The relationship between economic growth and agricultural growth :The Case of China

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***Abstract*—For the relationship between agriculture and economic development, this issue has been in controversy. This article performs econometric model analysis in the case of China for the year 1952-2007 showing that there has always been an positive relation between agricultural and economic growth and discusses how agriculture makes a contribution to economy growth . We conclude: (1) although the share of agriculture in GDP has declined significantly over time, the contribution of agricultural growth has maintained an upward trend with the elimination of the price index and it has made an important market, foreign exchange, factor (finance and labour), output contributions to nonagricultural growth and then it remains an irreplaceable driving force for economic growth; (2) economic growth strongly does not necessarily need a higher GDP growth rate in the agricultural sector. China should and have strength to enter the stage of industry nurturing agriculture. Enhancing agricultural contributions needs to continue to encourage the transfer of rural labour, raise the level of consumption of rural residents, encourage export and increase farmers' income so that the national economy develops rapidly and orderly.**

Keywords-agriculture growth; nonagricultural growth; economic development

I. LITERATURE REVIEW

Two polar views on the agriculture's role in the process of economic growth are prominent in the literature of economic development. At one pole, a substantial literature argues agriculture plays a negative role in the growth of national economy. At the other pole is the view that agriculture is of importance to economic growth.

Agriculture plays a negative or insignificant role in developing countries. Agriculture is a declining industry during the process of economic growth, that is, the share of agriculture in GDP over time becomes smaller and smaller(Chenery and Syrquin 1975; Syrquin 1989)[1]. Some people convince policy makers to consider agriculture as a black box and resources can be deprived from them without expense. Lewis(1954)[2]asserts it is not worth investing as a low-productivity sector. This indicates resources should be transferred from the agricultural sector to nonagricultural sectors due to nonagricultural sectors are more productive to modernize the economy and enhance the entire national output. Does a development strategy of "rapid industrialization", apparently the surest path to higher incomes, mean that agriculture should be squeezed for resources (Timmer,1988)[3]. Fane and Warr(2003) conclude "The poor do much better if a given amount of GDP growth is producted by technical progress in services or in manufacturing than if it is owing to technical progress in agriculture".

Agricultural development and economic growth has a positive relationship. Most of the modern development economists agree that the role of agriculture and agricultural development are absolutely the main part of nation-building and healthy development (John and mellor,1961)[4]. The new growth economics studys the agricultural potential role in promoting economic growth from the perspective of analysis (Barro and Sala-i-Martin, 2001)[5]. Schultz(1953)[6], Anderson and Hayami(1986)[7], Timmer (1992) analyse how to stimulate the forward linkages between the growth process and agriculture. "Economic growth and the contribution of agriculture" is written by Professor Kuznets in 1961, a book which puts forward several "contribution" of agricultural sector to economic growth, namely product contribution (food and raw materials), market contribution, element contribution (including surplus capital and surplus labor), as well as exchange contribution. Time series techniques used by Kanwar (2000) and Rangarajan (1982) show that agricultural growth is causally prior to growth in manufacturing. Nichols (1963)[8] emphasize the interdependence between a country's agriculture and its industry. This result alone argues that past investments in agriculture have had large economic returns (Mundlak ,2000)[9].

Surprisingly, in view of the length of time the debate has been going on, there are still no satisfactory tests of the impact of changes in agricultural productivity on economic growth. Especially for China, there are relatively few empirical studies on agriculture's role in economic growth. In this paper, we conduct a mathematical analysis pointing out agriculture will influence economic development through a number of indirect factors, and then carry out an empirical test in the case of China concluding that although agricultural output in the national economy has declined, economic growth strongly does not necessarily have a higher productivity in the agricultural sector. The contribution of agriculture to the national economy in two

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different ways: agricultural output promote economic growth, namely, direct effect and agriculture promotes nonagricultural sectors growth and the whole economic by affecting *C, I, NX* and other factors, namely, indirect effect. Thus, China should enter a stage of industry nurturing agriculture from agriculture nurturing industry.

II. MATHEMATICAL ANALYSIS

The national economy can be divided into the agricultural sector and nonagricultural sectors, thus, national income accounting equation can be rewritten as:

$$y = (c + i + g + nx)$$
$$= \left[(c^1 + c^2) + (i^1 + i^2) + (g) + (nx^1 + nx^2) \right]$$

Of which: c shows consumption, c^1 shows agricultural consumption, c^2 shows the nonagricultural consumption, i shows investment (physical and human capital), i^1 indicates investment in agriculture, i^2 shows the nonagricultural investment; g shows the government purchase; nx shows net exports, nx^1 shows net agricultural export, nx^2 shows nonagricultural net export.

Under normal circumstances, if *dAi* is the growth rate of agricultural sector, then how *dyi* becomes function of *dAi*? We can conclude

$$dy_i = SA_i dA_i + (1 - SA_i) dNA_i$$

Of which: *SAi* indicates the share of agriculture in GDP,

dNAi says the economic growth rate of nonagricultural sectors

From the description above, we know agricultural growth has direct effect on economic development. Direct impact, that is, output growth in agriculture affects the overall economic development. In addtion, agriculture provides market contribution, capital contribution (product contribution--food, raw materials and element contribution --funding, human capital), foreign exchange contribution for industry to achieve indirect effect. While the effect size is subject to further testing, which corresponds to the four kinds of contribution proposed by Professor Kuznets .

III. EMPIRICAL TEST

A. Data collection and Inspection

Our data come from calculation of the data contained in *China 50 years of compiling statistical information* and *China Statistical Yearbook 2008*. This article uses the growth rate of GDP as economic growth indicator, the growth rate of the primary industry to measure the growth rate of agricultural and the growth rate of nonagricultural industries gotten by calculating relative data, time for the 1952-2007 year, then 1953-1978 indicators are based on 1952 constant prices, 1979 - 2007 based on 1978 constant prices.

B. Model specification, regression and analysis of results (time for the 1952-2007 year)

1) Agriculture's direct contribution to national economic growth

We broadly divide the time 1952-2007 into two development stages: 1952-1978 and 1979-2007. Using the year 1978 as the cutoff point, mainly because 1978 marks the beginning of China's reforms from agriculture.

Z is GDP growth rate as explained variable, *X* is the agricultural GDP growth rate as explanatory variable, *Y* is nonagricultural GDP growth rate as the explanatory variable, and then perform two-stage least-squares regression.

The agricultural GDP growth rate is in a declining trend can be seen from the two-stage regression in table I, that is, coefficient drops from 0.480755 to 0.281274. However, Agriculture should not be seen as a drag sector on economic growth. In the first stage, GDP growth in the nonagricultural sector fluctuates acutely, mainly because the overall strength is not strong. After that, the growth rate of GDP in nonagricultural sector has maintained an upward trend, which is in line with laws of economic development, namely, the proportion of agriculture GDP will gradually reduce when economic develops until a certain stage.

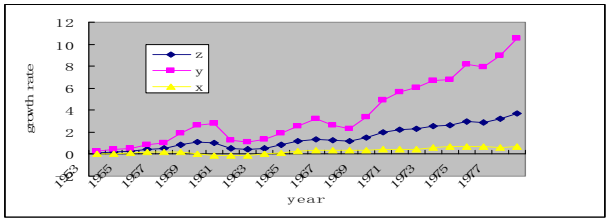

Figure 1. 1953-1978 years the growth rate curves measured at 1952 constant prices

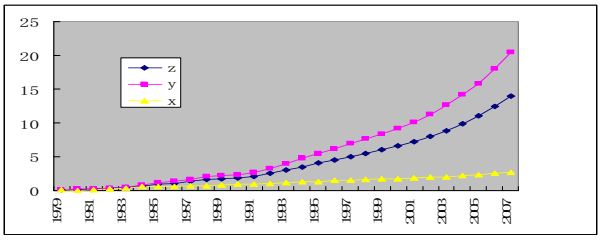

Figure 2. 1979-2007 years the growth rate curves measured at 1978 constant prices

TABLE I. LEAST-SQUARES REGRESSION RESULTS

	1953-1978			1979-2007		
variable	***y***	***x***	***ar(1)***	***y***	***x***	***ar(1)***
coefficient	0.3126	0.4807	0.9759	0.6190	0.2812	60.9255
P -value	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000
	$R^2 = 0.9983$ $DW = 1.8566$			$R^2 = 0.9999$ $DW = 1.9221$		

TABLE II. GRANGER CAUSALITY TEST RESULTS

Null Hypothesis	Lags	obs	Time	F-Statistic	Prob
x does not Granger Cause y	1	25	1953-1978	5.8291	0.0245
y does not Granger Cause x				0.00056	0.9813
x does not Granger Cause y	1	28	1979-2007	1.07278	0.3102
y does not Granger Cause x				2.5604	0.1221
x does not Granger Cause y	2	27	1979-2007	3.63829	0.0431
y does not Granger Cause x				3.28024	0.0567

2) Indirect effects of agriculture in different stages

This paper performs Granger causality test to examine that explained variable and explanatory variable are the linear causality. The test result is showed in Table II. Test result shows agricultural growth makes a larger degree contribution to nonagricultural growth from the year 1953 to 1978 while the nonagricultural growth is not the reason of agricultural growth. The significant causality do not exist between the agricultural growth and nonagricultural growth when the lag is 1 and as the lag period increases to 2, the agricultural growth and nonagricultural growth exists causation. Here we discuss only contribution of agriculture growth to nonagriculture growth, causation relationship of agricultural growth with nonagricultural growth has become gradually weak. This may because agriculture accounts for a large proportion of the national economy during 1953-1978, and then with economic development, the proportion of agriculture GDP has declined so that its direct contribution to nonagricultural growth has slipped, but it has once again become the driving force of nonagriculture by affecting other factors in the long run.

In order to know how agricultural growth makes indirect contribution to economic growth ?

We set $FNG = c + aCC + bZB + dXF$

Of which: *FNG* says nonagricultural sector GDP;*CC* shows that food contribution of the agricultural sector; *ZB* shows funding contribution provided by the agricultural sector for the industrial sector[1]; *XF* shows market contribution of agricultural sector to the industrial sector[2].

We carry out least-squares regression in stages. In addition, all the relevant indicators are difficult to obtain after the year 2004, we seclect 1952-2003 as our sample time scope. Rgression result is showed in table III. We can perform following results analysis.

a) Market Contribution

XF's coefficient increases to 34.4523 from -6.417216 showing that market contribution of agriculture to industry increases mainly because China's rural economic reform in 1980 has created a good development environment and the opportunity to get rich so that the life of rural residents have taken place a significant change and the overall quality of life has improved. There are mainly following characteristics: consumption level significantly increases, the consumption

[1] Using the savings of the agricultural sector.

[2] Using the consumption of the agricultural sector,mainly because most of the agricultural population are concentrated in rural areas.

TABLE III. REGRESSION RESULTS ON THE INDIRECT CONTRIBUTION OF AGRICULTURAL GROWTH

Time	1953-1978			
variable	*constant*	*CC*	*ZB*	*XF*
coefficient	228.1254	0.0394	11.8817	-6.4172
P-value	0.0030	0.0054	0.0000	0.0064
	$R^2 = 0.9585 F-Value = 177.0329$			
Time	1979-2007			
variable	*constant*	*CC*	*ZB*	*XF*
coefficient	9272.811	-0.4738	10.1296	34.4523
P-value	0.0079	0.0078	0.0009	0.0000
	$R^2 = 0.9955 F-Value = 1248.21$			

TABLE IV. THE PRICE INDEX SCISSORS

Year	1980	1985	1990	1995	1996	1997	1998
Value(billion)	300.34	391.8	726.45	2671	2826	3000	3591

China Statistical Yearbook 1999

structure optimizes, the monetary expenditure increases, household consumption has gradually towards socialization and commercialization, consumption quality gradually increases, traditional consumer attitudes gradually change, which reflect the market contribution of agriculture to the industry and overall economic growth.

b) Financial Contributions

Regression results show that the coefficient of *ZB* declines, but still not changes much. The funding source of capital contribution are taxation, industrial and agricultural product "price scissor", savings. In the traditional planned economy system, country through "price scissors" and heavy taxes on agriculture has removed huge amount of money from the agricultural sector. And then "Price scissors" should be gradually reduced, which is the most primitive desire of the economic restructuring during China's reform and opening up. But agricultural reform has always been acompanied with shadow of the planned economy, "Price scissors" not only still exists but in fact continues to increase according to "*China Statistical Yearbook 19*99". During span of 18 years, "price scissors" has increased nearly 12 times showed in table IV. Rural tax reform has exempted agricultural taxes, but Chinese farmers are still paying taxes. Although the farmers sell agricultural products with tax-free, it still needs farmers to take on taxes contained in means of production. In addition, with the diversification of sources of the farmers income, farmers saving compared with the previous capacity significantly increases. As a result, the financial contribution of agriculture to industry and the entire national economy is still huge.

c) Product Contribution (food and raw materials)

The coefficient of *CC* decreases from 0.03937 to -0.473797 showing that the dependence of industrial production on agriculture decreases. But the coefficient become negative mainly because agriculture industries offer

not only food. With economic developed varieties of agricultural products increase such as fruits, aquatic products, meat so that the share of food that selected as our food contribution variable will be reduced unavoidably. In the simplest analysis, the greatest product contribution of agriculture is feeding 1.3 billion people. It is difficult to provide enough food by importing in the case of China. In addition, while industrial production drops the dependence on agriculture, but in 2003, 23.8% of industrial output and its related production activities are based on agriculture. Agriculture is still the source of raw materials, such as providing textile raw materials and food for industry.

The transferring number of rural labor, agricultural products exports value between 1952 and 2007 are difficult to obtain completely, but their contribution to national economic growth are enormous.

d) Exchange contribution

China's agricultural trade is in surplus and the surplus amount reaches 124.38 billion dollars since the founding of China. The estimation results are just primary agricultural trade surplus, if take textile products, food and light industry products which use agricultural products as raw materials into account, the exchange contribution of agricultural products to the national economy is more huge. Although China's agricultural export share declines presently, export of agricultural products for China's economic development has become more increasingly important. China's agricultural export multiplier in 2002 is 1.66, equivalent to one dollar of agricultural export could generate 1.66 dollars of extra economic activities and every 1 million in agricultural exports, directly and indirectly create nearly 28 job positions. Agricultural export not only has great contribution to getting foreign exchange, but also promoting the development of the entire national economy, creating a large number of employment opportunities and facilitating the upgrading of industrial structure and trade structure.

e) The rural labour contribution – element contribution

Agriculture has provided a large quantity of cheap labour for the country's industrialization. In the early industrialization of the country, industrial sector's demand for labour had rapid expansion and the farmers began to become workers. High-quality and low-paid rural surplus labour more easily move out from the agricultural sector to the secondary and tertiary industries due to the rural reform and relaxation of the urban-rural household registration system which make a greater contribution to rural industrialization and rural-urban tertiary industry.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

At present in China, although the proportion of agriculture growth rate in GDP growth has decreased, the contribution of agricultural growth to the national economy has maintained an upward trend with the elimination of the price index.The agricultural growth makes market contribution, factor contribution (capital and labour), foreign exchange contribution, output contribution that have not disappeared even have more important significance. Agriculture still plays a contributed role in economic growth. Economic growth strongly does not necessarily need a higher GDP growth rate in the agricultural sector.

B. Countermeasures and Suggestions

To ensure the sustained, rapid and healthy development of national economic, the key point is continuing to cultivate domestic demand and expand the domestic market. The rural market is absolutely not be ignored. Even though their income levels and consumption levels have greatly improved, there is a strong development potential because they are still significantly lower than urban residents. To make better use of labour contribution of agriculture to promote economic development, we should broaden the means of labour transference and provide conditions to help the ongoing shift of rural labor force. Agricultural export has not only great foreign exchange contribution to Chinese economy, but creates a large number of employment opportunities and facilitates the upgrading of industrial and trade structure. Therefore, we should intensify efforts to support export of agricultural products and carry out agricultural export subsidies to better make use of foreign exchange contribution of agriculture .

Agriculture accounts for the declining proportion of the national economy in China presently, but its outpurt contribution, foreign exchange contribution, factor contribution, market contribution to the development of national economy are even more important. Nonagricultural industry has gained a strong dominant position in the national economy and their accumulation and development abilities have reach the stage of supporting agriculture. Thus, we should note addressing this problem is imminent. To make better use of direct and indirect contribution to national economic growth and create more wealth for the community, it is necessary to narrow the development gap between industry and agriculture.

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