional GDP for LNGDP, rural residents' consumption level for LNHC, rural fixed asset investment for LNRI, per capita annual net income of rural residents for LNPI. Time series diagram of LNRE, LNRL, LNGDP, LNHC, LNRI and LNPI were plotted and shown in Figure 1.

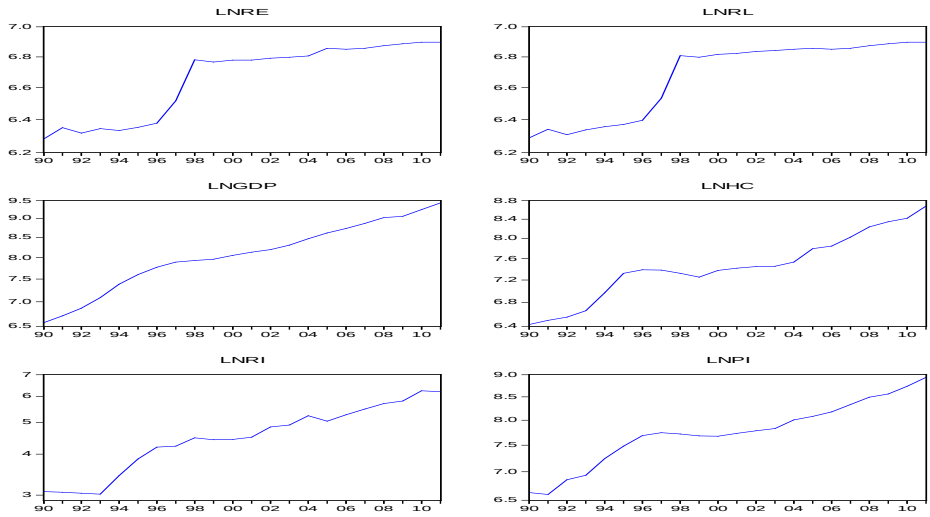

Figure 1: Time series diagram of LNRE, LNRL, LNGDP, LNHC, LNRI and LNPI

POSITIVE ANALYSIS OF MACRO FACTORS ON RURAL LABOR EMPLOYMENT

UNIT ROOT TEST

In order to avoid spurious regression caused by non-stationary either the stationary of relevant variables or the equilibrium relationship among variables was required by state space mode. In this study, LNRE, LNRL, LNGDP, LNHC, LNRI and LNPI were subjected to Augmented Dickey-Fuller (ADF) Unit Root Test, confirming whether or not there are unit roots and how many unit roots there are. Time series of 6 indicators were tested using EViews 6.0 software, indicating that LNGDP and LNRI reject null hypothesis under the significance level of 1% and 5%, respectively (shown in Table 1). These analyses suggest that series are smooth, while LNRE, LNRL, LNHC and LNPI are fluctuant. All series tended to be stable under the significance level of 1% when a second round of Unit

Root Test was applied to the first difference of above-mentioned 4 variables, which suggests that the series are integrated of order 1.

Table 1:Results of ADF test

Sequence	T values	Threshold（1%）	Threshold（5%）	Threshold（10%）	Conclusion
LNRE	-1.683370	-4.498307	-3.658446	-3.268973	Not smooth
LNRL	-0.999211	-4.467895	-3.644963	-3.261452	Not smooth
LNGDP	-5.208112	-4.571559	-3.690814	-3.286909	Smooth
LNHC	-1.991431	-4.498307	-3.658446	-3.268973	Not smooth
LNRI	-3.836441	-4.616209	-3.710482	-3.297799	Smooth
LNPI	-2.473896	-4.498307	-3.658446	-3.268973	Not smooth
⊿LNRE	-5.933889	-3.831511	-3.029970	-2.655194	Smooth
⊿LNRL	-5.778320	-3.831511	-3.029970	-2.655194	Smooth
⊿LNHC	-4.411147	-3.831511	-3.029970	-2.655194	Smooth
⊿LNPI	-8.254166	-3.831511	-3.029970	-2.655194	Smooth

STATE SPACE MODEL AND PARAMETER ESTIMATION

The status existing in economic problems is unpredictable, which, in economic system, reflects the true relationship among variables. State space model has established the relationship between the observable variables and the internal state of the system. The objective of analysis and observation can be achieved via the assessment of all sorts of state vectors. The state space model of LNRE variable parameters to LNRL, LNGDP, LNHC, LNRI and LNPI was established in this study (Zhao, 2004; Li, etc. 2009).

Measurement equation,

$$LnRE_t = c(1) + sv1 \times LnRL_t + sv2 \times LnGDP_t + sv3 \times LnHC_t + sv4 \times LnRI_t + sv5 \times LnPI_t + \mu_t \quad (1)$$

Equation of state,

$$sv1 = sv(-1)\ \ sv2 = sv(-2)\ \ sv3 = sv(-3)\ \ sv4 = sv(-4)\ \ sv5 = sv(-5) \quad (2)$$

Table 2: Parameter estimations by state space model

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	0.508089	0.869821	0.584130	0.5591
C(2)	-8.194407	0.103386	-79.26038	0.0000
	Final State	**Root MSE**	**z-Statistic**	**Prob.**
SV1	0.911790	0.019946	45.71392	0.0000
SV2	0.048561	0.045093	1.076889	0.2815
SV3	0.083499	0.046881	1.781076	0.0749
SV4	0.007979	0.017744	0.449644	0.6530
SV5	-0.127089	0.062255	-2.041412	0.0412
Log likelihood	4.615966	Akaike info criterion		-0.237815
Parameters	2	Schwarz criterion		-0.138629
Diffuse priors	5	Hannan-Quinn criter.		-0.214450

State space model was composed of the equation (1) and the equation (2), where c is a constant; LnREt, LnRLt, LnGDPt, LnHCt, LnRIt and LnPIt are observable variables; sv1, sv2, sv3, sv4 and sv5 are state vectors, reflecting the levels of sensitivity of RE to the changes of RL, GDP, HC, RI and PI at various time-points, also known as the elasticity coefficients. Recursive form was employed by the equation of the state, annotating the generation process of status variable. sv1, sv2, sv3, sv4 and sv5 can be shown as the first-order markov process, though unobservable, μ_t in the equation of state is the disturbance term, in accordance with the normal distribution of the mean valve being 0 and the variance being constant.

Equation (1) and equation (2) were subjected to Kalman filtering algorithm for parameter estimation (Harvey, 1989), the results of which are shown in Table 2 and 3.

Table 3: Estimation results of time-varying parameters by state space model

obs	SV1F	SV2F	SV3F	SV4F	SV5F
1990	0	0	0	0	0
1991	0.2044754546589783	0.2137211263057888	0.2091286891870852	0.1000654873880234	0.2156967463250873
1992	0.2063941875962286	0.3269698862922993	0.2299009671668079	0.05054419240126726	0.1045003862961071
1993	0.5196275955109051	0.1189770949636382	0.3264835388696181	0.2601983326933158	0.1772536098383929
1994	1.720140067078601	0.1583619120560005	0.7294622306087282	0.6478065195827048	0.09069573996223359
1995	1.630838358916202	0.9276347066314723	2.013884880227646	0.7389167538979617	0.01511113358008665
1996	0.7704601315927472	0.1886155277789336	0.5683487496175896	0.3049488649271459	0.08168151310326899
1997	0.9654262226675432	0.07597424371370682	0.06887278579440892	0.01728751548449575	0.06011697751686176
1998	0.9667975261350451	0.07836663580285696	0.07252243331968756	0.01891868728429942	0.06101546364245316
1999	0.9552742370907023	0.06117891571399692	0.05416057663638893	0.007995732335519779	0.04577472565781185
2000	0.9499018798561226	0.04276726791632978	0.04323987926209188	0.004492765798744584	0.03118335450166731
2001	0.947567199609972	0.02078822131034396	0.0544689131005178	0.002884384333908566	0.004771924588082628
2002	0.9467967851558247	0.009223141688013927	0.05885095204785883	0.002351710167453134	0.0216596912286481
2003	0.9456015823674995	0.007434548076570728	0.06111951008598713	0.0005198001121145407	0.02764136971033528
2004	0.9452844132071632	0.003982023185452209	0.06052033511482837	0.0002484964166399057	0.03099424098468673
2005	0.9450494861502852	0.004299222213916137	0.05693476981473646	0.0004640544831533999	0.02778990353487324
2006	0.9307816377405553	0.05435079792880702	0.0009760503990281638	0.006319751622726746	0.0613044860998019
2007	0.9230726120214269	0.07365585738888797	0.01834492657984957	0.00776944427562647	0.09196319990822666
2008	0.917307271154488	0.07403435410213393	0.04294839503463616	0.004344335309992604	0.1126378797799399
2009	0.9142290238493025	0.06812737668287082	0.064391878578793	0.0003037358520796857	0.1265760571115604
2010	0.9133185402423055	0.06069572652803812	0.07797157200561266	0.00329284343967702	0.1330915545462476
2011	0.912876330862826	0.04957005690417888	0.08183964212478929	0.007831085154607368	0.1274141475652403

CONCLUSION

The rural labor force employment is influenced by the changes of rural labor force. The trends of fluctuations between rural employment and rural labor force were basically the same, remaining stable from 1990 to 1996. However, during this time, elasticity of rural labor force showed significant fluctuations. sv1 rise from 0.20 to 1.72 from 1991 to 1994, namely when the population of rural labor force increases by 1%, the rural labor employment increases by 0.20% to 1.72%. On the contrary, sv1 fell from 1.63 to 0.77 from 1995 to 1996. The populations of rural employment and rural labor force grew dramatically between 1996 and 1998, and then sustained a modest growth. The rural labor force remained stable decreases after the experience of a small growth in 1996, suggesting that although the elasticity of rural labor force is still growing, the impacts of the population of rural labor force on the employment are getting smaller and smaller.

The rural labor employment was influenced by the changes of GDP. The increase of GDP can drive the growth of the rural labor employment. The influences of GDP on the rural labor employment maintain positive, though significantly fluctuant, except the transient negative impacts between 1990 and 1996. As can be seen from Table 3, GDP sustained steady growth. The number of rural employment kept stable between 1990 and 1996. The elasticity coefficient of GDP varies generally between 0.19 to 0.93, with peak in 1995 and valley in 1996. A modest increase of rural employment was observed after 1998. The fluctuations of elasticity coefficient of GDP are not significant, showing the trends of fall-rise-fall. In 2004, the level of positive influence was a minimum (0.004). However, when the GDP increased by 1% during the rest of the years, the rural labor force employment increased by about 0.05%.

As can be seen from Table 3, the rural residents' consumption level tended to grow, while sv3, time-varying parameter, showed a large fluctuation. sv3 kept rising before 1993 and then started to decrease, dropping to the lowest value of -2.01 in 1995. When the rural residents' consumption level increases by 1%, the rural labor force employment decreases by 2.01%. The significant growth occurred between 1995 and 1996, reaching the peak of 0.57. After 1998, the consumption level of rural residents continued to grow, while sv3 was negative. That is to say the rural labor force employment was shrinking with the increase of rural residents' consumption level. The elasticity coefficient of rural residents' consumption level maintains to be positive and gets to grow until 2007.

The number of rural labor force in Heilongjiang province had a great positive influence on rural labor employment. The elasticity coefficient reached its maximum 1.72 in 1994. The negative influences of rural residents' consumption level and the per capita net income of rural residents on rural labor employment lasted for a long time. 12 out of 22 years were negative influences. In 1995, the elasticity coefficient reached its minimum -2.01. All the factors developed positively from 1994 to 1996. The rural labor force, GDP and the rural fixed assets investment existed in a large scope of positive elasticity value. However, the rural residents' consumption level and the per capita net

income of rural residents existed in a large scope of negative elasticity value. The influence of consumption level of rural residents on rural labor employment was positive between 1996 and 1997, while the influences of rural per capita net income, GDP and rural fixed assets investment on rural labor employment were negative. All the factors studied in this research fluctuated dramatically between 1993 and 1997 and then the influential degrees of each factor tended to be relatively stable after 1998 but still in the course of fluctuations.

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