A Comparative Study of Economic Growth Mode for Jilin Provincial and the National Economy

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Abstract
Based on the Solow Growth Model, The Jilin Provincial and National TFP value are calculated by conducting OLS regression estimates and summarizing the provincial and national data of output, labor input and capital input. Through the judgment standard of growth mode, the economic growth mode of Jilin province and the nation are measured and compared, and it is concluded that both the Jilin province and the nation are significantly inclined on extensive mode in term of economic growth, while the growth mode of TFP is basically oriented by the capital productivity.

Key words: Jilin Province; National; Growth Mode; TFP; OLS

An in-depth study of economic growth mode in Jilin province is the precondition of comprehending the quality of economic operation in Jilin Province. Meanwhile the difference and provincial characteristics of Jilin Province on the entire nation in term of economic operation are reasonably found out through the provincial comparison and research on the whole nation. Therefore this paper focuses basically on the economic growth rate. The Jilin provincial and national economic data are the basic research objects. The difference and respective properties are expected to be found out through comparative studies.

1. THEORETICAL MODEL

This paper refers the foundation of new classical economic theory as a framework, estimates the Jilin provincial TFP and in addition calculates the categorized index of economic growth mode by employing the Solow residual method that matches the Hicks' neutral technical progress C-D production function. .

The Model

The production function of Jilin provincial economy is assumed as [1]

$$Y_t = Ae^{f(t)}K_t^{\alpha_K}L_t^{\alpha_L} \tag{1}$$

In the formula, α_K , α_L respectively are the output elasticity of capital K_t and labor L_t in the t year. $f(t)$ is the function of time t.

According to the assumption of Solow growth model, the return to scale is constant under the condition of the Hicks neutral technical progress.

That is $\alpha_K + \alpha_L = 1$ (2)

then, $Y_t/L_t = Ae^{f(t)}(K_t/L_t)^{\alpha_K}$ (3)

The logarithm of the above equation is $\ln(Y_t/L_t) = \ln A + f(t) + \alpha_K\ln(K_t/L_t)$ (4)

The Total Factor Productivity is defined as:

$TFP = G_Y - \alpha_K G_K - \alpha_L G_L$ (5)

In which G_Y, G_K, G_L are respectively the increasing rate of GDP, capital and labor.

1.2 The Growth Mode of Economy and TFP

The mode of economic growth is regarded as the composition mode of many factors that drive economic growth as well as the economic growth completion mode which is promoted by the combination of all kinds of factors. Therefore, the post economic growth mode can be clearly understood through the judgment of growth mode of economy and TFP (Li & Wang, 2006).

The modes of economic growth are abstracted into the three basic formats:

The Intensive Growth Mode : $\frac{G_A}{G} > 0.5$

The Neutral Growth Mode: $\frac{G_A}{G} = 0.5$

The Extensive Growth Mode: $\frac{G_A}{G} < 0.5$

The essence of transforming the economic growth mode is the contribution increment of TFP. While the TFP growth rate is the weighted average value of the productivity of each production factor. Therefore, through the analysis on the intrinsic reasons of TFP changes regarding the shares of each factor in TFP, the TFP growth mode are abstracted into the three basic formats:

The Labor Productivity Orientation: $\frac{\alpha_K(G - G_K)}{G_A} < 0.5$

The Neutral Orientation: $\frac{\alpha_K(G - G_K)}{G_A} = 0.5$

The Capital Productivity Orientation $\frac{\alpha_K(G - G_K)}{G_A} > 0.5$

2. DATA PROCESSING

The data applied in this article is according to the time series of Jilin provincial and China's total economic output, capital and labor input. The data is sourced from the *Jilin Statistical Yearbook* (1985-2010) and *Chinese Historical GDP Accounting information* and the *China Statistical Yearbook* 2010. The data are processed upon the following method, shown in the attached Table 1.

2.1 The Data of Output

The measurement index of overall economic output is the gross domestic product (GDP) or gross national product (GNP), this paper defines the gross domestic product as the measure of economic growth. The data is sourced from the yearly *Jilin Statistical Yearbook*, and is converted according to the fixed price in 1983.

2.2 The Capital Input

In the study on the calculation of factor's contribution rate employing the gross amount data, the key factor is the scientific measurement of the output and input data, especially the measurement of capital data is further important. The measurement method that has been widely used in calculating capital stock is the Perpetual Inventory Method initiated by Gordon Smith in 1951. In this article,

the capital inventory is calculated by using the perpetual inventory method when a fundamental year has been selected and its price has been fixed. This method can be displayed as:

$$K_{it} = K_{it-1}(1 - \delta_{it}) + I_{it} \qquad (6)$$

In this equation, "i" is referred as the "i" province (equivalent districts or metropolitans), "t" is the "t" year. There are totally 4 variables involved.

a. The fixed assets investment volume if the annual investment is I.

b. The price index of investment goods, which is basically referred to the Jilin provincial price index of investment goods, some missing data is substituted by the consumer price index.

c. The economic depreciation rate :δ,there are some researches note that the basic method of calculating depreciation is to settle down a reasonable depression rate. The average depreciation rate is 5% among Perkins (1998), Hu, Yong tai(1998), Wang, Xiaolu (2000) and Wang, Heyao(2001). This paper also uses 5% for depreciation rate.

d. The base years' capital inventory K. The initial capital inventory measurement is basically set on the fixed capital-output ratio. This article sets the capital-output ratio is 2.

2.3 The Labor Input

The labor input data should be defined as service flow within a certain period of time. Not only does it depend on the amount of factor inputs , but also does it relate to the utilization efficiency and quality of production factor. Given that China is in the transitional period from the planned economy to market economy system, while the income distribution system is not reasonable and the market adjustment mechanism is not perfect, further, China is lack of necessary statistical materials (Zhang, Wu, Zhang, 2004). Therefore, in this paper, the yearly amount of employed people is used for measuring the labor input.

3. MODEL ESTIMATION

The value of α_K, α_L in equation 1 needs calculation prior to the analysis of economic growth mode. The value is estimated by running an OLS regression according to the above data in this paper.

It is seen from the scatter diagram that neither the Jilin province nor the nation GDP per capita and capital inventory per capita has heteroscedasticity, it can be estimated by OLS model.
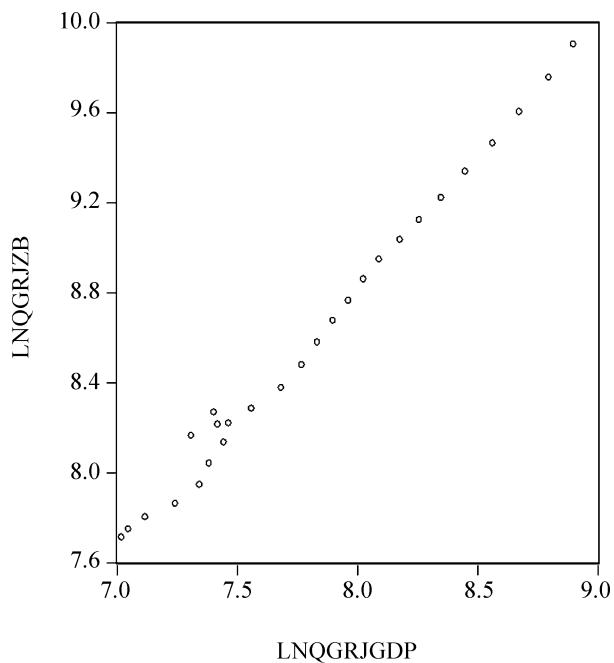
Figure 1
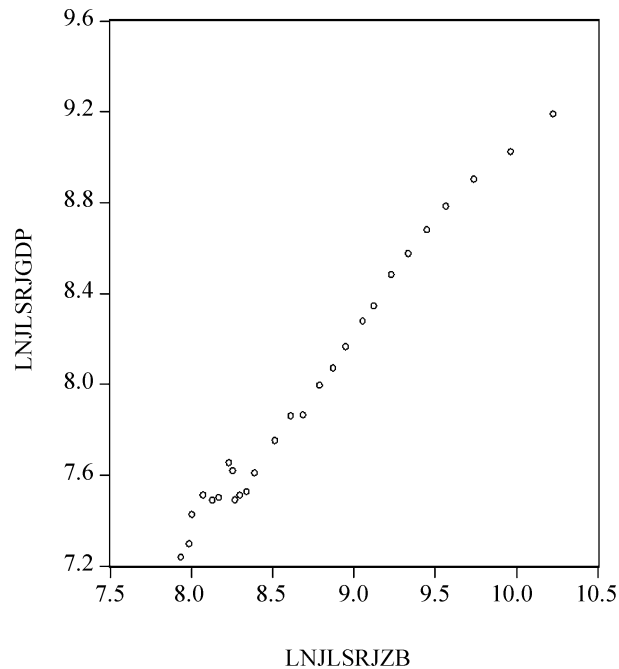**A Scatter Diagram of National GDP and Capital Inventory per Capita**

Figure 2
A Scatter Diagram of Jilin Provincial GDP and Capital Inventory per Capita

Table 1
The Estimated Value of α_L and α_K in Jilin and entire China

	$\hat{\alpha}_K$	$\hat{\alpha}_L$	T values	$\overline{R}^2$
Jilin	0.876	0.124	42.928	0.986
China	0.855	0.145	54.302	0.991

Being reviewed by the estimated results, meanwhile all the indexes pass the exam, the table notes that the Jilin provincial capital output elasticity, labor output elasticity respectively are: $\alpha_K=0.876, \alpha_L=1-0.709=0.124$; The national capital output elasticity and labor output elasticity respectively are: $\alpha_K=0.85576, \alpha_L=1-0.855=0.145$. The national capital output elasticity is 0.692 estimated by

Guo Qingwang, Jia Junxue (2005), the provincial capital output elasticity is 0.863 estimated by Li, Tianguo (2006), all of which is slightly lower than the results from this article.

3. THE GROWTH MODE JUDGMENT

3.1 TFP Estimation
The Jilin Provincial and National TFP are calculated according to equation 5 upon the estimation of factor's output elasticity, shown in Table 2.

Table 2
The Yearly Jilin Provincial and National TFP

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
China	-0.1	2.5	8.5	3.2	-4.6	-2.2	-5.6	-10.4	-0.7	7.3	8.9	5.1	-0.3
Jilin	-1.4	14.5	2.7	-7.9	-2.7	11.6	-5.9	-13.7	-0.6	-2.3	4.6	3.6	2.5
Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
China	-2.4	-1.8	-1.5	-2.0	-1.3	1.3	0.5	0.7	-0.1	0.7	-1.3	-0.9	-3.0
Jilin	-6.5	4.4	0.3	2.7	2.2	0.8	4.9	0.1	0.2	0.3	-3.9	-9.7	-8.1

The total factor productivity is an important measurement used to evaluate the influence of the technological progress and other factors on economic growth. It is seen from the table that both national and Jilin provincial TFP have a large number of negative value. Among the 26 years of calculation, nationwide has 16 negative TFP value while Jilin has 11. That is the contribution to the economic growth from the changes in technology including the constitution and mechanism is negative, indicating that in these period, the technology

progress has not been playing an positive role on economic growth, but having opposite effect.

4.2 Judgment of Economic Growth Mode
The calculation results prove that the China economic development has always been undergoing the extensive growth mode. The intensive degree of economy needs strengthening. The overall situation in Jilin province is almost indifferent with the national level. It also has a economic growth mode more extensive than less intensive

style. However, in general, the variance of data tested weakened since 1990's in the last century. The variance was light although the growth mode was more extensive.

It did not appear sharp fluctuations, which shows that the economy ran in a status of stability staying in a certain level although th economic growth mode is extensive.
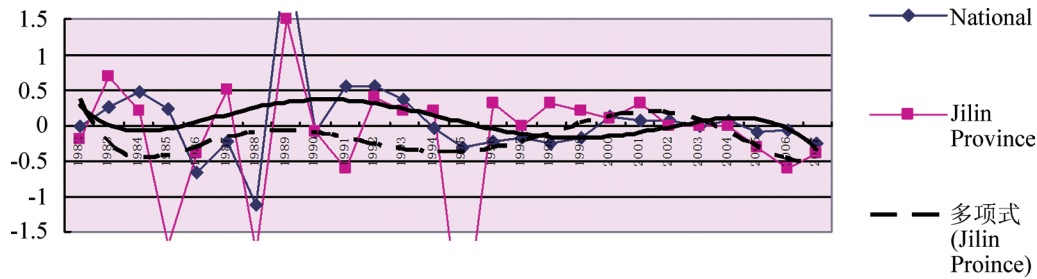
The two smooth curves in the figure are the economic growth mode tendency lines of Jilin province and the nation. The tendency line is composed of six polynomial equations. Reading the two tendency lines of two sets of data, it is found that the growth mode of nation is more intensive than Jilin province. During the period 1998-2003, the intensive degree of economic growth is higher than the national economy. The fluctuations of economic growth experienced roughly two and a half circle in the past 26 years. The fluctuation of Jilin province is more volatile than the national one appearing that the crests or troughs are 2-3 years ahead of the national one. The economic growth mode of Jilin province had the tendency of transition to intensive mode during the beginning two years of the 11th 5-year plan, while the whole country continuously went as extensive growth mode.

4.3 Judgment of TFP Growth Mode

Table 3
Judgement of TFP Growth Mode of Jilin Province and Nation

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
National	5.3	0.6	0.8	0.5	1.1	1.4	1.1	0.9	-1.3	0.8	0.8	0.6	5.4
Jilin	0.5	0.8	0.6	1.0	1.1	0.8	0.9	0.9	1.4	1.1	0.8	0.5	0.4
Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
National	1.4	1.5	1.7	1.5	1.7	0.0	-1.2	-0.9	24.4	-1.4	2.3	3.2	1.5
Jilin	1.0	0.6	-2.2	0.5	0.3	-0.1	0.6	-8.4	-5.8	-4.0	1.4	1.2	1.3

Reading from the TFP growth mode judgment data table, it is found that the national and Jilin provincial TFP growth mode are basically all capital productivity oriented. The amount of other orientation pattern is less. In nationwide, 1985 is the only year when the national TFP growth mode is neutral oriented. Jilin province exhibited neutral oriented growth mode only in the year of 1982, 1993 and 1998. There were 5 years when the national TFP growth mode was labor productivity oriented, while Jilin had 7 years. The change of TFP relies considerably on improvement of capital productivity, while the labor productivity has less effect on TFP changes both in Jilin province and the entire nation.

Empirically, the economic intensive degree and level of economic development exhibit obvious corresponding relationship. The higher level of economic development, the more intensive it is. On the contrary, the lower level of economic development, the less intensive it is. The process of economic development has tendency of advancement. That is it will shift from extensive to intensive type (Li & Wang, 2006)nFrom the above analysis, it is seen that Jilin province and China's extensive economic growth mode has not been significantly improved. China's pursuit of intensive economy is still very hard.
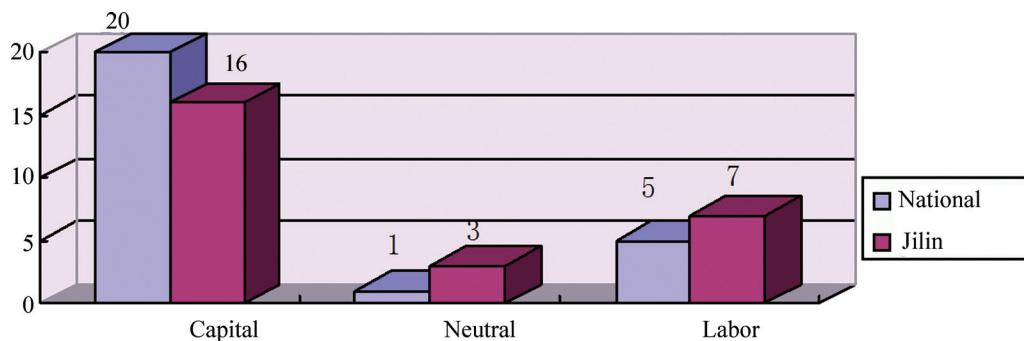

Table 4
Amount Comparison of TFP Growth Mode Types

CONCLUSION AND DISCUSSION

● The estimated capital output elasticity in this article is relatively bigger than the results of previous studies. It is probably due to the difference of estimation methods and data sample selection. However the method and sample selection are consistent in this paper when it compares Jilin province and the nation, therefore, it has certain valuable comparison reference.

● Through measurement, both Jilin province and the country's total factor productivity have many negative values. It implies that the technical progress including the mechanism of institution reform of Jilin province and China has limited effect on economic growth, even negative effect somehow.

● Both Jilin province and the country have the extensive economic growth mode in majority. It implies the quality of economic growth in both Jilin province and China is inferior. In the rapid economy development, the low growth quality is not conducive to long-term sustainable development. It does not exhibit a shift to intensive mode from long-term review.

● It is known through the analysis of the growth mode of TFP, Jilin province and the national TFP basically are capital productivity oriented, that is the utilization of investment and capital plays a critical role of TFP growth. This may be related to that China's economic development considerably rely on the investment power.

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