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Dynamic Impact Mechanism of Birth Rate and GDP in Liaoning Province[1]

MÉCANISME DE L'IMPACT DYNAMIQUE DU TAUX DE NATALITÉ ET DU PIB DANS LA PROVINCE DU LIAONING

HUANG Fei-xue[2]
SU Jing-qin[3]
LI Cheng[4]

Abstract: This paper's objective is to study the issue of impact mechanism of birth rate between Liaoning province and China integrating unit root test, cointegrating test, vector error correction model (VECM), generalized impulse response function and variance decomposition. After selecting the data of birth rate, infant mortality rate and real GDP per capita of Liaoning province and China, we've found that: (1) The log series of birth rate, infant mortality and real GDP per capita are integrated of order one; (2) Long-term co-integration relationships exist among these three series, and the impacts of infant mortality rate and GDP per capita on birth rate are more significant in Liaoning province; (3) According to VECM, the adjustment of birth rate in Liaoning province is 0.09067971446 while it is 0.463901315 in China, which means self-regulatory ability of birth rate in Liaoning province is relatively weak; (4) According to generalized impulse response function and variance decomposition in the short-term birth rate fluctuation of Liaoning isn't affected by infant mortality rate and GDP per capita while in the national level the effect is great. The conclusions and suggestions are: (1) China is in the period of "Demographic window of opportunity" nowadays so high-speed economic growth and low birth rate are both necessary. China should improve professional education and training to build the harmonious society; (2) Remove obstacles of labor migration in order that the most active factor of production – labor force can flow into Liaoning freely, therefore, we can improve the allocative efficiency without a larger population.
Key words: Population Bonus; Social Security System; Education and Training; Birth Rate; Vector Error Correction Model

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[2] Faculty of Management and Economics Dalian University of Technology Dalian 116024,China.
[3] Faculty of Management and Economics Dalian University of Technology Dalian 116024,China.
[4] Faculty of Management and Economics Dalian University of Technology Dalian 116024,China.
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Résumé: L'objectif de cet article est d'étudier le problème du mécanisme de l'impact du taux de natalité dans la province du Liaoning et en Chine, en intégrant le test de racine unitaire, le test de cointégration, le modèle à correction d'erreur vectorielle (MCEV), la fonction de réponse impulsionnelle généralisée et la décomposition de la variance. Après avoir sélectionné les données du taux de natalité, du taux de mortalité infantile et du PIB réel par habitant de la province de Liaoning et de la Chine, nous avons constaté que: (1) Les séries de logarithme du taux de natalité, du taux de mortalité infantile et du PIB réel par habitant sont intégrés dans le premier ordre; (2) Des relations de co-intégration à long terme existent entre ces trois séries, et les impacts du taux de mortalité infantile et du PIB par habitant sur le taux de natalité sont plus importants dans la province du Liaoning, (3) Selon MCEV, l'ajustement du taux de natalité dans la province de Liaoning est de 0,09067971446, alors qu'il est de 0,463901315 en Chine, ce qui signifie que la capacité d'auto-réglementation du taux de natalité dans la province de Liaoning est relativement faible; (4) Selon la fonction de réponse impulsionnelle généralisée et la décomposition de la variance à court terme, la fluctuation du taux de natalité du Liaoning n'est pas affectée par le taux de mortalité infantile et le PIB par habitant alors qu'au niveau national, l'impact est plus important. Les conclusions et les suggestions sont les suivantes: (1) Aujourd'hui, la Chine est en une période de "fenêtre démographique d'opportunité", donc une croissance économique rapide et un taux de natalité faible sont tous nécessaires. La Chine devrait améliorer l'éducation et la formation professionnelle pour construire une société harmonieuse; (2) Il faut supprimer les obstacles de la migration du travail afin que le facteur le plus actif de la production - la main-d'œuvre peut circuler librement dans la province du Liaoning, par conséquent, nous pouvons améliorer l'efficience allocative sans une population plus grande.
Mots-clés: bonus de la population; système de sécurité sociale, éducation et formation; taux de natalité; modèle à correction d'erreur vectorielle

1. INTRODUCTION

Foreign scholars explored the influencing factors of fertility rate very early. Becker(1960) is the scholar who earlier supported the view that birth rate should be a endogenous variable of economic system (Becker, 1960). Adelman(1963) proved that there was positive relationship between birth rate and revenue through empirical analysis (Adelman, 1963). Heer(1966) got that economic development had double effects on birth rate which were positive direct effect and negative indirect effect processing the data of 41 countries (Heer, 1966). Soon afterwards, some scholars distinguished the relationships of population and economy between developed and developing countries. The research of Friedlander and Silver(1967) indicated that the relationship of birth rate and revenue in developed countries was positive while in developing countries it was negative (Friedlander & Silver, 1967). These early researches only adopted one population variable--birth rate and one economic variable--revenue to research the relationship of population and economy. The models were relatively simple so they couldn't accurately depict the complex reality.

Yamada(1995) verified that infant mortality rate and birth rate were joint determined and discovered that real income per capita had negative effect on infant mortality rate and positive effect on birth rate (Yamada, 1985). Kirk(1996) and Van de Kaa(1996) finished the theoretical generalization of the causes of demographic transition and they did empirical analysis on the relations among infant mortality rate, birth rate and economic development from the view of development economics and the results were that there were connected relations among the three variables (Kirk, 1996; Van, 1996). Baguette and Schtickzelle(2006) did the meta-analysis of the population time series of five butterfly species which indicated that (meta)population dynamics were driven by density-dependent factors and interspecific comparison revealed a significant inverse relationship between population growth rate and the magnitude of dispersal distance (Michel & Nicolas, 2006). These conclusions were based on the foreign data so whether they are applied to the situation of China is yet to be studied.

Foreign scholars continued to research into the effect of birth rate on society. Bavel(2004) suggested a method of securing evidence on the issue for married couples which was applied to three cohorts living in a Belgian town in the nineteenth century. The findings indicated that, even before the fertility transition, couples in the working class were controlling their fertility by deliberate spacing (Jan, 2004). Mirowsky(2005) analyzed the healthy state and the age at first birth of women aged from 25 to 95, made the curve between the two variables and indicated that the age at first birth, the social relation and pregnant outcome would influence the healthy state in the succeeding years (John, 2005). Guzzo and Furstenberg Jr.(2007) found that Among women with a nonmarital first birth, 14% subsequently had a birth with another partner, and 41% with two or more children had had multiple partners indicating first births occur set the stage for subsequent childbearing and programs that helped women avoid having births in unfavorable circumstances, such as in early and unstable relationships, may reduce the prevalence of multipartnered fertility (Karen et al., 2007). These researches all showed that birth rate and the state of birth had great impacts on society.

China’s academia did qualitative and quantitative researches on Chinese fertility problem from various angles and different sides. They concentrated on birth level, sex unbalance and also relevant policy problems. There are：Zhai Zhenwu, Chen Wei(2007) using education statistics from Ministry of Health, which were independent of statistics from population-related departments, assessed levels and patterns of underreporting in the 2000 census and found that China’s total fertility rate in the late 1990s stood at 1.7-1.8 (HAI & CHEN, 2007). Wei Yan(2007) explained the reason of fertility decline in China adopting an analysis of the province level time series data (WEI, 2007). Yang Juhua(2007) from microscopic view argued the relations of patterns of living arrangements and fertility using event history analysis (YANG & Susan, 2007). The above scholars proved that there were influence factors which were macrocosmic or microcosmic and direct or indirect causing the decline of Chinese birth rate. At the same time, some scholars predicted the situation of China’s further generation. The case study of Suzhou from Ding Renchuan, etc.(2007) indicated that by the joint action of the increasing percentage of only child at marriage and child bearing wish, the low population fertility level in Suzhou will continue(DING et al., 2007). Wang Jinying, etc.(2007) argued that the potential increase of population in developing countries was still large by comparing the actual fertility and replacement fertility among the development countries and areas in Asia and Africa. The trend of worldwide population growth would behave powerfully for the high birth rate of developing countries (WANG et al., 2007). Among these studies, there are almost studies on nationwide while the fertility status in each area of China is not the same so there is a lack of concrete analysis on concrete conditions.

The paper aims at the interrelationship of population structure and economic growth comprehensively adopting ADF test, cointegration test, VECM model, generalized impulse response function and variance decomposition. And the paper obtained the long-term cointegration relations between population variable and economy variable choosing the annual data of birth rate, infant mortality rate and real GDP per capita of Liaoning province and China from 1978 to 2007.

2. EMPIRICAL PROCESS AND RESULTS

2.1 Data source, pretreatment and variables description

To discuss the influence factors for dynamic change of birth rate in Liaoning province, three variables are chosen which are birth rate(CSL)、infant mortality rate(SWL) and GDP per capita(PGDP) selecting the annual data of Liaoning province and China from 1978 to 2007. The data sources are “China Statistical Yearbook” published by State Statistics Bureau, “Liaoning Statistical Yearbook” and related official websites. To eliminate heteroscedastic phenomenon, we get the nature logs of all variables symbolized as *LNCSL*、*LNSWL*、*LNPGDP*.

2.2 The interrelations among population and economic variables

To show the quantitative interrelations among population and economic variables, Table 1 provides the correlation matrix among *LNCSL*、*LNSWL*、*LNPGDP*(* denotes it is the correlation coefficient of national variable).

From Table 1, there are some same properties between Liaoning and China: Birth rate has a certain positive correlativity with infant mortality rate and a high negative correlativity with GDP per capita; Infant mortality rate has positive correlativity with birth rate and GDP per capita; GDP per capita has a high negative correlation with birth rate and a certain positive correlation with infant mortality rate.

Tab.1: Correlation coefficient matrix of the population and economic variables

	LNCSL	*LNSWL*	*LNPGDP*
LNCSL	1.000000 1.000000*	0.429258 0.237366*	-0.870442 -0.845483*
LNSWL	0.429258 0.237366*	1.000000 1.000000*	0.588942 0.026965*
LNPGDP	-0.870442 -0.845483*	0.588942 0.026965*	1.000000 1.000000*

2.3 Cointegration analysis on population and economic variables

2.3.1 Unit root test

First, to ensure the stationarity of the data we conduct unit root test. DF (Dickey-Fuller) test, ADF (Augmented Dickey-Fuller) test and PP (Phillips-Perron) test are commonly used. In this paper, we adopt ADF to test the stationarity of series. Results are shown in Table 2.

Tab.2: Unit root tests of the related variables

Variable	ADF value PP value	Type （c,t,n）	5% critical value	DW	Conclusion
LNCSL	-1.538848	(c,t,1)	-2.967767	2.219080	Nonstationary
*LNCSL**	0.184988	(c,0,3)	-2.967767	1.198931	Nonstationary
△LNCSL	-6.19027	(c,0,1)	-2.911853	2.051449	Stationary
*△LNCSL**	-3.192800	(c,0,3)	-2.971853	1.612398	Stationary
LNSWL	-3.301526	(c,t,1)	-2.967767	2.044212	Nonstationary
*LNSWL**	-1.819357	(c,t,3)	-3.574244	1.373027	Nonstationary
△LNSWL	-7.238137	(c,t,1)	-2.981038	2.190348	Stationary
*△LNSWL**	-3.889222	(c,t,3)	-3.580632	1.900691	Stationary
LNPGDP	-0.752573	(c,t,1)	-2.971853	1.674313	Nonstationary
*LNPGDP**	-1.705026	(c,t,3)	-3.574244	0.621373	Nonstationary
△LNPGDP	-2.509874	(c,t,1)	-2.971853	1.710498	Nonstationary
*△LNPGDP**	-2.251376	(c,t,3)	-3.580623	1.413382	Nonstationary
LNPGDPM	-1.457981	(c,t,1)	-2.967767	1.535909	Nonstationary
*LNPGDPM**	-0.215428	(c,t,3)	-2.967767	1.191462	Nonstationary
△LNPGDPM	-3.886905	(c,t,1)	-2.971853	1.982186	Stationary
*△LNPGDPM**	-3.324608	(c,0,3)	-2.971853	1.751310	Stationary

Remarks: * denotes national data; α denotes the significant level; The critical level in the table denotes the MacKinnon critical value that refuses the null hypothesis; In the type (c, t, p), c denotes intercept term, t denotes trend term and p denotes lag order; D denotes the first difference; 5% critical value denotes 5% significant level; The lag order is based on AIC and SC; DW denotes DW value of serial correlation.

Under 5% significant level, ADF values of the original series of China and Liaoning are all larger than the critical values, which indicates the series are nonstationary; ADF values of *LNCSL*、*LNSWL* are both less than 5% critical values showing the series are stationary; *LNPGDP* is nonstationary but by using Holt-Winters applicative model of exponential smoothing we get *LNPGDPM* which is stationary after the first difference. The results show that *LNCSL*、*LNSWL* and *LNPGDPM* are all integrated of order one marked as I(1). Though *LNCSL*、*LNSWL*、*LNPGDPM* are nonstationary series which can't be used to analyze with traditional methods, they are integrated of the same order so we can do cointegration analysis and build VECM.

2.3.2 Cointegration test

Cointegration was first proposed by Engle and Granger winners of the Nobel Prize in 2003 for Economic Sciences. When the linear combination of some nonstationary time series is stationary, the long-term steady equilibrium relationship is called cointegration. The combination reflects the long-term steady property relation among the series. The methods of cointegration test mainly have two kinds: one is EG test and CROW test and the other is Johansen test. Generally speaking, EG test only applies to the system that only has two variables, moreover under the small sample OLS estimation is biased which would increase the possibility of the error of second kind.

To study the long-term equilibrium relationship among the three variables--birth rate, infant mortality rate and GDP per capita we adopt Johansen method under the multivariate model. The basic thought of Johansen cointegration test based on VAR model changes the problem of solving the maximum likelihood function into the problem of solving characteristic roots and corresponding eigenvectors. Results are shown in Table 3.

Tab.3: Johansen co-integration test of the related variables

LNCSL	*LNSWL*	*LNPGDPM*	*C*
1.000000	-36.22924	1.524606	52.68542
1.000000*	-0.980361*	0.173668*	-2.328634*
	(7.38325)	(0.42720)	(10.9780)
	（0.59284）*	（0.01308）*	（1.14036）*

Remarks: * denotes national values; In the bracket there are standard errors; The significant level is 5%; The form of the equation is liner and it has deterministic trend.

Under 5% significant level, the results of max-eigen test and trace test show that there is at least one cointegration equation. We choose each one equation as follows (Equation 1a is the long-term cointegration relation among population and economic variables of Liaoning; Equation 1b is that of China):

$$LNCSL = 12.00826\,LNSWL - 0.81045\,LNPGDPM - 14.12258 \quad \text{(1a)}$$
$$LNCSL = 1.62338\,LNSWL - 0.19501\,LNPGDPM + 1.28973 \quad \text{(1b)}$$

Results of cointegration test indicate that:

(1) According to equation 1a, infant mortality rate has positive effect on birth rate in Liaoning, that is if infant mortality falls by 1%, birth rate falls by 12%; GDP per capita has negative effect on birth rate, that is if GDP per capita increases by 1%, infant mortality rate falls by 0.8%; The initiative birth rate of Liaoning is low reflected by the intercept term -14.12258. The reasons may be that Liaoning has early industrialization and the urbanization rate is high. The one-child certificates in the province are more drawn limited by public policies so the fertility rate is lower than the national level.

(2) According to equation 1b, infant mortality rate has positive effect on birth rate in China that is if infant mortality falls by 1%, birth rate falls by 1.6%; GDP per capita has negative effect on birth rate that is if GDP per capita increases by 1%, infant mortality rate falls by 0.2%.

2.4 VECM

Based on Granger theory, a group of variables that have cointegration relation must have the expression form of VECM. From the previous analysis, there are cointegrations among variables so we build VECM to study the long-term and short-term relations among variables of the system. Equation 1a and 1b have shown the long-term equilibrium relations among these three variables while VECM can get the error correction term which reflects the extent deviating from long-term equilibrium in the short term. Equation(2a、3a、4a), (2b、3b、4b) respectively give the VEC models of population and economic variables of Liaoning province and China:

D(LNCSL)=-0.09067971446*(LNCSL(-1)-12.00825519*LNSWL(-1)+0.8104526796*LNPGDPSM(-1)+14.12257679)-0.2069017858*D(LNCSL(-1))-0.4570972657*D(LNCSL(-2))-0.8110379772*D(LNSWL(-1))+0.6088287753*D(LNSWL(-2))+0.1934951497*D(LNPGDPSM(-1))+0.07977715817*D(LNPGDPSM(-2)) (2a)

D(LNSWL)=0.07102013314*(LNCSL(-1)-12.00825519*LNSWL(-1)+0.8104526796*LNPGDPSM(-1)+14.12257679)-0.09216307212*D(LNCSL(-1))-0.1268578187*D(LNCSL(-2))+0.1051264392*D(LNSWL(-1))+0.1732783248*D(LNSWL(-2))-0.1799414901*D(LNPGDPSM(-1))-0.09329521541*D(LNPGDPSM(-2)) (3a)

D(LNPGDPSM)=0.05132930611*(LNCSL(-1)-12.00825519*LNSWL(-1)+0.8104526796*LNPGDPSM(-1)+14.12257679)-0.1050494286*D(LNCSL(-1))-0.1725728759*D(LNCSL(-2))+0.5943318743*D(LNSWL(-1))+0.5117118292*D(LNSWL(-2))+0.3365431902*D(LNPGDPSM(-1))+0.1391091362*D(LNPGDPSM(-2)) (4a)

D(LNCSL)=-0.463901315*(LNCSL(-1)-1.623376624*LNSWL(-1)+0.1950110364*LNPGDPSM(-1)-1.289725221)+0.3444754809*D(LNCSL(-1))-0.2271508858*D(LNCSL(-2))-0.844979089*D(LNSWL(-1))-0.8544122615*D(LNSWL(-2))+0.05334072912*D(LNPGDPSM(-1))+0.08362954842*D(LNPGDPSM(-2)) (2b)

D(LNSWL)=0.07538334044*(LNCSL(-1)-1.623376624*LNSWL(-1)+0.1950110364*LNPGDPSM(-1)-1.289725221)+0.2141808118*D(LNCSL(-1))-0.06438348562*D(LNCSL(-2))+0.602845795*D(LNSWL(-1))+0.2034861978*D(LNSWL(-2))+0.0492126175*D(LNPGDPSM(-1))-0.06434688893*D(LNPGDPSM(-2)) (3b)

D(LNPGDPSM)=-0.3924960833*(LNCSL(-1)-1.623376624*LNSWL(-1)+0.1950110364*LNPGDPSM(-1)-1.289725221)-0.8618095095*D(LNCSL(-1))+0.2229036317*D(LNCSL(-2))-1.984008741*D(LNSWL(-1))+1.276217441*D(LNSWL(-2))+0.6919048072*D(LNPGDPSM(-1))+0.3005068352*D(LNPGDPSM(-2)) (4b)

The results of tests for statistics of the model are shown in Table 4(* denotes national value):

Tab. 4: Test results of the Models

	D(LNCSL)	***D(LNSWL)***	***D(LNPGDPM)***
	0.185179	0.436791	0.013314
R^2	0.733948*	0.334017*	0.192626*
	-0.059268	0.267829	-0.282692
Adjusted R^2	0.654133*	0.134222*	-0.049586*
	0.667687	0.082683	0.294136
RSS	0.017932*	0.005325*	0.191777*
	0.182714	0.064297	0.121272
Standard error	0.029936*	0.016318*	0.097923*
	0.757544	2.585136	0.044977
F statistic	9.195550*	1.671798*	0.795279*
	11.63559	39.83443	22.70258
Log likelihood	60.47494*	76.85852*	28.47664*
	-0.343377	-2.432180	-1.163154
AIC	-3.961107*	-5.174705*	-1.590862*
	-0.007419	-2.096222	-0.827196
SC	-3.625149*	-4.838747*	-1.254904*

The results of Granger causality test of *LNCSL*'s VECM are shown in Table 5:

Tab.5: Granger Causality Test of the LNCSL'S VECM

Dependent variable：D(LNCSL)

Variable	χ^2	**df**	**Prob.**
	2.626391	2	0.2690
D(LNSWL)	5.423015*	2*	0.0664*
	0.326706	2	0.08493
D(LNPGDPM)	5.963025*	2*	0.0507*
United	3.173190	4	0.5293
	8.172415*	4*	0.0855*

Table 5 shows that the fitting result of VECM of China's birth rate is better while that of Liaoning has a certain deviation.

For the paper aims to discuss the influence factors of birth rate in Liaoning province so we analyze equation 2a and 3a. From VECM of birth rate we know that:

(1) In equation 2a the short-term fluctuation of *LNCSL* is caused by two parts, one is the direct impacts of differences of *LNCSL*、*LNSWL*、*LNPGDP* in the short-term, and the other one is the adjustment of long-term equilibrium relation. Error correction coefficient in equation(2a) is -0.09067971446 and the direction is negative, which indicates when there is a deviation from long-term equilibrium the error correction term plays a negative role in adjusting and it reduces the deviation extent so the system trends to be more and more steady. But the value is small so the role of convergence mechanism that prevents deviating from long-run equilibrium is limited. When the short-term fluctuation of birth rate deviates from long-run equilibrium, the economic system will draw non-equilibrium state back to equilibrium state with the adjustment of 0.09.

(2) In equation 2b, error correction coefficient is -0.463901315 and the direction is negative indicating when the short-term fluctuation of birth rate deviates from long-run equilibrium, the economic system will draw non-equilibrium state back to equilibrium state with the adjustment of 0.46.

(3) Compared with the adjustment of Liaoning, when birth rate of China deviates from the long-term equilibrium state, the self-regulatory ability is stronger so there must be related measures to control it in Liaoning when its birth rate deviates from the long-term equilibrium.

2.5 Impulse response function and variance decomposition

Empirical analysis above gives the data attributes of population and economic variables, causality relations, long-term equilibrium relations and error correction mechanism. Generalized impulse response function and variance decomposition can be further used to research on dynamic characteristics which are impacts on themselves among variables--birth rate、mortality rate and GDP per capita.

2.5.1 Impulse response function

The basic idea of the impulse response function is to analyze the impact of the impulse of random disturbance unit standard deviation on the current and future values of each endogenous variable. When the generalized impulse response method is adopted, if a positive impact is on birth rate, we can get the generalized impulse response functions among birth rate itself、infant mortality rate、GDP per capita based on VECM shown in Figure 1(The left is in China and the right is in Liaoning province):

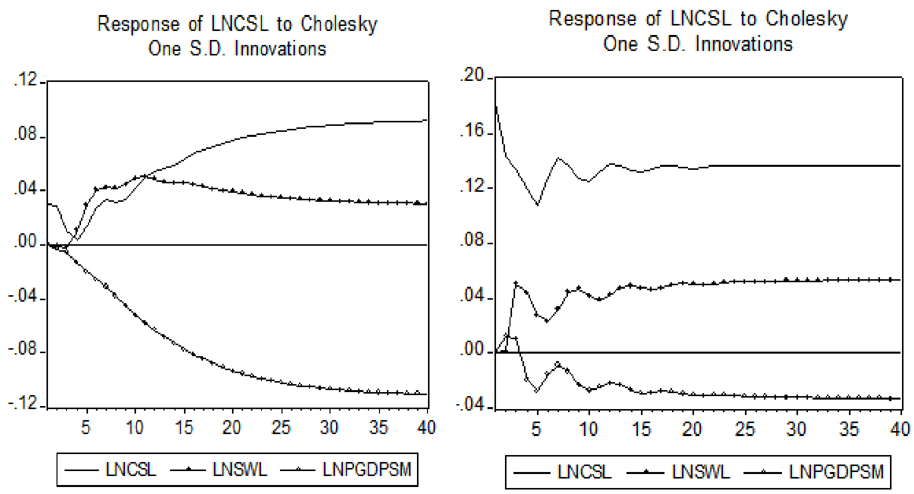

Fig.1: Generalized impulse response function of LNCSL

In Figure 1, the horizontal axis denotes the lag period of impulse (Unit: year), and the vertical axis denotes the response of impulse.

For *LNCSL*, through comparisons and analysis from Figure 1 we can get:

(1) *LNCSL* itself fluctuates in the short term and the impact of birth rate of Liaoning on itself reflects that it is violent compared with China (0.14 to 0.04);

(2) The positive impact of infant mortality rate will cause birth rate rising in the short term(1 year) and in the subsequent medium-term(5 to 15 years) it will lead to birth rate vibration of Liaoning while

the state of China is relatively steady.

(3) The positive impact of GDP per capita of China will have opposite influence on birth rate and make it weak all the way while the positive impact of GDP per capita of Liaoning will decline its mortality rate fluctuation and the trend is to be steady.

2.5.2 Variance decomposition

Variance decomposition is to decompose fluctuation of every endogenous variable in the system into parts which are associated with random disturbance terms of equations according to causes and in order to understand the relative importance of random disturbance terms to endogenous variables in the model.

To analyze the contribution rate of each structure impact to *LNCSL* and evaluate the importance of different structural impacts so we do variance decomposition of *LNCSL* shown in Figure 2(The left is in China and the right is in Liaoning province):

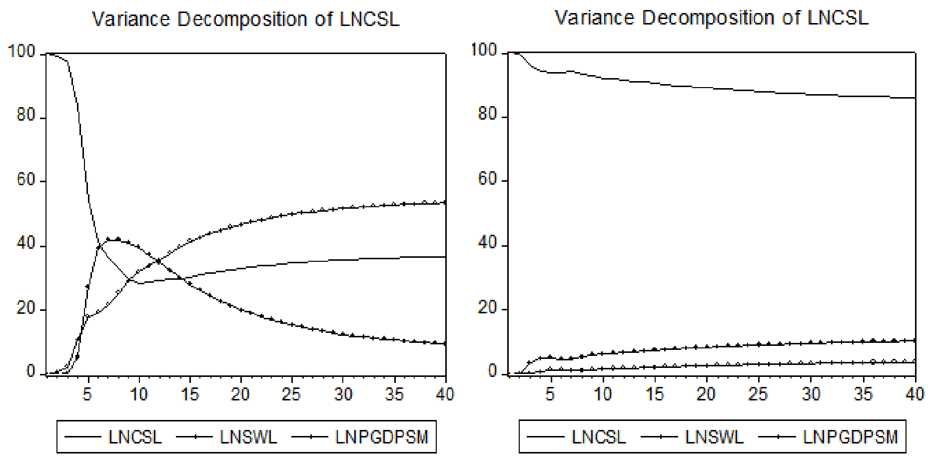

Fig. 2: Variance Decomposition of LNCSL

In Figure 2, the horizontal axis denotes the lag period (Unit: year), and the vertical axis denotes the contribution rate of each variable to *LNCSL*(unit: percentage). We can get:

(1) The contribution rate of *LNCSL* to itself in China drops suddenly in the short term(10 years) and slowly rises to smooth; While the contribution rate of *LNCSL* to itself in Liaoning is relatively stable.

(2) The contribution rate of *LNSWL* to *LNCSL*, in China it quickly rises in the short term(by almost 40%) and then falls year by year; While in Liaoning it is small and steady.

(3) The contribution rate of *LNPGDP* to *LNCSL*, in China it rises yearly and in the long term the increase is almost 60%; While in Liaoning it is very small even not reach to 10%.

3. CONCLUSIONS AND SUGGESTIONS

3.1 Conclusions

(1) There are mutual dependence relations among population variables--birth rate、infant mortality rate and economic variable--GDP per capita no matter in Liaoning and China;

(2) Birth rate、infant mortality rate and GDP per capita are all integrated of order one and by using Johansen cointegration test we get two long-term cointegration relations that are equation 1a and 1b indicating that these variables have long-term equilibrium relations. According to cointegration equation, the long-term impact of mortality rate and GDP per capita on birth rate is more significant in Liaoning than in China, the reason of which may be that the birth rate of Liaoning is always low. From the intercept term -14.12258 of equation 1a we can see the long-term influence of infant mortality rate and GDP per capita on birth rate will be very large.

(3) VECM can get the error correction term which reflects the extent deviating from long-term equilibrium in the short term. In equation (2b) of China error correction coefficient is -0.463901315 and the direction is negative indicating when the short-term fluctuation of birth rate deviates from long-run equilibrium, the economic system will draw non-equilibrium state back to equilibrium state with the adjustment of 0.46. In equation (2a) of Liaoning error correction coefficient is -0.09067971446 and the direction is negative. And for the value is small, the role of convergence mechanism that prevents deviating from long-run equilibrium is limited. When the short-term fluctuation of birth rate deviates from long-run equilibrium, the economic system will draw non-equilibrium state back to equilibrium state with the adjustment of 0.09.

Compared with China, the self-regulatory ability of birth rate of Liaoning is weaker and when the state deviates from the long-term equilibrium, the adjustment of Liaoning is not strong so there must be corresponding child-bearing policy to coordinate with it.

(4) According to impulse response function and variance decomposition, the impact of infant mortality and GDP per capita on short-time change of birth rate in Liaoning is smaller than that in China, which proves the conclusion (3).

At present, China even the world are subject to enormous impact brought by the financial crisis and China's economic development faces serious challenges. In this case, the reconstruction of Northeastern old industrial base has been the priority. The birth rate of Liaoning is low and there will be labor shortage in the short time. Considering the national level, although the birth rate controlled by family planning policy is relatively low of the world, we still have a large population base so the policy of encouraging childbirth is still inappropriate. In order to ensure the adequacy of industrial labor force, there are two points should be adopted in the following:

3.2 Suggestions

(1) Government at all levels should set up special "Education and Training" funds.

Taking the opportunity of the global financial crisis we need promote China's economic restructuring which is from export-oriented low value-added "World Factory" to high value-added "Modern Manufacturing and Services " promoted by domestic demand. For example in 2002 the average hourly earning in the whole manufacturing of China was only \$0.57, even though it is almost doubled now, it is only 6% of the standard level of Europe, Japan and other developed countries; 20% of "Four Little Dragons" in Asia; 50% of Brazil and Mexico. The core idea of traditional manufacturing is based on machines instead of people, but modern manufacturing and services need lots of professional labor force. So China should strengthen education and training of labor force, especially that all levels of governments should set up special "Education and Training" funds training the inefficient labor force into the required labor force with professional skills so as to contribute to the sustainable economic growth of China;

(2) The government should eliminate barriers of labor migration so that the most active factor of production--labor force can be flowed to Liaoning freely, thereby with no increase of the total population we can improve the allocative efficiency of labor force.

China now can build a project of "Teaching for China" referring to the successful project of "Teaching for America" and employ hundreds of thousands of new graduates to teach in rural areas where are severe short of qualified teachers. Through this human capital investment, China can not only increase its human capital, but also can build harmonious society in the difficult time.

China is in the opportunity phase of population, so we should seize the opportunity to make use of labor force advantage, accumulate more social wealth and resist the pressure brought by the coming aging society. Economic crisis results in negative impacts on developing the economy and building a harmonious society in China. For instance, students' graduation from school meaning unemployment, corporate downsizing, most of migrant workers returning home, labor force flowing from high-efficient sectors to low-efficient sectors. Therefore it is time to resolve education, training and liquidity problem of labor force.

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